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ARCHITECTURE OF MULTIFUNCTIONAL COMPLEXES

Educational book
for students of the specialty
191 “Architecture and Urban Planning”

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For students studying in English on the specialty 191 "Architecture and Urban Planning" of the second (master's) level of full-time higher education.

The educational book reveals the main provisions of designing multifunctional complexes. Information is provided on the general prerequisites for the formation of multifunctional complexes: socio-economic, urban planning, functional-typological, their classification and features of placement in the structure of the city and the solution of the general plan of their site, on the main types of multifunctional complexes and features of their functional-planning, architectural-compositional and engineering-constructive structure.

The educational book is intended for students of higher educational institutions who are studying in specialty 191 "Architecture and Urban Planning".

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INTRODUCTION

Against the background of the modern cities' development and significant socio-cultural shifts in society, the problem of inconsistency between the existing environment of settlements and the new socio-cultural requirements of their residents is becoming increasingly obvious. Historical experience, world trends in architecture, and attempts to practically resolve this contradiction indicate the need to apply the principles of multifunctional organization of both individual architectural objects and territories of settlements.

The concentration of various functions increases the social and cultural significance of architectural objects and public spaces of settlements, ensuring the successful implementation of multiple activities. Today, multifunctionality has become an integral characteristic of most buildings and structures and is an important component of the structural organization of both small objects and large buildings and structures.

In this context, the multifunctional organization of architectural space consists in creating conditions for integrated, diverse, and intensive in all its manifestations of human social activity in the spheres of everyday life, leisure, communication, creativity, recreation, and education. As foreign and domestic experience shows, the service sector infrastructure development in the largest cities most effectively occurs in multifunctional complexes.

According to DBN V.2.2-9:2018 "Public buildings and structures. Basic provisions" [], multifunctional buildings and complexes are defined as buildings and complexes that are formed from rooms, their groups, buildings, and structures of various public and residential purposes.

In the urban planning aspect, this is the concentration of public service elements in one place, since the compact location of everything necessary for a modern person for living, work, shopping, recreation, entertainment, and sports allows you to save time on moving around the city, sets a special rhythm of life and forms a completely new urban environment. Such places – public activity zones – are integrated into the system of the city's planning elements thanks to convenient transport connections and are an important part of the mechanism for distributing service potential across the city.

For multifunctional public complexes, this mechanism operates in the form of a system of urban centers. The system of urban centers is a set of interconnected public spaces of various types that perform distribution, recreational, and communication functions. This involves the interconnected location of areas of multifunctional complexes in nodes (centres) of population attraction, which are actively and constantly visited by citizens and are connected by intensively used transport and pedestrian links. An important urban planning aspect is the efficient use of the development site and the territory adjacent to the structure. Multifunctional public complexes allow for increasing the efficiency of land plots

due to higher density of development, rational organization of communication infrastructure, and provision of comfortable conditions for visitors.

A multifunctional public complex in a socio-cultural context is a space that combines opportunities to meet the various needs of city residents – from communication and self-realization to solving everyday tasks. The concentration of public functions in such complexes contributes to the provision of a full range of services within their zone of influence. The concentration of public functions in such complexes contributes to the provision of a full range of services within their area of influence. The location of the building, its functional content, forms, and service technologies, as well as capacity are determined by the needs of the community and the characteristics of the urban environment. The analysis of these aspects allows us to form a typology of multifunctional complexes. At the present stage, consumption at the local and global levels is considered as a socio-cultural phenomenon, focused on the processes of socialization of the individual. The main goals of designing such architectural spaces are to create a comfortable environment, ensure functional diversity, a high level of services, and conditions for self-realization of residents of settlements.

From an architectural point of view, a multifunctional public complex is a harmonious system of interconnected spaces and volumes of public use, united into a single architectural ensemble, which is a component of a multi-layered urban environment. Such a complex organically fits into the urban context, combines closed and open public spaces, has unique figurative characteristics, acts as an accent in urban development and reflects a modern lifestyle, new ways of communication, and recreation formats.

The combination and integration of various functions, areas, and forms of service give multifunctional complexes special features that noticeably distinguish them from highly specialized structures. In modern conditions, the construction of such complexes has reached significant scales and has become an important direction, because separately located low-profit objects with limited functions have already lost their effectiveness. The growing interest in multifunctional buildings and complexes is easy to explain because they attract the attention of not only architects, but also city residents, real estate tenants, and representatives of large and small businesses. Such complexes can provide not only a high level of comfort for the population but also significant economic benefits, efficient use of urban territory, and material and technical resources. They also contribute to solving environmental problems, creating a harmonious urban environment, and maintaining psychological comfort.

Multifunctional buildings are distinguished not only by their convenience, diversity, and high quality of services but also by their ability to embody the concept of “urban life” in a compact form. They harmoniously integrate external and internal spaces, creating a unique environment for interaction and development.

Architectural design of multifunctional buildings and structures is a complex and important area of professional activity of an architect, which requires deep knowledge in various fields. Designing multifunctional structures requires an integrated approach to organizing space, and maintaining a balance between aesthetic, functional, and technical requirements. The tasks facing the architect in this area include taking into account the diverse needs of users, adapting buildings for different types of activities, and ensuring comfortable and safe conditions for all categories of citizens. A creative approach is necessary to create innovative but practical solutions that allow for a combination of different functions within one building or complex. In addition, it is important to take into account trends in energy saving, sustainable development, and inclusiveness. This is necessary in the formation of modern buildings and structures.

This educational book was developed by the authors using authors' publications on the architecture of multifunctional complexes. Introduction, chapters 1, and 3, subdivisions 2.1, 2.2 were prepared by Associate Professor, Associate Professor of the Department of Architecture of Buildings and Design of the National University "Yuri Kondratyuk Poltava Polytechnic" Olha Tyshkevych; chapters 4, subdivisions 2.3, 2.4, references and alphabetical an subject index – by Andrii Dmytrenko, Ph.D., Associate Professor, Associate Professor of the Department of Architecture of Buildings and Design of the National University "Yuri Kondratyuk Poltava Polytechnic".

1. PREREQUISITES FOR THE FORMATION OF MULTIFUNCTIONAL COMPLEXES

1.1. Socio-economic and urban planning prerequisites for the formation of multifunctional complexes

The formation of multifunctional complexes is closely related to the transformations taking place in modern society and their impact on the economy, urban planning and lifestyle of the population. Urbanization and the growth of the urban population are one of the prerequisites for the formation of multifunctional complexes. The modern world is experiencing rapid urbanization, which is a key trend in the development of society. According to forecasts, in the coming decades, the majority of the world's population will live in cities, and the share of megacities will increase. This necessitates the search for new solutions to meet the needs of the urban population in housing, work, recreation, social and cultural life. The concentration of the population in megacities leads to the formation of a complex structure of urban areas. For the effective functioning of such areas, innovative approaches to planning are needed that take into account modern challenges, in particular, land scarcity, infrastructure congestion and transport problems. Multifunctional complexes are one of the solutions that can solve these issues. In addition, multifunctional complexes create unique opportunities for the economic development of urban areas. They provide job growth in the service sector, stimulate business activity, and contribute to attracting investment.

The changing lifestyles of the modern population are a powerful incentive for the development of multifunctional complexes. Modern society is in conditions of constant acceleration of the rhythm of life, which forces people to look for new ways to save and optimize time. This is especially true for residents of large cities, where the duration of daily trips, traffic jams, and the location of the main service infrastructure facilities at considerable distances lead to significant time losses. In such conditions, multifunctional complexes become the optimal solution that meets the modern needs of residents. One of the main advantages of multifunctional complexes is the integration of residential, office, retail, recreational, and cultural functions in one place. Thanks to this, residents of large cities can significantly reduce the time spent traveling between different parts of the city. For example, work, a gym, shops, or cultural events become available within the same building, which allows for more efficient use of time.

Another important factor is the changing priorities of modern society. People strive for a balance between work and personal life, looking for opportunities for recreation and self-development near their place of residence or work. Multifunctional complexes meet these expectations, creating comfortable conditions for recreation, sports, cultural events, and social interaction.

Changing lifestyles are also associated with a trend towards increased mobility and a simultaneous desire for localisation of services. Multifunctional

complexes meet this need, contributing to the creation of a compact, accessible environment that ensures the implementation of the concept of sustainable development. Reducing the need for long-distance travel contributes to ecological balance, reducing the transport burden on the city and reducing emissions.

The development of digital technologies also affects the lifestyle of the population, changing its priorities. People expect the ability to access various services in the shortest possible time. Multifunctional complexes equipped with modern technologies allow for the implementation of innovative solutions: "smart" offices, interactive retail spaces, digital services for residents, etc.

Economic development in the context of globalization significantly affects settlements and the formation of their infrastructure. In modern conditions, when markets are becoming increasingly integrated and competition for investments is growing, there is a need to create innovative, multifunctional spaces that could meet the requirements of both businesses and residents. Multifunctional complexes play a key role in this process. They provide not only physical space for commercial activities but also create an environment that stimulates innovation, and promotes cross-sectoral cooperation and the implementation of modern technological solutions. Such complexes usually include office space, retail space, conference rooms, residential apartments, recreation areas, and other facilities, which allow combining different functions in one place. In addition, multifunctional complexes contribute to increasing the competitiveness of cities. They become centres of economic activity, attracting investors and creating new jobs. Due to their integrated structure, such complexes ensure the efficient use of urban resources and contribute to savings on infrastructure costs.

In a globalized world, it is important to ensure that architectural spaces meet international standards of sustainable development. Multifunctional complexes meet these requirements by using energy-efficient technologies, reducing transportation costs, and creating conditions for sustainable urban life. They also stimulate the local economy by integrating local enterprises into their structure, supporting small and medium-sized businesses.

The growing demand for quality infrastructure is an important consequence of active urbanization and the rapid growth of urban areas. With the development of cities, the population increases and, accordingly, the need to create efficient and convenient infrastructure systems. One of the main problems that cities face is the overload of existing infrastructure, which is manifested in traffic jams, congested roads, a lack of facilities for business and social institutions, as well as limited accessibility to cultural and leisure facilities. In this context, multifunctional complexes play an important role. They integrate various functions in one territory, which reduces the need for movement between different parts of the city. This approach helps to optimize the use of urban resources since all necessary services – from housing to offices, shops, restaurants, cultural and entertainment facilities – are concentrated in one area. This not only reduces the

load on the transport infrastructure but also helps to reduce air pollution and improve the environmental situation in the city.

In addition, multifunctional complexes allow for more efficient use of available land resources, reducing the need for urban expansion and contributing to rational settlement planning. The integration of various functions in one complex helps to create a more sustainable and balanced urban environment, where services become more accessible to the population and the burden on infrastructure is reduced. This not only increases the efficiency of the use of urban resources but also improves the quality of life of residents, creating comfortable conditions for work, recreation and socialization within the complex.

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The construction of multifunctional complexes is an important tool for combating the problem of socio-economic polarization, a process that results in a growing gap between the richer and poorer segments of the population, which can lead to serious social and economic problems in the city. The difference in income levels, access to quality services, and living conditions creates a noticeable gap in the opportunities of different social groups, which increases their isolation and inequality.

One of the main advantages of mixed-use complexes is their ability to meet the diverse needs of different social groups. They can combine different types of premises – from affordable housing to elite offices or luxury retail premises, as well as include infrastructure for health, education, and cultural needs. This allows for the provision of services for a wide range of residents – from the poor to the middle class and wealthy citizens. Such complexes can be designed taking into account the principle of social inclusion. For example, combining residential areas for different categories of the population (economy class, middle class, and premium class) allows for the provision of housing for more people, thus reducing social tension between different social groups. Moreover, such facilities can be equipped with a variety of social and commercial spaces, allowing residents to access important services without having to travel long distances or at high costs.

Another important aspect is the accessibility of cultural, educational, sports and medical institutions that can be located within such complexes. This allows for the creation of spaces where all segments of the population have equal access to basic services, which has a positive impact on social integration and reduces social tension. Due to the fact that multifunctional complexes combine residential, commercial and social functions, they help reduce socio-economic polarization,

ensuring equal access to important resources and reducing the feeling of isolation for socially vulnerable groups.

The demand for environmental sustainability in construction is growing in response to global challenges such as climate change, environmental pollution and the scarcity of natural resources. In this context, mixed-use complexes play an important role in creating sustainable urban environments that combine not only comfort and functionality, but also environmental responsibility. Their development contributes to the creation of more sustainable, energy-efficient and environmentally friendly cities that meet the requirements of modern society and future generations. One of the key advantages of mixed-use complexes is their ability to optimize the use of territories. They allow combining several functions in one space – housing, offices, commercial and cultural areas, which reduces the need to expand development into new territories. This reduces the burden on the environment, helping to preserve natural landscapes, green areas and agricultural land. Mixed-use complexes have great potential to reduce the transport burden on urban infrastructure. Since they combine different types of functions (residential, commercial, recreational), residents and workers of these complexes can access most of the necessary services and infrastructure without having to make large movements around the city. This reduces the use of private cars, which in turn reduces greenhouse gas emissions and improves air quality in urban areas. Modern multifunctional complexes are designed taking into account the requirements of energy efficiency and sustainable development.

The use of environmentally friendly materials, the installation of energy-efficient heating, ventilation, and air conditioning systems, and the use of renewable energy sources (solar panels, geothermal systems) help reduce energy consumption and reduce carbon emissions into the atmosphere. The introduction of rainwater collection and recycling systems, the use of natural ventilation systems, and green roofs also contribute to the conservation of water and energy resources, as well as improving the quality of the urban environment.

In addition, such complexes are often designed using green design approaches – the creation of green areas, parks, and gardens on the territory of the building, which helps maintain biodiversity and improves the microclimate. An environmentally sustainable approach to construction also contributes to improving the living and working conditions of residents and users of multifunctional complexes. Thanks to the use of natural materials, high air quality, natural lighting, and the preservation of green areas, such complexes create a favorable environment for people's health and well-being. In addition, reducing noise pollution due to green areas and reducing car traffic, reducing stress levels due to a healthier and cleaner environment – all this has a positive impact on people's physical and mental health. Given global trends that focus on sustainable development and ecological construction, multifunctional complexes are becoming key elements in the formation of green cities of the future. They contribute to the integration of energy-saving technologies, emission reduction,

rational use of resources, and the creation of healthy and comfortable conditions for people to live and work.

Modern society, especially in large cities, requires social integration. Alienation, cultural diversity, economic inequality, and the fast pace of life contribute to the separation of social groups. In this context, multifunctional complexes become important centres of integration, contributing to the creation of spaces for communication, interaction, and joint leisure. The diversity of functions provides opportunities for interaction between people with different income levels, cultural backgrounds, and social status. For example, educational centres or cultural hubs in such complexes become platforms for learning, exchange of experience, and creative activities. Public spaces, such as parks, courtyards, recreation areas, or sports grounds, create opportunities for informal communication. Joint events – festivals, exhibitions, fairs – attract residents of different ages and interests, forming a sense of community. Modern multifunctional complexes are adapted for people with limited mobility and have children's areas and spaces for the elderly. This approach promotes social equality and the involvement of all categories of the population in public life. Coworking areas and hubs in multifunctional complexes stimulate professional interaction, and the development of startups and innovations. Joint activities in such spaces not only contribute to economic development but also form social ties between representatives of different professional fields. Often, multifunctional complexes include spaces for public organizations or initiatives that involve residents in solving common issues. This contributes to the formation of active communities and increases the level of trust between people. People who live or work in multifunctional complexes have more opportunities for socialization, which helps to overcome feelings of isolation, especially in large cities. Shared infrastructure, such as swimming pools, gyms, or hobby clubs, brings residents together and helps strengthen social ties. Multi-purpose complexes also act as cultural bridges, organizing events that introduce people to different traditions, languages, and arts. Such initiatives promote tolerance and mutual respect among city residents. Thus, multi-purpose complexes become not only architectural objects but also social platforms that unite people, reduce tensions in society, and create an environment for the harmonious integration of different social groups.

Multifunctional complexes are an important element of the modern urban environment, influencing the formation of the architectural and planning structure of settlements. Their emergence is associated with the need to adapt urban areas to new social, economic and environmental challenges. The growth of megacities and ongoing urbanization processes cause a shortage of areas for development. This phenomenon is observed, in particular, in the centers of large cities and in their nearest suburbs, where available land resources do not meet the needs for providing housing and infrastructure for a growing population. In such conditions, the efficient use of space becomes a key task of urban planning. In a situation of limited land plots, the transition to vertical development is important, which

allows integrating several functions within one complex without the need to occupy new areas on the ground. High-rise multifunctional complexes allow placing not only housing, but also offices, retail spaces, cultural and recreational areas in one limited space. This allows for maximum use of the territory and reduces the need for new land plots to create the necessary facilities. The use of multifunctional complexes also allows for optimization of infrastructure. For example, not only buildings, but also transport hubs, parking lots, and recreation areas can be integrated on one site, which reduces the need for additional land plots to create individual infrastructure facilities. This is especially important in conditions of a shortage of free territories in the city center, where the creation of new transport systems or communications requires large areas. In situations where it is not possible to use new sites, cities can actively implement strategies for the restoration and adaptation of existing structures and territories. Multifunctional complexes can appear on the site of outdated industrial facilities, warehouses, or other low-value areas for development, which allows for the preservation and most efficient use of existing territories.

One of the key aspects of modern urban planning is the integration of transport infrastructure with other functions of the urban environment. Transit-Oriented Development (TOD) is becoming an important approach to the formation of multifunctional complexes, as it allows you to create comfortable and accessible urban spaces. The development of transport infrastructure and the integration of multifunctional complexes with transport-oriented planning is an important step towards creating sustainable, convenient and environmentally friendly cities of the future. Transport-oriented planning is a concept aimed at locating objects in close proximity to convenient means of transport, such as metro stations, bus stops, tram lines, railway stations. Multifunctional complexes located in such locations allow people to quickly and conveniently move between different parts of the city, reducing dependence on personal transport. This allows you to reduce the car load, reduce congestion and reduce travel time. One of the main problems of urbanization is pendulum migration – the constant flow of people between housing and work. Multifunctional complexes can significantly reduce this flow, as they allow working, living and relaxing within one or more facilities. This reduces the need for long trips, which not only saves time, but also reduces the burden on urban transport systems. The integration of multifunctional complexes with a developed transport network allows you to create environments where people can move freely without the need for cars. This increases the accessibility of different parts of the city for all social groups, including people with disabilities and those who do not have their own transport. Thus, population mobility increases, which is especially important for large cities, where the efficiency of movement is an important factor in ensuring the stable functioning of urban systems. By integrating transport hubs with residential and commercial facilities, multifunctional complexes are able to reduce the overall load on the city's transport network. By optimizing traffic and reducing the number of cars

on the roads, air quality improves, noise is reduced and the environmental impact is reduced. This also allows you to reduce operating costs for supporting transport infrastructure.

One of the advantages of multifunctional complexes is that they can be part of strategic plans for the development of transport corridors in a city. This may include new metro lines, modernization of railway stations or organization of new bus routes connecting different parts of the city. The location of multifunctional complexes near these strategic transport nodes allows for the efficient use of existing infrastructure and reduces the need for expanding urban areas. In many cities, there is increased attention to the environmental aspects of transport – the development of a network of bicycle paths, pedestrian zones and convenient stations for electric scooters and bicycles. Multifunctional complexes can include special zones for these types of transport, which allows for further reduction of dependence on cars, ensuring environmentally friendly mobility. This approach also complies with the principles of sustainable development, which is an important component of modern urban planning. Modern technologies make it possible to integrate intelligent transport systems (ITS) into urban infrastructure, including mixed-use complexes. Traffic monitoring and management systems, road condition forecasts, access to online information about transport routes greatly facilitate movement within large cities. Thanks to these technologies, it is possible to reduce traffic jams, improve the efficiency of public transport use and ensure comfort and safety for residents. Multifunctional complexes located in strategic points of the city can become not only centres of housing and commerce, but also transport hubs, where people can easily transfer from one type of transport to another. These can be transfer stations between different types of public transport (metro, bus, tram), as well as places for parking cars and the possibility of exchanging vehicles for shared use (car-sharing, bike-sharing).

Multifunctional complexes play an important role in the processes of reconstruction of urban areas, especially in depressed or neglected areas. Cities often have areas that are losing their original function and need reconstruction. This may be an outdated industrial or commercial environment that does not meet modern requirements and is unattractive to investors and residents. Multifunctional complexes allow transforming such areas by combining different functions, such as housing, offices, retail space, recreational areas, which makes them suitable for new users and contributes to the restoration of the local economy. In addition to physical reconstruction, multifunctional complexes help improve the social potential of areas, change the social climate in areas where the standard of living was low. By creating new jobs, cultural and entertainment spaces, commercial facilities and public areas, multifunctional complexes stimulate social integration and improve the social atmosphere. Residents of these areas gain access to better quality services, the level of interaction among different social groups increases, which contributes to reducing social tension and developing the local community.

Revitalization through multifunctional complexes can be aimed at reviving economic activity in the area, attracting investment and developing new business initiatives. Typically, multifunctional complexes provide a wide range of commercial opportunities: from retail space and cafes to business centres and office spaces. This creates new jobs, attracts entrepreneurs and professionals to the area, which contributes to stable economic growth and the development of small and medium-sized businesses. One of the results of revitalization is the improvement of infrastructure: upgrading roads, creating new transport links, improving communications and ensuring a high level of services for residents. Multifunctional complexes, being integrated into the local infrastructure, contribute to the optimization of transport flows and reducing the load on existing networks, which makes the area more convenient and accessible for residents and businesses. Revitalization often involves not only economic and physical renewal, but also the development of cultural and public infrastructure. Multifunctional complexes can include theatres, galleries, libraries, cultural centres, parks and other spaces for social events that contribute to the development of local culture and creative initiatives. They also become centres for organizing various events, festivals, exhibitions that involve residents in active cultural life. Revitalization of depressed areas often requires large financial investments. Multifunctional complexes can become catalysts for attracting private and public investments. Creating attractive and functional spaces in these areas increases their commercial and investment attractiveness, which contributes to the expansion of business and the development of the local economy. The restoration of such areas can also have a positive impact on the overall situation in the city, improving its image and competitiveness in the global market. A feature of the revitalization process is the possibility of involving the local community in participating in the planning and development of their environment. Involving residents in the development of projects of multifunctional complexes allows taking into account their needs and priorities, creating more personalized and comfortable living conditions. It also contributes to increased social cohesion and a sense of belonging to the changes taking place in their environment. Thus, mixed-use complexes are important tools for the regeneration of depressed urban areas. They not only solve the problems of outdated infrastructure, but also create new socio-economic opportunities, support cultural development, and promote environmental sustainability and investment attraction.

Multifunctional complexes are an element of the polycentric structure of cities, contributing to the even distribution of functions and services, reducing the burden on infrastructure and improving the quality of life in different parts of the city. The transition from a monocentric to a polycentric model is an important stage in the development of modern cities. In traditional monocentric cities, the main functions and infrastructure are concentrated in one central area, which can lead to congestion and low quality of life due to a large concentration of people and limited access to resources in peripheral areas. At the same time, the

polycentric structure involves the even distribution of key functions throughout the city, where several centres with different functions and activities replace one large centre. Multifunctional complexes are important elements of this structure, as they contribute to the integration of various functions within one location and support the development of several centres of activity within the city. In polycentric cities, multifunctional complexes perform the function of local centres that combine housing, offices, shopping areas, cultural and recreational areas. This approach significantly reduces the burden on the city centre and ensures equal access to essential services for a larger number of residents. It also contributes to a more efficient use of territories and resources, as communities can receive all the necessary services without the need for long trips to central areas.

Multifunctional complexes play an important role in the transformation of the functional and spatial organization of cities, ensuring the integration of various functions within one territory. Traditionally, urban areas are formed according to the principle of functional zoning: residential areas, business districts, industrial areas, etc. This approach promotes functional segregation, which complicates access to necessary services, increases traffic flows and increases dependence on road transport. Multifunctional complexes, combining residential, commercial, educational, cultural and recreational functions, reduce this segregation, contributing to the creation of compact multifunctional zones where residents can live, work and spend their leisure time within one space. Multifunctional complexes act as catalysts for the development of new centres of activity, which are evenly distributed throughout the city. This contributes to decentralization, reducing dependence on the city-wide centre. Such complexes form local centres where vital functions are concentrated, which facilitates access to services and makes the city more convenient for residents. Multifunctional complexes are characterized by flexibility, which allows them to adapt their spaces to the changing needs of the city. For example, certain parts of the complex can be repurposed from office space to co-working space or from commercial space to cultural or educational spaces. Such adaptability increases their value for the city and its residents.

Multifunctional complexes play a significant role in shaping the architectural image of modern cities. Multifunctional complexes often become visual landmarks that determine the character and structure of the city. Due to their height, scale and expressive architectural and compositional elevation, they attract attention, create accents in the urban environment and provide a clear identification of a certain area. For example, buildings such as Burj Khalifa in Dubai or Marina Bay Sands in Singapore are icons of their cities. Multifunctional complexes significantly affect the urban silhouette, adding dynamism and expressiveness to it. The integration of unique shapes, multi-level facades, transparent and mirror surfaces creates expressive architectural compositions. Thanks to the use of innovative materials such as glass, metal and composites, the complexes can harmoniously combine with the surrounding environment or,

conversely, contrast with it. The architectural and compositional solutions of multifunctional complexes use progressive techniques, such as expressive asymmetrical forms, green facades and roofs, interactive facades and lighting. The architecture of multifunctional complexes is often influenced by the cultural, historical or natural features of the region. For example, unique forms and visual elements can symbolize natural landscapes, traditional motifs or national identity. This not only contributes to the creation of a recognizable image of the city, but also makes the building attractive to tourists and investors.

The design of multifunctional complexes is aimed at creating comfortable, safe and harmonious spaces for living, working and relaxing, which contributes to the humanization of the urban environment and meets the modern needs of city residents. They have access to all necessary services within one complex, which reduces the time for moving around the city and improves the quality of life. The integration of cultural institutions, such as museums, galleries, theaters, concert halls, contributes to raising the cultural level of the population and expanding opportunities for leisure. Multifunctional complexes contribute to the development of social ties between residents, creating spaces for communication and interaction, ensuring the accessibility of all functions for different social groups, including low-mobility categories of the population. The humanization of the urban environment includes environmental approaches that are used in the design of multifunctional complexes and contribute to sustainable development: optimization of land use; energy efficiency of buildings and the introduction of "green" technologies; reduction of transport load due to the integration of many functions within one territory. These positive qualities of multifunctional complexes make them a promising type of buildings used to form modern cities.

Control questions and tasks

1. How does urbanization affect the development of multifunctional complexes?

2. How does the change in the lifestyle of the modern urban population affect the development of multifunctional complexes?

3. How do multifunctional complexes affect the competitiveness of cities?

4. How can the development of multifunctional complexes reduce the excessive load on urban transport infrastructure?

5. How can multifunctional complexes affect the reduction of social inequality?

6. How does the development of multifunctional complexes contribute to the integration of different socio-cultural groups into the urban community?

7. How does the development of multifunctional complexes contribute to the creation of more sustainable, energy-efficient, and environmentally friendly cities that meet the requirements of modern society and future generations? How does the development of multifunctional complexes affect the reconstruction of urban areas, including the revitalization of depressed and neglected areas of cities?

8. How do multifunctional complexes affect the development of a polycentric structure of cities?

9. Give examples of the influence of multifunctional complexes on the formation of the architectural image of cities.

1.2. Factors influencing the location of a multifunctional complex

When designing multifunctional complexes in cities, it should be taken into account that the system of public centres has already been formed to a certain extent in the conditions of a developed multi-layered urban infrastructure. In addition to the existing architecturally and planned defined centres, spontaneous centres of social activity often arise in cities, which can become potential public centres. All these elements are combined into a single system with the help of extensive infrastructure connections: transport, pedestrian, engineering, information and spatial.

Transport communications play a key role in the structure of connections of public centres. A high concentration of transport interchanges, such as railway stations, bus stations, metro stations or public transport stops, ensures an even distribution of visitors to public facilities regardless of the administrative and territorial division of the city.

Designing new and improving existing community centres is related to the effective use of urban areas. This requires assessing the accessibility of territorial resources, analysing the dynamics of transport flows, studying the functional content of the territory, determining the socio-cultural significance of the intended activity, as well as assessing the ecological potential of development sites. One of the key criteria is the balance between the accessibility of territories and the density of functions.

The formation of ***a system of community centres*** should be based on the following basic principles:

Flexibility. The system of community centres is considered as an open multifunctional structure, which is characterized by complexity, branching, and the possibility of free combination with urban development. Such a system takes into account the spatial planning features of the development of urban areas and responds to dynamic changes in socio-economic relations.

Functional differentiation. The typology of community centres assumes the presence of monofunctional and multifunctional complexes, facilities for standard or selective service, elements of the city-wide or district level, as well as universal or specialized structures.

Self-regulation. Each multifunctional centre is important as a component of the city-wide structure (external level) and as an autonomous object with its own functional patterns (internal level). Their interaction is based on the principle of end-to-end interdependence, which ensures the harmonious development of the system.

Territoriality. The boundaries and spheres of influence of public centres within the city are determined. Analysis of the classification and typological characteristics of territories allows us to clearly establish their place and function in the overall system. This also ensures an even distribution of public service services, maintaining a balance of their accessibility.

Climatological optimization. Taking into account natural and climatic conditions is an important aspect of planning. For example, different areas of the city may be negatively affected by aggressive winds, thick fogs or low temperatures. Therefore, it is advisable to zone urban areas according to the level of climatic risks. In the cold season, internal service areas are used more actively, while in the warm season, coastal or open spaces are more involved. In terms of relief, it is necessary to take into account protection from prevailing winds and the harmonious connection of the landscape with buildings.

Optimization of communication links. Effective interaction between the locations of public centres is ensured by their integration into an open multifunctional system that supports agglomeration links within the settlement system. The network of streets, highways, squares, boulevards, and parks not only solves transport and functional problems but also contributes to the creation of architectural dominants that form the spatial organization of the city.

Thus, the system of public centres is the basis for the formation of interconnected architectural ensembles that differ in their functional content and spatial composition.

The location of multifunctional public complexes in the city and determining their specialization is an important task that affects both the well-being of individual residents and the quality of life of the entire urban population. The choice of location and functional purpose of such facilities depends on a number of key factors, including:

Features of the city's planning structure, which include division into separate urban planning units with unique characteristics of territories, demographic indicators, infrastructure, etc., and require an individual approach to the analysis of existing development and the development of new projects.

The existing public service system, which determines the nature of the distribution of service facilities in the city, the ratio of public buildings to facilities of city-wide importance, as well as the level of accessibility and provision of the population with necessary services.

Characteristics of individual parts of the urban structure, such as peripheral residential areas with local service institutions, recreational areas with leisure facilities, suburban areas with sports and recreation complexes, etc.

The architectural and compositional role of the future complex, which determines its significance as a visual accent in the overall appearance of the city and in creating its panoramas.

The location and specialization of a multifunctional complex are interrelated aspects. To determine the leading function that will be the basis of its specialization, it is necessary to conduct a comprehensive assessment of the typology and distribution of service facilities in the zone of influence of the selected area.

A key factor in determining the zone of influence of a multifunctional complex is the duration of the time it takes to get to it. It should be taken into

account that the walking distance usually varies from 250 to 1800 m at an average speed of 4 km/h, and the optimal time for transport travel is within 10–18 min. The following indicators are used to calculate transport accessibility: bus speed – 20–25 km/h, trolleybus – 18–20 km/h, tram – 25–35 km/h, metro – 35–50 km/h, and personal transport – up to 60 km/h. However, for accuracy, adjustments should be taken into account: delays at traffic lights up to 30% of the time, acceleration – 10–15%, braking – 5%. It is known that the optimal travel time by public transport or on foot is 10–15 minutes. Residents who live in this area or come to work there are direct visitors to the future multifunctional complex. A travel period of more than 20 minutes (by transport or on foot) is considered critical, and in this case only 25% of people will visit the complex.

To make a final decision on the selection of a site for the placement of a multifunctional complex, it is necessary to compare different sites according to several criteria. Important factors are:

– ***communication accessibility*** of the site and the intensity of flows in the area of its influence: transport (personal and public transport, organization of cargo delivery, places for future unloading nodes, parking lots and public transport stops) and pedestrian (varieties and saturation of flows, centres of attraction and routes of movement);

– ***the nature of interaction between the nearest public spaces*** (in the area of influence) as a condition for the integration of the site into the general functional and spatial system at the district or city level;

– ***functional multi-layeredness of the territory:*** density and diversity of its functions, typology of existing architectural objects, range of services and information, diversity of public spaces, level of landscaping;

– ***the availability of opportunities for intensive or extensive development of the site and directions of its development***, including determining the specialization of the multifunctional complex; preservation, development or restoration of environmental archetypes that the complex can embed in the surrounding space for the further development of the urban system;

– ***demographic and social characteristics of the population in the area of influence of the complex,*** in particular the number, demography, population density, distribution, as well as the daytime population (employees, visitors to organizations of urban importance, transit persons, etc.), in particular their professional composition, income and consumer flows;

– ***accessibility of engineering communications:*** electricity, water supply, communications, sewage, heat supply, as well as the location of transformer stations and connection points to existing networks, the depth and level of communications;

– ***economic factors:*** financing aspects, investment process, budgetary and economic efficiency;

– ***legal issues:*** land allocation, establishment of ownership, tax conditions, rights to new real estate, legal relations between owners and tenants;

– ***ecological capacity:*** the ability of the selected site to withstand urban loads without negative impact on people, nature and the environment as a whole; determined on the basis of an analysis of natural and anthropogenic factors affecting a given territory;

– ***urban planning characteristics of the site:*** configuration, area, relief, geological conditions, groundwater level, presence of natural water resources, architectural and cultural monuments, archaeological sites.

A comprehensive analysis of several sites according to the above criteria allows you to compare them and choose the one that has the greatest economic potential and can become the basis for the formation of a high-quality urban environment. In global and domestic practice, several types of sites are distinguished: within the city, in adjacent territories, on new sites, as well as in the process of reconstruction and integration into dense urban development.

New sites in the suburbs are usually used for multifunctional complexes oriented towards long-term stay. Their operation is characterized by cyclicity during the day and week, that is, with obvious fluctuations in attendance. Such sites are mostly oriented towards owners of personal and well-organized public transport. Architects have some freedom in making decisions, but must take into account forecasts for the development of the city and transport infrastructure.

New sites within the city often appear on the periphery or as a result of the demolition of old buildings in the city centre. In such cases, it is necessary to take into account planning characteristics, site size, existing transport and pedestrian communications, the capacity of the territory, style, and future prospects for the development of surrounding buildings.

Sites in reconstruction zones require the inclusion of elements that are important for the city (for example, housing, bus stations, garages, and green areas). At the same time, additional difficulties arise in organising freight flows, pedestrian circulation, traffic and waste management, which requires a comprehensive solution to all problems in the reconstructed area, taking into account city-wide systems.

An integrated site is formed when a public complex organically fits into the existing urban development. In this case, it is necessary to ensure the continuity of the environment, and architectural and planning solutions must be in harmony with the style of the surrounding buildings. Typically, such a site consists of several small, previously undeveloped territories or sites that became vacant after the demolition of old buildings. These can be underground spaces, roofs, streets, alleys or adjacent buildings. Usually, such sites often have an irregular shape, which complicates their operation but opens up opportunities for non-standard architectural and urban planning solutions.

Areas for the placement of multifunctional complexes differ in environmental characteristics, and three main options can be distinguished. The first option assumes that the site is located in a historically formed urban environment with existing buildings, a stable consumer flow and a developed

transport and pedestrian infrastructure. Usually this is the city centre or its surrounding areas, which have signs of centrality. In this case, the multifunctional complex internally compensates for the functional or planning shortcomings of the environment, but its appearance respects the environment and organically fits into the general context. The second option is to place the object in an already existing, but faceless and amorphous environment. In this case, the public complex should become a driving force for environmental changes. The object is able to "attract" numerous small, undeveloped in form and content functions, providing services of a higher category. Accordingly, the architectural characteristics of such a complex will require the transformation of public spaces not only in adjacent areas but also in the entire zone of its influence. The third option involves a situation where the areas do not have pronounced environmental characteristics due to the lack of existing conditions. This often happens during the construction of new neighbourhoods, the modernization of large urban areas, the development of suburban areas or the transformation of depressed areas. In this case, a multifunctional facility becomes a development centre, performing a structure-forming role and determining the development strategy of this territory.

Control questions and tasks

1. What role do multifunctional complexes play in the formation of the city's community centre system?

2. Name the main principles of the formation of the city's community centre system.

3. What factors influence the location and functional specialization of multifunctional complexes?

4. How is the zone of influence of a multifunctional complex determined?

5. What factors are used when comparing several possible sites for the placement of a new multifunctional complex?

6. What are the three main options for the placement of multifunctional complex sites in the city structure?

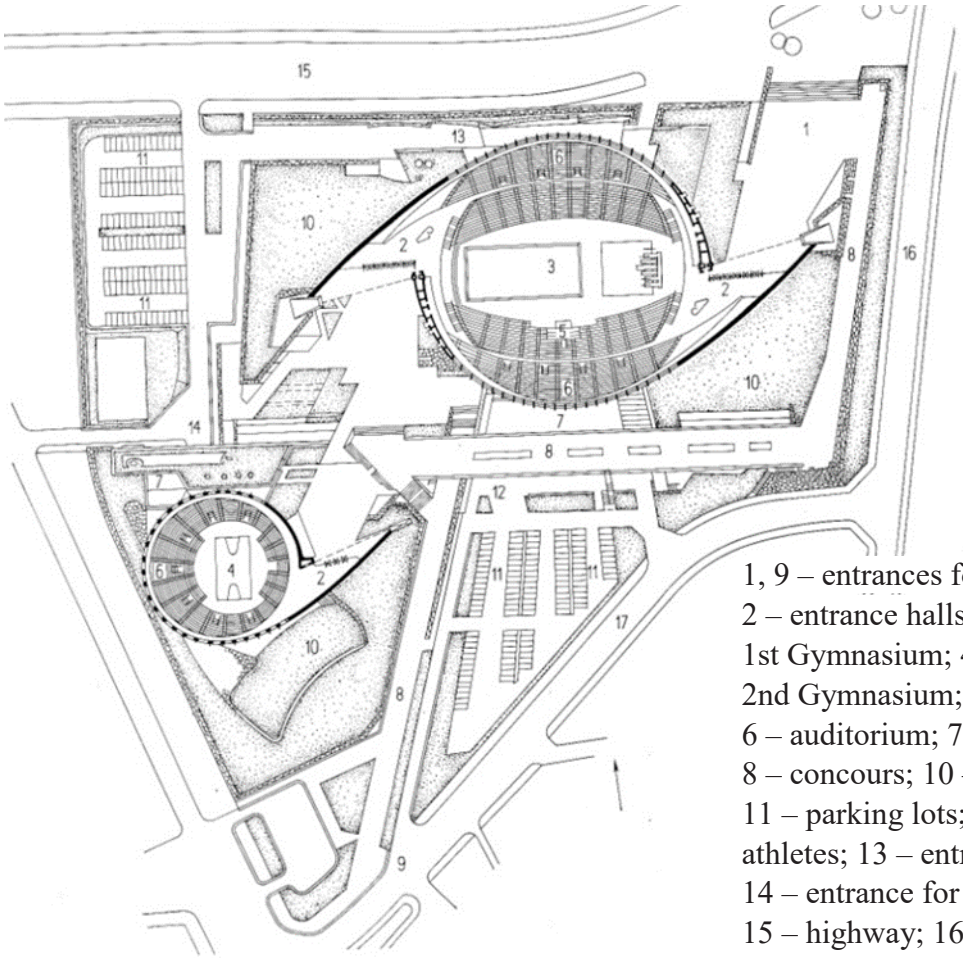
1.3. Master plan of the multifunctional complex site

The specifics of each urban planning situation necessitate an individual approach to creating the external environment of a multifunctional complex and organising a system of public spaces on its territory. The area adjacent to the future complex should be considered as a space with high consumer activity, which requires a specially developed program of use, taking into account the characteristics of the environment. In such a context, the new facility becomes a key element of the urban space, complementing the existing pedestrian infrastructure and socio-cultural components. The main task when creating public spaces in a built-up area is to ensure the diversity of their use and achieve functional completeness and high density, which meets the requirements of the modern urban environment and is determined by the general spatial concept of the complex.

The new multifunctional facility becomes a key component of the urban space, which already has an established pedestrian infrastructure and numerous elements that enrich and complement the socio-cultural environment. When planning public space in the development area, the main task is to create conditions for diverse use of the site and achieve its functional completeness and optimal density, which meets the requirements of the modern urban environment and is determined by the overall spatial concept of the complex.

Several approaches to planning areas of multifunctional public complexes exist, which differ both in the methods of developing the territory allocated for development and in the principles of structural organisation of the multifunctional facility.

The first approach involves the location of service establishments in separate buildings. Each of these facilities is equipped with its own utility zones, which include courtyards behind the buildings, as well as open parking lots adjacent to the structures. The pedestrian zone is organised in the form of shopping streets and platforms between the buildings. Pedestrian and transport flows are distributed on one level. Functional zoning of the territory is also carried out within one level, and open spaces act as a unifying element (Fig.1.1).



1, 9 – entrances for spectators;
2 – entrance halls; 3 – arena of the 1st Gymnasium; 4 – arena of the 2nd Gymnasium; 5 – VIP seats;
6 – auditorium; 7 – internal garden;
8 – concours; 10 – gardens;
11 – parking lots; 12 – entrance for athletes; 13 – entrance for the press;
14 – entrance for service personnel;
15 – highway; 16, 17 – metro lines

Fig. 1.1. Yoyogi National Stadium in Tokyo, Japan (1961 – 1964). Architect Kenzo Tange. Master plan

The second approach involves the cooperation of service establishments. The territory is used more efficiently due to joint or multifunctional use: the organization of common parking lots, a single utility and warehouse area for the entire centre, as well as the formation of a common pedestrian zone. The functional zones of the site are integrated, but the establishments themselves remain structurally separate. Architectural objects are grouped but operate autonomously. Usually, they have their own entrance groups or are interconnected by passages.

Fig.1.2. Multifunctional complex of the community centre of integrated blocks (project), arch. V.M. Liakh:
a – general view; b – plan of the 1st floor: 1 – catering unit (cafe, restaurant); 2 – block of social and cultural activities (hall for spectators, club premises); 3 – block of children's music school and sports; 4 – block of communal services (communication department, bank branch, pharmacy); 5 – consumer service unit

The third approach involves the integration of service facilities with the abandonment of strict zoning. This allows you to create an effective structural scheme of the complex, placing the facilities around a common communication channel, which performs the function of the main pedestrian zone. Such a channel can be made in the form of a pier, passage, or plaza (at different levels or in the form of an atrium), which allows you to avoid the intersection of pedestrian,

cargo, and transport flows. The integration of service facilities includes the joint use of underground space, parking lots, warehouse areas, as well as public and recreational spaces and approaches to the complex. Utility and transport zones are located on the lower levels, which reduces the area of open areas since some of them become part of the architectural volume (Fig.1.3).

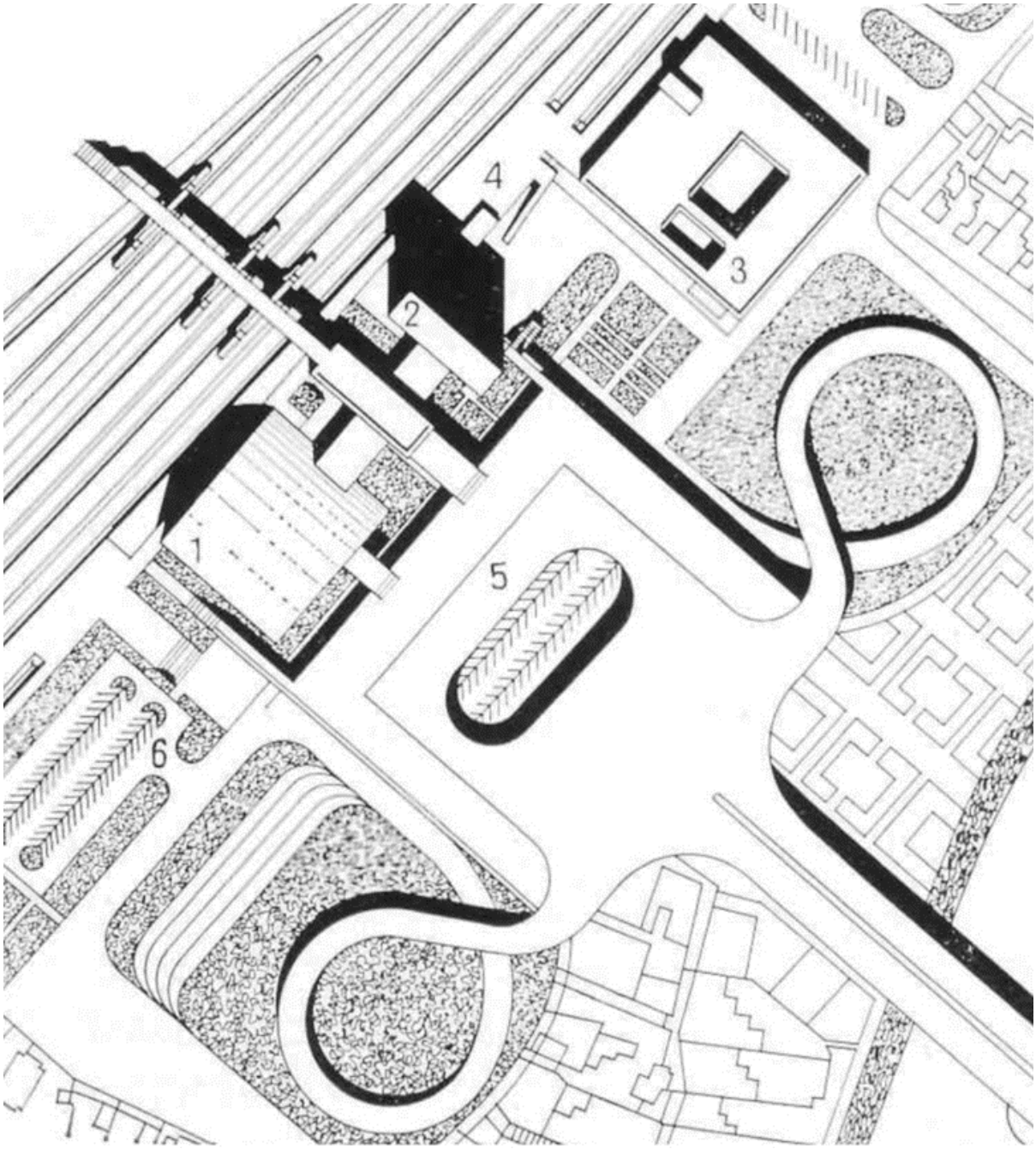


Fig. 1.3. Master plan of the railway station complex, Luhansk, Ukraine. Architects V. Batyrev, Ya. Vynohradov, A. Sukhorukova, engineer L. Kazachynskyi:
1 – railway station, 2 – hotel, 3 – post office; 4 – baggage claim; 5 – railway station forecourt on two levels; 6 – parking lots

The fourth approach involves a master plan solution, when the functional zones are almost completely integrated within the structure of the building. The complex is formed according to the principle of multi-layered organization, where complex spatial intersections of the main zones provide the necessary connection of functional processes. Instead of large parking lots at ground level, multi-level parking lots are created, which are connected to the multi-tiered structure of the main consumer zone. The service zone (utility, administrative and warehouse premises) becomes more flexible, distributed throughout the complex, and its area is reduced due to technological improvements. A communication structure is formed, ensuring the movement of visitors, the work of personnel, the organisation of delivery and engineering support, which is the basis for the interconnection of all elements. Thus, a structural unification of service establishments occurs.

Regardless of the capacity, specialization, and type of spatial organization of the multifunctional complex, there are general requirements for the functional zones of the sites.

Pedestrian zone. It is intended for the free movement of various pedestrian flows: target (for visiting the complex's service facilities); transit (for passing by the complex's buildings); and recreational (for staying in recreation areas, walking, communicating near the complex). Although the architectural and planning solutions of pedestrian spaces can be very different, several main approaches can be distinguished. In particular, the nature of transit flows determines the use of the following schemes: ***through*** (diagonal or transverse crossing of the pedestrian zone), ***frontal*** (the pedestrian flow moves along the red line of the development), ***peripheral*** (flows intersect at the edge of the main pedestrian zone) and ***angular*** (pedestrian flows move along the longitudinal and transverse fronts of the development and intersect).

To ensure comfortable movement and increase the intensity of use of pedestrian space, the most convenient and continuous routes should be organized in the form of pedestrian streets with express service, the width of which should be 5–7 m. Public transport stops should be integrated with blocks of accompanying service facilities and information elements, taking into account the general architectural concept of the multifunctional complex. When planning target flows, it is worth choosing the most effective pedestrian connection schemes, taking into account the intensity of space use. Such schemes include ***linear, compact*** and ***dispersed.***

When using such schemes, the following parameters must be taken into account: the width of the passages in a linear scheme should not exceed 10–15 m, the radius of movement in a compact scheme should not exceed 30–40 m, and the distance between the elements of a dispersed scheme should not exceed 10–15 m. In addition, to attract visitors, it is advisable to organize specialized zones near the entrances to the multifunctional complex that perform the functions of advertising, providing information, seasonal and related services, decorative

design, etc. For recreational flows, it is recommended to create zones for spectacles, entertainment, sports and games, shopping and food zones. Such zones can include open amphitheatres, playgrounds, summer cafes, exhibition spaces, pavilions, canopies, pergolas, etc. To ensure the integrity of the architectural and spatial organization of the complex, elements of external landscaping should be located directly next to the corresponding premises of the complex.

Despite the wide choice of planning solutions for pedestrian zones, several main types of spatial elements that form the pedestrian environment can be distinguished: ***linear*** (shopping alleys, pedestrian streets, passages); ***compact*** (areas of various configurations, simple or complex); ***complicated*** (complex networks of pedestrian streets and areas between separately located buildings). In all options, the key issue is pedestrian safety, which is ensured by the separation of transport and pedestrian flows.

To ensure planning integrity and effective functioning of the public complex, it is necessary to apply a systemic approach to the organization of the pedestrian zone. This approach allows integrating the pedestrian zone into the general structure of the life of the planning area (as the "centre" of public life), urban infrastructure (as part of the urban architectural node), architectural organization of the complex itself and neighbouring objects (as a connecting element of all structures). The main requirements for the organisation of the pedestrian zone are the interconnection of its elements, high intensity and diversity of use, integrity, structure, continuity of communication links at all levels, as well as direct access to public transport stops and green recreational areas.

Transport zone include public transport access areas, car and freight parking lots, freight access areas, and transit access routes. The main principles of planning transport areas include:

• organization of separate access routes for visitors, service and utility vehicles;

• creation of separate parking lots for visitors, staff and utility vehicles;

• arrangement of freight access areas to the utility zone, isolated from the pedestrian zone, taking into account pedestrian safety;

• arrangement of "safety islands" in parking areas in the form of pedestrian areas and sidewalks;

• proper placement of green spaces and landscaping elements around parking lots, which does not reduce visibility and does not affect traffic safety.

Types of parking lots, their location, number of parking spaces and planning organization depend on their functional purpose. They are divided into service and visitor parking lots. Service parking lots are determined by the needs of the business part of the multifunctional complex, and visitor parking lots are determined by the structure of consumer zones and the characteristics of the pedestrian infrastructure of the complex. Various types of structures are used to store cars: garages, covered and open parking lots. Their organization involves

the use of ground and underground spaces, the basement, part of the intermediate floors or roofs of the complex and adjacent buildings.

If the complex is located in free areas, it is possible to provide open parking for visitors (Fig.1.4). In urban conditions, the optimal solution is to organize underground parking (Fig.1.5) with appropriate entry and exit routes through ramps, or mechanical means. For historical areas, an effective approach is to integrate garages and parking lots into the structure of the complex or to place them underground. In such cases, it is important to take into account the difficulties of manoeuvring cars through vertical load-bearing structures and the selected methods of movement to parking spaces (ramps, lifts), which requires special design.

The number of underground parking levels should not exceed four. If the parking lot is long, it should be divided into fire compartments, each of which should accommodate no more than 100 cars. Parking lots are classified by capacity: small (up to 50 cars), medium (from 50 to 300 cars) and large (more than 300 cars). For parking lots for 100 or more cars in complex development, it is recommended to design multi-level parking lots.

The capacity of parking lots can be increased through economical placement of cars. The total number of parking spaces is determined taking into account the needs of the complex, reducing it by 15% when combining objects with similar operating modes and up to 35% – when operating at different times.

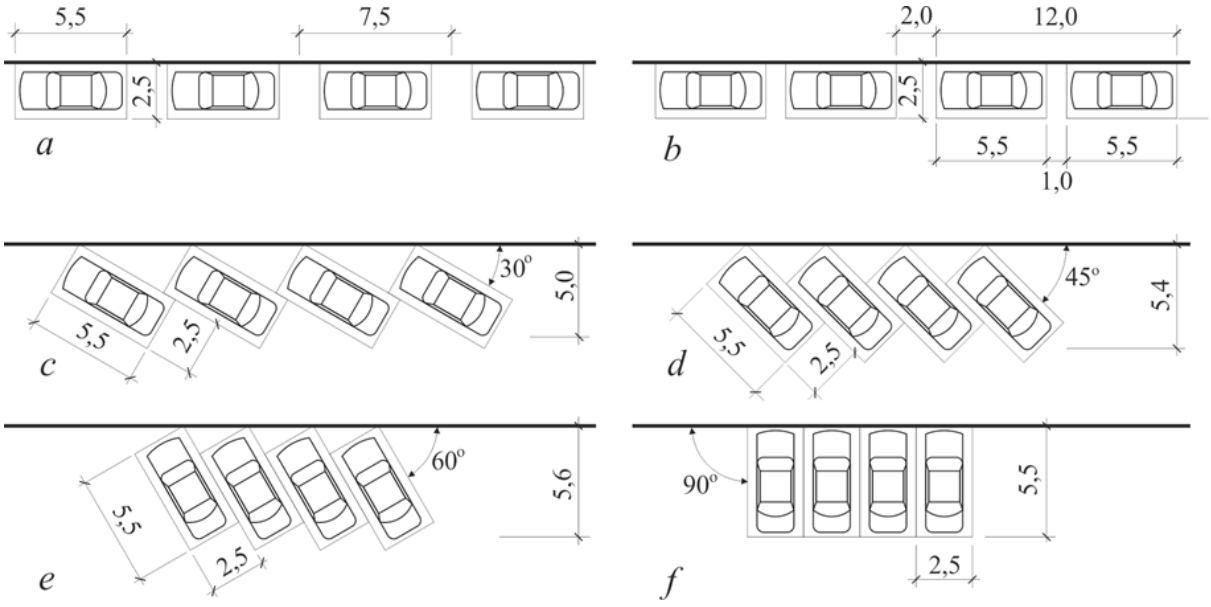


Fig.1.4. Schemes of cars placement in open parking lots (the sizes are specified in m)[21]: a – parallel to the passageway of separate cars (with continuous entry and exit); b – parallel to the passageway of pairs of cars (with separate entry and exit); c – at an angle of 30° to the passageway; d – at an angle of 45° to the passageway; e – at an angle of 60° to the passageway; f – at an angle of 90° to the passageway

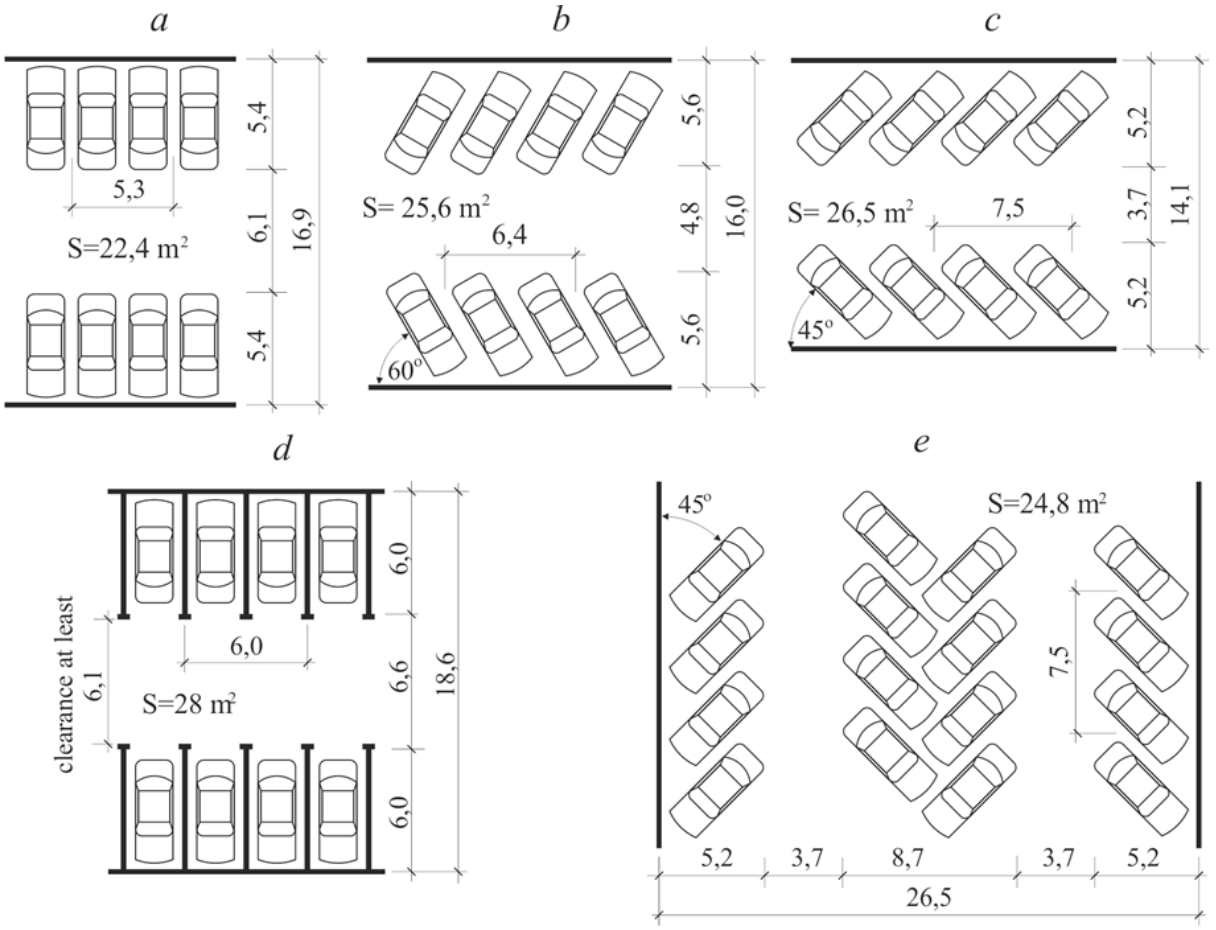


Fig.1.5. Schemes of car placement in garages (the sizes are specified in m) [21]:
a – at an angle of 90°; b – at an angle of 60°; c – at an angle of 45°; d – at an angle of 90° when placing boxes indoors; e – when placed at an angle of 45° in two rows

Utility zone. This is the zone of delivery, unloading and movement of goods, products, equipment, tools, materials and other items to the place of storage or use. Depending on the concept of the multifunctional complex, the economic zone can be represented by an open area – a yard, remote and visually isolated from the main pedestrian zone, be located in the underground part of the building (with rationally organized passages and provision of through ventilation), be designed on several levels (with coordination of the main levels, unloading areas and access roads). The economic zone consists of open and closed elements. The open ones include economic entrances, areas for turning and maneuvering machines, areas for garbage collectors. The closed ones include areas for unloading, storing materials and containers, areas for production workshops. The optimal combination of open elements is, while the combination of closed ones is possible only if the operating mode of all objects of the complex is coordinated. The main requirements for the design of a business zone: the area and configuration of the territory must ensure safe maneuvering of transport and convenient access to unloading points; for transport waiting to be unloaded, parking lots should be provided that will not interfere with active movement -

sedimentation tanks; the unloading zone must have a slope to ensure the flow of precipitation and other liquids. The area of the zone depends on many factors: the type of waste removal (removal, destruction on-site, pressing with subsequent removal), the equipment of the unloading zone (landing platform, gantry cranes, trucks, lifts), the area of the maneuvering zone, the equipment of the warehouse zone, volumes and types of storage.

Green zone. In areas of multifunctional complexes, it performs several functions: sanitary and protective, decorative, soil preservation and strengthening, a tool for functional zoning, an important element in creating an architectural environment, and is an integral part of the overall greening system of an urban area.

Reserve area. The area reserved for future expansion of a building complex and temporarily used for pedestrian areas, landscaping, parking lots, or transportation routes.

The process of planning the site of any public building involves dividing the available territory into six main zones:

I – ***buildings*** (buildings for the main, service and technical purposes, as well as for additional services), 20–30% of the total area;

II – ***pedestrian zone*** (main square, walking areas, passages between buildings, transit pedestrian paths), 30–40% of the total area;

III – ***transport zone*** (parking lots for private cars, public transport stops and parking lots, taxi ranks, passageways, and areas for turning), 10–15% of the total area;

IV – ***utility zone*** (passages for service and freight transport, utility yards, loading and unloading areas, passageways and areas for maneuvering trucks), 5–15% of the total area;

V – ***green zone,*** 15–20% of the total area;

VI — ***reserve zone,*** 15–20% of the total area.

Control questions and tasks

1. What are the main approaches to the planning organization of a multifunctional complex site?

2. What main functional zones are distinguished on the site of a multifunctional complex?

3. What schemes for organizing pedestrian transit flows do you know?

4. What schemes for organizing pedestrian target flows do you know?

5. In what cases is it advisable to organize above-ground parking lots, and in what cases – underground parking lots?

6. What schemes of car placement in open parking lots do you know?

7. What schemes of car placement in garages do you know?

8. What is a utility zone for?

9. What are the functions of a green zone?

10. What is a reserve area?

1.4. Classification of multifunctional complexes

The prerequisite for the typological diversity of multifunctional complexes is the consideration of factors that characterize the urban planning situation, as well as the features of the purpose and operation mode of the structure, taking into account the needs of the population. As a result of the study and generalization of modern scientific and design practice, types of multifunctional public complexes were identified according to the following characteristics.

By the predominant function, multifunctional complexes are divided into ***residential*** and ***public.***

Multifunctional residential complexes are complex architectural objects that include different in purpose, functioning independently of each other groups of premises: residential, public and administrative institutions, garages and parking lots, united by a single compositional and planning concept. Depending on the presence of functions, residential-commercial, residential-recreational, residential-educational, residential-cultural complexes are distinguished.

Residential-and-commercial complexes combine residential premises with commercial areas (shopping centres, offices, cafes, restaurants). These complexes are often located in the city centre, where there is a high population density and demand for various services.

Residential-and-recreational complexes. These complexes combine residential premises with various areas for recreation and entertainment. Typically, such complexes include fitness centers, sports grounds, swimming pools, spa services and other amenities that allow residents to maintain an active lifestyle and relax after a working day. Entertainment infrastructure is often located in separate parts of the complex or on lower floors to provide convenient access for residents. This allows you to create a comfortable living environment where residents can also actively relax. Such complexes are located mainly in green areas, which makes them even more attractive to residents.

Residential-and-educational complexes. These complexes combine housing with educational institutions, such as schools, universities, kindergartens and other educational institutions. This approach provides convenience for families with children, since all the necessary educational services are located near the housing, which significantly reduces the need for long trips to educational institutions. Residential and educational complexes create an environment where education, upbringing, and the daily life of residents are integrated, which allows for comfortable living for families. In addition, the presence of educational institutions contributes to the development of local communities and social ties among residents. Such complexes may also include sports and cultural areas for children and adults, which makes them even more attractive to families with children.

Residential-and-cultural complexes. These complexes combine residential premises with cultural institutions, such as theatres, cinemas, museums,

exhibition halls and other cultural facilities. They create an environment where residents can not only live, but also actively participate in cultural life without leaving their living space. This is especially important for people who value access to cultural events and have a desire to be part of a cultural community. Residential-and-cultural complexes may include a variety of cultural and artistic institutions that contribute to the development of the creative interests of residents and the cultural enrichment of the community. One example of a residential-cultural complex is La Défense in Paris, France. This area combines residential, commercial and cultural functions. It is home to not only modern residential complexes, but also cultural facilities such as the La Défense Museum of Contemporary Art and large exhibition halls that host various cultural events. The area is also home to numerous galleries, theaters, and cinemas. Another example is The Barbican Centre in London, UK. It is one of the largest residential and cultural complexes in Europe. It combines residential buildings with cultural institutions such as the Barbican Centre, which includes a theater, concert hall, cinema, galleries, and a library.

Depending on the dominant function of the complex, ***multifunctional complexes for public purposes*** are divided into the following.

Multifunctional commercial complexes are buildings or complexes that combine retail space with other functional areas, such as offices, housing, entertainment, educational or cultural institutions, medical centers, etc. The main purpose of such complexes is to integrate various services and functions in one place, which contributes to the convenience of visitors, increased efficiency of space use, and economic effect for owners. The most common are shopping and entertainment, shopping and office complexes.

Shopping and office centres are buildings whose main purpose is commercial activity, in particular trade, but some of their floors are occupied by office space. A shopping centre can effectively organize no more than three shopping floors: the first will operate at 100%, the second at 50%, and the third at 25%. Since land plots are expensive, building owners often choose to build higher buildings to maximize the use of space. As a result, the first floors are equipped with a shopping centre, and the remaining floors are used for offices or other functional premises. The combination of trade and offices is neutral, since these functions do not contribute to each other, but do not create obstacles either.

Shopping and entertainment complexes. One way to attract visitors to a shopping centre is to organize entertainment infrastructure. Entertainment areas are usually located on the upper floors. Thus, the first few floors are intended for trade, and the upper ones are for cinemas, sports entertainment, restaurants, etc. This allows for the flow of visitors to the shopping floors due to the fact that people, going up to the upper floors for entertainment, also pass through the shopping areas. One of the most popular entertainment services is multiplex cinemas (multiplexes), which are usually focused on family viewing, which determines their program and additional services. The multiplex is one of the main

“anchors” of a shopping centre, capable of attracting thousands of people every day. Also, effective “anchors” include bowling clubs and fitness centres.

Sports complexes are buildings and facilities that combine various sports, commercial, recreational, and residential functions. They are aimed at meeting the needs of a wide range of users – from professional athletes to amateurs and spectators. Such complexes provide the opportunity to hold sports events, training, mass cultural events, and leisure. They can be sports and entertainment, sports and health, sports and recreational complexes.

Cultural and artistic complexes combine various cultural and artistic institutions, may include theatres, concert halls, cinemas, museums, exhibition halls, etc. They are usually intended for holding cultural events, exhibitions, concerts, theatrical performances, as well as for organizing cultural recreation and leisure for a wide audience. Depending on the available functional components of the complex, they can be further divided into cultural and artistic, cultural and exhibition, museum and exhibition, multimedia cultural, cultural and entertainment, cultural and educational, cultural and tourist complexes.

Administrative and office complexes are buildings or complexes that combine office and administrative premises with other functions, such as trade, exhibition, recreational, public and others. These complexes are aimed at providing a functional and convenient infrastructure for business, as well as at creating a comfortable environment for people working in them or visiting them. Depending on the presence of additional functions, they can be office-commercial, office-hotel, office-recreational, office-cultural complexes.

Medical complexes are buildings or complexes that combine medical facilities with other functions, such as administrative, commercial, educational, recreational, and others. They are created to optimize medical services, and convenience for patients and medical staff, as well as to provide additional services. Additional medical complexes are divided into medical diagnostic complexes, medical rehabilitation complexes, medical educational complexes, medical commercial complexes, medical complexes with residential areas, medical complexes with recreational functions, medical complexes with administrative functions, and medical complexes with pharmaceutical functions.

Educational complexes are facilities that integrate educational institutions with other functions, such as residential, cultural, sports, recreational and commercial. They are focused on creating a modern environment for learning, living, recreation, and development of students, teachers, and researchers. Depending on the functional composition, educational-residential, educational-cultural, educational-sports, and educational-commercial complexes can be formed.

Transport complexes are multifunctional buildings or structures that combine transport hubs (train stations, airports, bus stations, metro stations, etc.) with additional functions: commercial, cultural, administrative or recreational. They are aimed at ensuring effective passenger and cargo service, convenience of

movement and expansion of the range of services. Additionally, by functional orientation they are divided into transport and trade, transport and administrative, transport and recreational complexes.

By location in the structure of the settlement, they can be local, at the intersection of transport hubs, in the historical core, in the central part, in the middle part, on the periphery, in the suburban zone, and in the recreational zone.

By size – small, with an area of up to 3000m^2, medium (3000 – 10000m^2), large (10000 – 30000m^2), extra-large (from 30000m^2 and more).

By role in the service system – quarter, district, citywide, regional.

By number of floors – single-story, low-rise (2 – 3 floors), medium-rise (4 –8 floors), multi-story (9 – 23 floors), high-rise (more 24 floors).

Depending on the location in the development structure, multifunctional complexes can be small and occupy part of the block (local), an entire block (quarterly), several blocks (fabric), develop along the street front (linear) or occupy significant areas along the street front with adjacent blocks (developed main), mixed structure.

Local complexes are located mainly in the areas of the historical core of the city, where continuous demolition is unacceptable, and only selective construction is possible. These are, as a rule, compact formations with a high coefficient of land use and with buildings up to 8 floors.

Quarter and ***fabric*** complexes (respectively, have an area of 5 – 10 hectares and 3 – 7 thousand residents) are formed within one or several blocks, often with an enlarged network of pedestrian and transport links.

Developed highway complexes are formed more often within the middle zones of large cities (in conditions of reconstruction of dilapidated buildings or old industrial areas) and are located in territories bordering the main transport communications. These are significant spatial formations (with an area of 10 – 15 hectares and 12 – 15 thousand residents), which are solved at one or several levels.

By type of ownership – commercial, social, commercial-social. Commercial facilities are owned by private owners or companies and are used for business, while social facilities can be state or municipal property aimed at meeting the needs of society.

By type of construction – new construction and reconstruction.

By the characteristics of the site where the complex is located (on vacant plots within the city; on plots that are being cleared of old buildings; integrated into existing development; on vacant plots of the suburbs).

By the development of the spatial-planning structure (one-stage involves an unchanged spatial-planning structure or the use of prefabricated structures for minor internal transformations; phased, which ensures the gradual growth of the complex due to the addition of tiers, the addition of blocks, the reconstruction and connection of neighboring buildings, the inclusion of underground spaces, the use of the roof; dynamic involves changing the spatial-planning structure as needed based on flexible planning.

By the composition of service establishments (highly efficient, i.e. capable of providing a wide and deep range of goods and services for a large number of visitors in a short period of time; universal; specialized with the presence of narrow or broad specialization; branded; standard with an orientation towards the serial and current nature of service).

By the role in the architectural environment (placement in an environment with high characteristics requires integration into the context of the urban planning situation; placement in an environment with low characteristics leads to the strengthening and consolidation of positive environmental qualities; placement in an amorphous environment without bright characteristics stimulates the beginning of its transformation).

By targeting the target audience (intended for people with different incomes, ages, professional activities, ways of spending free time, health status, etc.).

So, an important factor that ensures the diversity of types of multifunctional complexes is taking into account the conditions of the urban planning situation, as well as the characteristics associated with the purpose and operating mode of the building, taking into account the needs of visitors to the multifunctional complex and the possibility of their implementation. This is because the profitability of the complex depends on the interest of consumers, which increases due to the targeted nature of the service, effective placement, positive atmosphere, and comfortable service conditions.

Control questions and tasks

1. How are multifunctional complexes divided by the predominant function?

2.How are the types of multifunctional residential complexes distinguished depending on the available functions?

3. What is a residential and recreational complex?

4. How are multifunctional public complexes classified depending on the dominant function?

5. What is a sports complex?

6. What is a cultural and artistic complex?

7. How are multifunctional complexes classified by location in the structure of the settlement?

8. How are multifunctional complexes classified by size?

9. How are multifunctional complexes classified by role in the service system?

10. How are multifunctional complexes classified by number of floors?

11. How are multifunctional complexes classified by number of floors?

12. What is a developed highway complex?

13. How are multifunctional complexes classified by type of ownership?

14. How are multifunctional complexes classified by the development of the spatial-planning structure?

15. How are multifunctional complexes classified by the composition of service establishments?

2. FUNCTIONAL AND PLANNING ORGANIZATION OF MULTIFUNCTIONAL COMPLEXES

2.1. Determining the functional composition of a multifunctional complex

The combination of various functions increases the social and cultural value of civil buildings and structures, creates conditions for the effective implementation of commercial, educational, recreational, and other types of activities, and also increases the attractiveness of complexes as centres of social life and space for personal development. This determines the requirements for the functional and planning organization of multifunctional complexes, in particular, the composition and area of premises, the functional structure and the relationships of functional zones. When determining the functional composition of a multifunctional complex, it is necessary to take into account the diversity of forms of public service, taking into account socio-cultural standards and levels of public consumption, the formation of a competitive environment, adaptability in the processes of organizing service, as well as taking into account the psychophysiological characteristics and behavioural models of visitors in the context of the urban planning situation.

The functional and planning solution of multifunctional complexes should ensure the rational organization of functional zones in the building; the relationship of internal premises with the environment, taking into account the features of the use of adjacent territories; optimization of the movement of visitors, personnel, and transport; the combination of similar functional processes, based on the principle of functional zoning; adaptive use and the possibility of transformation of functional zones and premises.

The functional organization of a multifunctional complex involves the integration of various public service institutions. The features are manifested in the mode of operation of the facility, the composition of the premises, the level of technological and sanitary-hygienic requirements, the applied planning solutions, etc. Therefore, for the formation of the complex, it is important to take into account the principles of combining functions, which will ensure its effectiveness.

The use of a multifunctional complex is always based on one or more main public functions that act as structure-forming. ***The main function*** is determined by the type of public service that must be provided first. For example, for a shopping complex it is trade, for a theatre and concert complex – spectacles, for a scientific and cognitive complex – enlightenment and education, etc.

Functions that complement the main one are called ***auxiliary*** and are included to increase the social value of the complex, and its economic efficiency, as well as to ensure environmental and functional diversity. These are, as a rule, large-capacity institutions: for a shopping complex it can be a restaurant, parking, bank, entertainment centre, etc.; for a theatre and concert complex – a restaurant,

hotel, exhibition hall, green area, parking; for a research and educational complex – a library, a universal hall, parking, exhibition hall, etc.

Related service functions, which are borrowed from related industries and are aimed at increasing convenience, comfort, attractiveness and organizational flexibility, include various establishments and services. For example, for a shopping complex, these may be small cafes and restaurants, service facilities, reservation offices, company offices, etc.; for a theatre and concert complex – a small exhibition space, catering facilities, small shops, various offices and service points; for a scientific and educational complex – cafes and restaurants, service facilities, leisure, publishing premises, demonstration and testing grounds.

A preliminary set of service facilities that are part of a multifunctional complex is determined at the stage of developing an architectural concept when target areas of activity are determined. This program not only allows you to refine the list of functional processes but also helps to determine the main, additional, and related functions that will form the basis of the functional structure of a multifunctional building.

To create an effective multifunctional architectural object, it is necessary to provide a certain set of functions that, in the aggregate, will correspond to the socio-cultural role of the complex and determine its specifics. Such functions include:

– functions aimed at mass, interpersonal, and intergroup communication, obtaining information, training, and organizing leisure;

– practical functions of a commercial, household, and socio-cultural nature that provide for the daily needs of the population and should be available in close proximity to the place of residence;

– organizational and administrative functions that allow the authorities to carry out social and public activities, businesses to hold demonstration or advertising events, and urban communities to organize festivals and competitions;

– functions that provide permanent or temporary residence of people and their services;

– functions that include various zones and services aimed at supporting a healthy lifestyle and physical development;

– medical and rehabilitation functions that contribute to the restoration of health, rehabilitation after injuries, illnesses, or operations, as well as the maintenance of physical and mental health. These functions are focused on providing comprehensive assistance to people who need medical intervention to restore health or improve the quality of life;

– transport and logistics functions that ensure the effective organization of the movement of people, goods, and transport. They are aimed at optimizing transportation, convenience of moving visitors and cargo, as well as reducing the negative impact of transport on the environment;

– educational functions in multifunctional complexes are aimed at creating conditions for learning, development, and cultural enrichment of visitors of

different ages and professional groups. These functions are aimed at promoting the spread of knowledge, developing creative potential, as well as creating a platform for social and professional interaction through education.

The composition of public service institutions and enterprises included in a particular multifunctional complex is determined by the following factors:

– urban planning conditions of the city district (location in the structure of the settlement; distance and transport connections to its centre; size and planning organization of the site; features of the organization of cultural and household services in the settlement; proximity to workplaces and recreation areas, existing complexes and service centres);

– local natural and climatic conditions;

– prospects for the development of residential areas;

– principles for creating recreational infrastructure;

– the current legal and economic framework;

– the program for the formation of a multifunctional complex, developed at the stage of creating an organizational (commercial) concept.

Enterprises and service establishments that are part of multifunctional public complexes can be classified according to the following criteria:

– ***by assortment*** (with a limited but deep selection; with a wide but small assortment; seasonal service; on the principle of "everything under one roof"; large specialized enterprises with additional services);

– ***by the nature of the space use*** (enterprises on their areas in state or private ownership, as well as on areas leased for a long or limited period; with universal use of space; seasonal use; market trade and craft services provided by non-professional sellers and performers; organization of related services);

– ***by type and volume of services*** (sale of small, large, perishable, popular, fragile, complex goods and structures; serial, branded, author's goods and services; services with high technical equipment, having variety (modifications), requiring long-term familiarization and selection; goods and services of high or average quality; provision of new products, exclusives, express service on-site and on-demand);

– ***by price*** (enterprises serving at free, fixed, regulated, high, reduced prices; a combination of several options is possible);

– ***by orientation to different population groups*** (enterprises serving consumers with high or low incomes, children, people with impaired health, certain ethnic groups, certain professional groups; people with a certain lifestyle: fashionable, sporty, bohemian; taking into account the type of household management, for example, expanded or reduced, hobbies and the specifics of free time);

– ***by the nature of consumption*** (enterprises with instant service on site, i.e. providing ready-made meals, packaged goods, pre-ordered services, etc.; long-term service on site as a pastime, communication, business meetings with individual choice; service outside the complex, for example, at home or in the

office; enterprises offering exquisite goods or novelties, exclusive and individual service);

– ***according to the operating hours*** (during the day, around the clock, every day, taking into account seasonality and holidays).

The list of service enterprises included in the multifunctional complex is determined in accordance with the strategy of forming a complex multifunctional structure based on preliminary analysis and socio-economic justification. When selecting institutions for integration, they must be classified into main, additional and related, and their operating mode must be coordinated. The optimal combination is enterprises and institutions that operate at different times of the day, week or season, with different peak loads, as well as institutions that serve a small but stable flow of visitors.

The selection and combination of functional elements of the complex should be based on common spatial planning and design characteristics, ensuring flexibility of functions and the possibility of changing the purpose of individual groups of premises in the future. To achieve the effectiveness of such a combination, it is necessary to take into account both the needs of visitors and technological processes. From the point of view of users, it is important to combine premises of institutions similar in function, avoiding duplication and, if possible, increasing their area. In the case of homogeneous functions, it is convenient to combine specialized institutions of the same purpose, which allows you to create functional groups, zones, or sections. When combining functionally similar premises, it is advisable to combine communication and recreational premises. From a technological point of view, the greatest efficiency is achieved when combining institutions that require similar technological or engineering and auxiliary premises, as well as utility zones and transport entrances.

When choosing institutions to combine into a complex, it is important to consider the need to coordinate their operating modes and ensure more intensive use of the premises. It is optimal to combine enterprises and institutions that operate at different times of the day, week or season, as well as those whose "peak" hours do not coincide, or which have a uniform but small flow of visitors. When combining different enterprises in one premises, it is necessary to provide for the possibility of both joint use and separate operation of each of them.

Today, several approaches to the functional unification of enterprises and institutions into a single entity are used in design practice: ***integration, intrasectoral, intersectoral.***

Integration is considered the simplest option for combining service institutions. In this case, only administrative, auxiliary, utility, and some technical premises and communications are combined, while the main premises function autonomously.

Intrasectoral combination is typical for institutions that have similar functional processes. For example, entertainment and recreation facilities can be used jointly by leisure establishments and catering establishments. Multipurpose

halls intended for watching movies or meetings can also serve as demonstrations of clothing models, art objects or for holding festive events and balls. Shops, salons, offices and agencies work more efficiently when sharing recreational and communication areas. This approach is especially effective in the formation of cultural, sports-and-recreation, and shopping complexes.

Intersectoral combination involves the inclusion of individual enterprises of various purposes from related industries in the main zone as additional types of services. For example, in a cultural complex, inter-industry connections with catering enterprises, museum and exhibition centres, sports and recreation facilities, and administrative and business institutions are most desirable. For a sports and recreation complex, intersectoral connections with catering enterprises, medical and consulting institutions, clubs, halls for performances, trade and service enterprises are possible. Thus, it is possible to jointly operate premises for entertainment and recreation in clubs and catering enterprises. Universal halls intended for film screenings or meetings can also be used for demonstrations of clothing models, and objects of art, holding festive events or balls. Shops, salons, bureaus, and agencies work more efficiently when using recreational and communication spaces together. Inter-industry and intra-industry associations help create multifunctional complexes capable of ensuring more intensive use and uniform operation of premises, comfort for visitors, improvement of technological processes, etc. Thus, the identity of the nature of some processes for most enterprises (transport access, unloading, and storage, distribution of personnel flows, operation of halls, etc.) allows them to be combined into functional zones (transport, economic, communication, entertainment, etc.), the interaction of which is possible only under the conditions of a general structural organization.

Control questions and tasks

1. What are the advantages of combining several functions in one civil building (complex)?

2. Name the main requirements for the functional and planning solution of multifunctional complexes.

3. What are the main and auxiliary functions in a multifunctional complex?

4. At what stage of design is the preliminary set of service institutions included in the multifunctional complex determined?

5. What functions should be provided for in the multifunctional complex to ensure its effective use?

6. Name the factors that determine the composition of public service institutions and enterprises included in a particular multifunctional complex.

7. By what main features are enterprises and service institutions included in multifunctional public complexes classified?

8. How should the operating mode and the number of visitors in different time periods be taken into account when selecting service institutions for their combination in a multifunctional complex?

2.2. Functional and planning structure of multifunctional complexes

The most important task in forming the functional and planning structure of a multifunctional complex is the rational distribution of functional processes and flows, the elimination of undesirable intersections of flows, the creation of favourable conditions for the functioning of all structural elements without prejudice to effective functioning. With proper planning, each institution of a multifunctional complex can positively affect the profitability of neighbouring institutions. A necessary condition for the successful operation of a multifunctional building is not only the successful combination of various internal functions, but also the connection of its structure with the urban context, adjacent streets, public transport stops, the creation of a single architectural environment with it.

Functional structure is a system of relationships between various functional processes that occur simultaneously. It is determined by the level of integration and expediency of grouping functional and planning components into a single whole. The main elements of this structure for multifunctional complexes are: a functional unit, which usually corresponds to separate premises (for example, a trading floor, a kitchen, a hall, a cinema hall, a warehouse); a functional cell consisting of two or more units that have a common purpose (for example, trading floors arranged according to the principle of minimal connections; club rooms united by type of activity; entrance nodes, including vestibules, lobbies, cloakrooms, distribution corridors); a functional zone consisting of several functional cells that complement or develop this element, creating larger groups of premises, sometimes within an autonomous part of the building (for example, retail and service premises form a retail zone, offices of the directorate and commercial services – administrative, warehouses and unloading nodes – utility one). The zones form unity and constitute the functional structure of the complex, which can be implemented in various volumetric and spatial solutions.

The planning structure is manifested in specific forms of the functional content of the building. The main element of this structure is the planning cell – an enlarged planning module, the parameters of which are defined and set by the values of a single modular system. The planning cell and zone correspond to functional elements, reflecting their composition of premises, purpose and relationships, but at the same time have a specific planning form. The names of the planning zones and cells coincide with the names of the corresponding functional zones, such as entrance, administrative, or utility. All these elements are combined into a holistic structure, which on floor plans or levels illustrates the principles of organizing premises and the interaction of the main zones, determining their spatial and planar relationships.

The principles of spatial placement of the building on the site are determined by the planning scheme. The essence of the process of planning organization of any architectural object is to choose the form of implementation

of the adopted functional structure in the form of specific premises and the principles of their unification. This is the initial stage of forming the general structural organization of the building, which includes determining the optimal orientation according to the cardinal points, preliminary arrangement of public and service areas, development of a system of transport and pedestrian communications, as well as the search for a volumetric and spatial composition on the scale of the city or urban district.

The formation of a rational planning scheme of a multifunctional complex is an important stage in the design process, as it determines the efficiency of space use and the integration of various functional zones within a single organizational structure.

The formation of a planning scheme involves the logical combination of various facilities of a multifunctional complex into a single structure in order to avoid conflicts between different functions and ensure optimal access to each zone. For example, residential areas should be located so as to minimize the impact of noise from commercial or entertainment premises.

The planning scheme should ensure the rational use of territory and area, which will allow for the effective placement of all functional elements of the complex without crowding certain areas. This is achieved by balancing between different types of premises, providing sufficient space for parking, as well as providing green areas for rest and recovery.

The planning should take into account the requirements for engineering systems, such as water supply, drainage, heating, ventilation, electrical networks and other communications. Their effective placement within the overall structure allows for the uninterrupted operation of the complex with minimal energy resources.

To ensure high efficiency of the complex's operation, it is important to integrate the latest technologies, such as automation systems, smart building management, as well as energy-efficient solutions. This may include the integration of solar panels, rainwater harvesting systems, smart lighting and temperature control.

An important element is the thoughtful placement of main and auxiliary communications, in particular pedestrian and transport routes. They should provide convenient and safe access to each part of the complex for visitors and staff, taking into account the flows of people and vehicles. In particular, convenient routes for pedestrians, cyclists and vehicles must be correctly combined to ensure unhindered movement.

Since multifunctional complexes are often built in urban areas, it is important to take into account their impact on the environment. This includes not only environmentally friendly technologies, but also the creation of comfortable conditions for residents and visitors, for example, through the presence of parks, recreation areas, green roofs, etc.

The planning organization of a multifunctional complex is associated with the determination of a layout scheme on the site and the choice of a layout scheme for internal premises. To date, three basic layout schemes have been developed that underlie the planning diversity of public complexes: linear, compact, and combined.

Linear layout is one of the main types of planning organization, in which the main functional blocks or zones are located along one axis, forming a linear sequence. In such a scheme, each element has its own clearly defined line of communication with others, and flows of people move from one functional block to another along a simple straight line or with small bends. Rooms or zones with a linear layout are located in a clear sequence, which forms a convenient and understandable path for moving from one functional element to another. This provides ease of orientation and navigation for visitors in a large multifunctional complex. The linear organization allows for a clear distribution of flows of people, vehicles, and goods, preventing their cross-traffic, which increases the efficiency of the complex. This arrangement can be especially appropriate for buildings located on narrow plots where there are restrictions on building area.

Compact layout is a type of planning organization where functional areas or rooms are located within a single volume. It involves maximum efficiency in the use of space and the organization of space so that all necessary functions are located within a compact, often concentric or closed structure. All functional elements are placed taking into account the minimum number of corridors, distances between functional blocks, which allows maintaining a high concentration of functional elements. Such a layout provides convenient access to all areas with minimal time and effort, since all functions are located close to each other. In compact schemes, communication and infrastructure costs (for example, elevators, stairs, corridors) are reduced, since all areas are interconnected within a single volume. Flows of people, goods and services move over short distances, which increases the efficiency of the complex. Compact layout is usually used in facilities where it is important to ensure the effective use of limited space (for example, in small multifunctional complexes).

A combined layout is a type of planning organization that combines elements of linear and compact layouts, creating an effective and flexible spatial solution for multifunctional complexes. It allows you to integrate different functional areas within a single facility, using both linear and compact structures to achieve optimal area distribution and rational use of space. A combined scheme combines the advantages of linear (to create convenient communication paths) and compact (to save space and facilitate interaction between functional areas) layouts. This allows you to obtain a flexible structure that is suitable for complex facilities. Using a combined layout, you can easily adapt internal spaces to different functions. For example, linear corridors can connect separate compact blocks containing different functional areas, providing convenience and space savings. This layout is ideal for multifunctional complexes, where it is necessary

to combine various functional areas (retail spaces, offices, residential premises, entertainment areas, etc.) within one volume. With a combined scheme, the flows of visitors and resources are organized in such a way as to maintain a logical connection between the various functions of the building and at the same time reduce the costs of communications and infrastructure. The combined scheme allows you to take into account the specific needs of different groups of visitors and users of the building. For example, you can organize separate corridors for visitors and staff, or separate areas for commercial and administrative functions.

Today, the functional and planning structure of a multifunctional complex has acquired a standard form: large-capacity service establishments (department stores, concert halls, museums, restaurants, etc.), which act as *"anchors"* with high attractiveness, are connected by a communication space in the form of a pier-passage or a pedestrian area – plaza. Small establishments for various purposes are located along their perimeter. Compact planning schemes, as a rule, have one or two *anchors* in their structure, and linear ones have several.

The functional and planning scheme is determined by the conditions of the development site (placement of the main objects, entrances and approaches to the building, spatial orientation of the volumes, the nature of the use and arrangement of the adjacent territory) and determines the general principles of the internal organization of the multifunctional complex (typology of communication and distribution spaces, location of structural elements, general volumetric and spatial composition). The formation of the general functional-planning structure of multifunctional complexes is carried out based on the principles of functional zoning (horizontal, vertical, mixed). ***Vertical zoning*** involves the distribution of different functions on different floors, while ***horizontal zoning*** involves the combination of different functions on one level, and ***mixed zoning*** has the features of vertical and horizontal functional zoning (Fig.2.1).

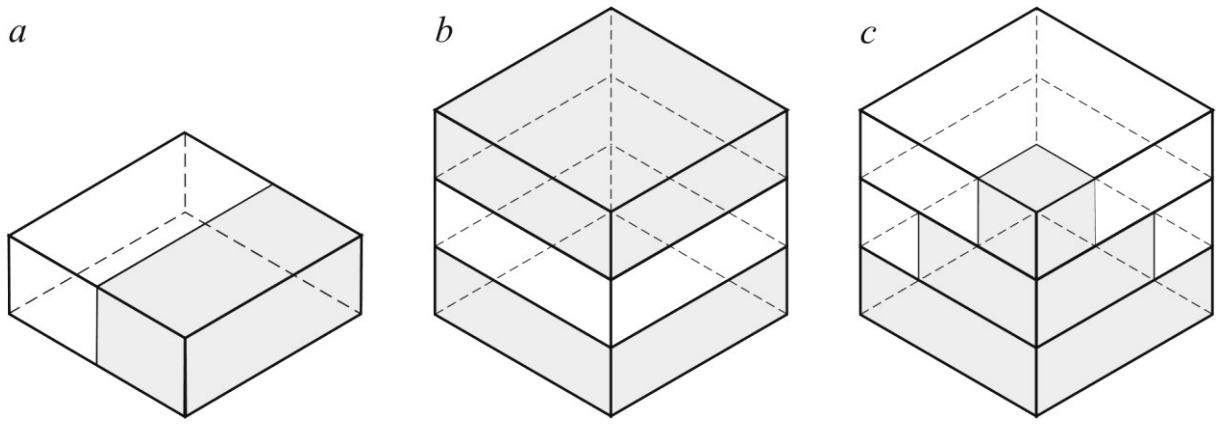


Fig.2.1. Types of functional zoning of a multifunctional complex:
a – horizontal; b – vertical; c – mixed (vertical-and-horizontal)

When combining different institutions and enterprises into a single multifunctional complex, it is necessary to find the right technological solution for each component and determine the conditions for their integration. Cooperative and integrated placement is the most effective way of mutual location of enterprises, in which joint use of a number of premises is possible. Cooperation and integration should not involve the mechanical combination of different institutions in one building, but the unity of technological and volumetric-spatial systems with a unified architectural environment. The functional-planning structure should provide not only for common information-communication and recreational spaces but also for unified administrative-economic premises and technical maintenance premises.

Rational planning of public service facilities involves the effective organization of the movement of people both to the facility and within it. The routes of pedestrian flows are formed taking into account the following principles:

– ensuring unhindered and logical movement, allowing visitors to cover all service facilities or purposefully move to the chosen goal;

– organization of through traffic in accordance with fire safety requirements, evacuation standards and general rules for the operation of the facility;

– development of coordinated routes for visitor flows, transportation of goods, official transport, personal cars and movement of personnel;

– alternating activity and rest areas to reduce physical and psychological fatigue (for example, shopping areas should be supplemented with spaces for rest and fast food; for audience halls, it is necessary to provide foyers and corridors; exhibition spaces need contrasting zones, such as low rooms next to high halls or small rest rooms next to large ones;

– formation of a “forced” and “unforced” nature of movement within the complex (“forced” consists in the need to bring the visitor to the centre of gravity: intense, bright, saturated, and “unforced” – in the arrangement of small establishments along the route in such a way that the visitor could visit them even without prior intention).

In the functional-planning structure of a multifunctional complex, structural elements that form it can be distinguished: ***entrance spaces, communications, main premises,*** and ***auxiliary premises.***

The key element of a multifunctional building is ***communications***, which have a dual purpose: on the one hand, they ensure the effective distribution of functional flows (visitors, personnel, material and technical resources, information, etc.), and on the other hand, they serve as a unifying framework for various constituent elements, such as service facilities, parking lots, unloading areas, warehouses, administrative and management areas and public spaces. The network of vertical and horizontal communications, including piers and plazas, which include stairs, elevators, escalators, halls, recreational areas, galleries and corridors, plays the role of a key structural element, providing functional and

spatial connections within the complex. Public communication (information and communication and recreational) space integrates all functions into a single functional and planning structure. In multifunctional cooperative complexes, the central public space can occupy up to 30% of the volume and up to 10% of the working area, including lobbies, passages, atriums, piers, forums, halls, foyers, recreation and communication areas, business meetings, etc., which provides an overall economy of space compared to the disparate placement of such premises. The organization of a single communication structure in a multifunctional complex creates convenient access to the building, effective distribution of consumer flows, and provides convenient orientation of visitors, access to information, and psychologically comfortable conditions for the consumer.

The main premises are formed as a result of the unification of numerous enterprises and institutions providing direct service to visitors. There are two layout options: blocking and integration of institutions. The first option leads to the division of an array of enterprises, and the second – contributes to the "fusion" of individual enterprises into a single structure.

Auxiliary premises are intended for the movement of service personnel, delivery of goods, their movement, etc.

The evolution of the planning structure of multifunctional complexes has revealed the priority and structure-forming role of the ***pedestrian zone.*** Today, this space is intended for the movement and service of visitors, the organization of leisure, obtaining information, entertainment, etc. Regardless of the type of multifunctional complex, it will be formed around a pier (linear pedestrian zone) or a plaza (intersection of linear paths in the form of a square) as the main communication space, the core of the entire system. The pedestrian zone determines the principles of the planning organization of the multifunctional complex, determining not only the method of distributing visitor flows but also the conditions for the effective combination of the main premises into functional zones. In design practice, various planning solutions for pedestrian zones are used – *malls, plazas, tiers, bypass galleries, courtyards,* and *covered areas*.

Malls are linear pedestrian areas, shaped like long corridors or walkways, that connect different parts of a complex. Malls typically contain shops, cafes, restaurants, and other commercial spaces on both sides, providing convenient access for visitors to the different functional areas of the complex.

Plazas are open or partially enclosed spaces located in the centre of a complex, often at the intersection of linear pedestrian routes. Plazas can be used for recreation, social activities, or cultural events, providing a space for meetings and entertainment. They are often surrounded by shops, cafes, and other public spaces.

Tiers are multi-story pedestrian areas that may include stairs or escalators to move between different levels. Tiers are often used to separate visitor flows or to create spaces that connect different parts of a complex at different heights. They may include galleries, shops, or cafes on different levels.

Bypass galleries are corridors or passages that connect different parts of a complex, allowing visitors to walk around the interior spaces or along the facades. Galleries can have decorative elements or provide access to various shops and service areas.

Courtyards are cosy open spaces, often surrounded by building walls or galleries. They can be used for relaxation, cultural events or to provide natural light for the surrounding spaces. Courtyards create an atmosphere of privacy and comfort within the complex.

Covered areas are open spaces covered with a roof that allows for protection from the weather. They can serve as a pedestrian area, creating a protected place for visitors at any time of the year. Covered areas are often used for social events, exhibitions, or as part of the entertainment infrastructure of the complex.

The utility zone occupies an important place in the structure of a multifunctional public complex. The main processes are carried out in this zone, in particular, unloading and loading of cargo, warehousing and delivery of materials, goods and equipment to the place of use. The work of service personnel also takes place here and various organizational and technical processes are implemented, such as garbage removal, storage of reusable containers, maintenance of the winter garden, etc. The planning organization of the economic zone is determined by the options for the movement of freight transport, the conditions and technical equipment of the unloading process, the types of warehouses and the schematic distribution of warehouse and main (trading, exhibition, entertainment, etc.) functional zones. In solving these issues, it is important to correctly group the tasks related to unloading, warehousing and delivery of cargo, which are associated with the organization of channels for cargo flows, which cover the entire volume of the structure and are formed according to both horizontal and vertical schemes. The horizontal scheme of cargo flows involves the movement of cargo in one level of the building. It may include corridors, aisles, streets, open or closed galleries, as well as various platforms and platforms for unloading. The vertical cargo flow scheme involves moving cargo between floors using elevators, escalators, and stairs, as well as special hoists or conveyor systems.

The choice of the scheme and methods of its implementation is determined by the following factors:

– the type of freight transport and the adopted scheme of its approach to the place of unloading and loading works;

– the type of warehouse premises, conditions and technical equipment of the unloading process.

An important factor in the effective operation of a multifunctional complex is determining the ratio of service areas (administrative, economic, preparatory, etc.) and main premises (trading, dining, exhibition, office, etc.), as well as the

use of effective schemes for moving people and cargo from warehouses or reception rooms to places of their use.

The complex management offices, staff canteen, information centre, office space, meeting rooms and other elements make up the ***administrative zone,*** which is recommended to be designed as a separate volume with comfortable transitions to the main nodes of the complex or as an isolated block on the upper floors. The problems of forming the economic and administrative zones are closely interconnected and develop into the task of effective organization of the transport zone. At the same time, the tasks of moving private cars, company cars, and trucks, and effective parking on the floors or in the underground space are solved.

In multifunctional complexes, the organization of ***parking spaces*** is an important aspect, as it affects the convenience of using the facilities and the efficiency of using the territory. For organizing temporary storage of vehicles of personnel and visitors of multifunctional complexes, open parking lots and covered parking lots, underground parking lots are usually used. Open and covered parking lots can be located on the roof of the building, in an attached volume, in the space between the floors occupied by the main premises. It is advisable to use technologies that help to quickly place cars in a limited space, for example, mechanical lifts or vertical systems, which allow for the most efficient use of the available parking space. The combination of different options, for example, underground, open and covered parking lots with automated and traditional systems allows for flexibility and efficient use of space.

Control questions and tasks

1. Name the most important task that is solved when forming the functional and planning structure of a multifunctional complex.

2.What is a functional structure? Name the main elements of the functional structure of multifunctional complexes.

3. What is a planning structure? Name the main element of the planning structure.

4. What are the principles of spatial placement of a building on a site?

5. Name three basic layout schemes of multifunctional complexes.

6. What are the characteristic features of the multifunctional complexes linear layout?

7. What does the compact layout of a multifunctional complex involve?

8. What type of planning organization of multifunctional complexes combines elements of linear and compact layouts?

9. What are vertical, horizontal and mixed functional zoning?

10. What principles should be taken into account when forming the routes of pedestrian flows within a multifunctional complex?

11. What main structural elements can be distinguished in the functional and planning structure of a multifunctional complex?

12. Name the planning solutions for pedestrian zones within multifunctional complexes that are used in modern design practice.

13. What processes are carried out in the business zone of a multifunctional complex?

14. What factors determine the choice of a horizontal or vertical scheme for organizing cargo flows within a multifunctional complex?

2.3. Techniques of the planning organization of the internal space of multifunctional complexes

The main groups of premises in multifunctional complexes include:
entrance group (entrance vestibules/draught lobbies, lobbies, cloakrooms);
main premises (offices, classrooms, auditoriums, trade halls, etc.);
auxiliary and utility premises (pantries, inventory, technical, toilets);
horizontal and vertical communications (corridors, galleries, transitions, lift halls, stairwells, ramps).

Entrance vestibules/draught lobbies are small rooms, which are equipped with entrances to buildings, made in the form of one or two airlocks. The doors in the vestibules must open to the outside. Their minimum depth is determined taking into account the width of the door leaves with the addition of 0.2 m, and the width – 0.25 m on each side of the doorway. The minimum depth of the entrance vestibule is 1.2 m, accessible for people with reduced mobility – 1.8 m (Fig. 2.2).

The solution of the ***lobby*** depends on the purpose and capacity of the house. The main lobby is equipped with a wardrobe. Cloak-rooms can be one-sided, two-sided and island type depending on the planning solution of the lobby (Fig. 2.3). The cloak room depth is not more than 6 m.

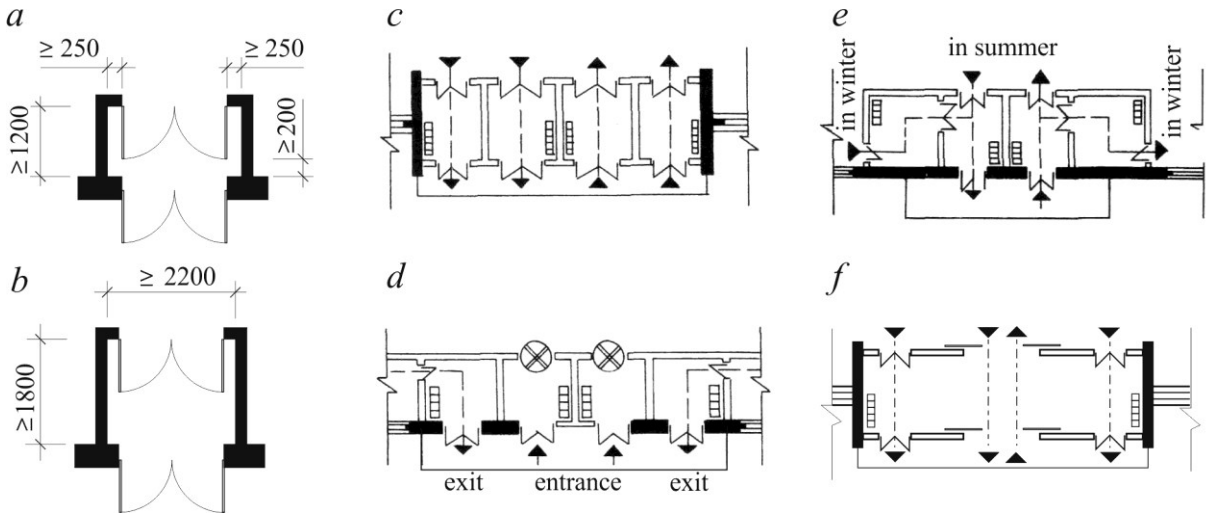


Fig. 2.2. Planning schemes of entrance vestibules/draught lobbies in multifunctional complexes:
a – service entrance vestibule/draught lobby;
b – common entrance vestibule/draught lobby, accessible to people with reduced mobility;
c – at rectilinear movement;
d – with differentiated movement organization;
e – with seasonal change in traffic organization;
f – when equipping the vestibule with automatically opening doors

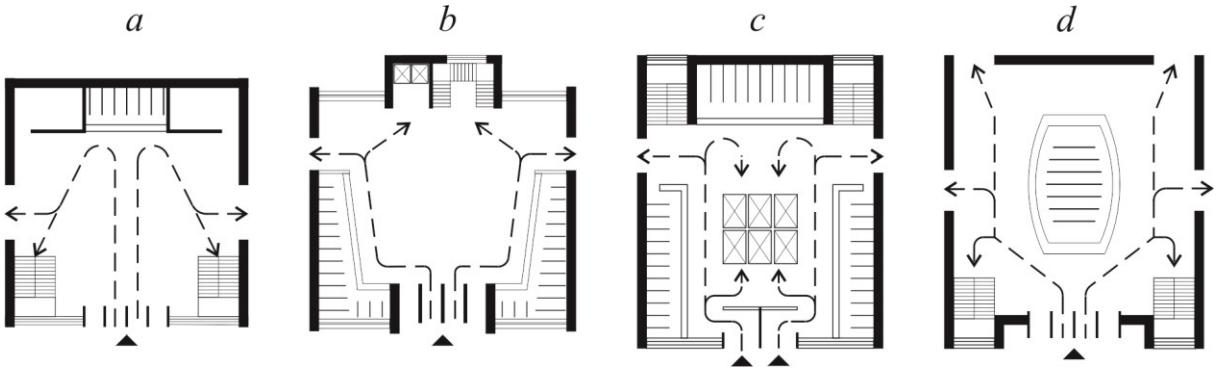


Fig. 2.3. Layouts of cloak room in the lobby of a multifunctional complex:
a – deep; b – lateral; c – perimeter; d – island

The barrier for delivery of clothes has a width of 0.6 – 0.7 m and a height of 0.9 – 1.2 m. Between a barrier and hangers free passage for service personnel not less than 1 m is provided. The area of dressing rooms for outerwear the barrier should be taken at the rate of one place not less than 0.08 m^2 when using cantilever type hangers, and 0.1 m^2 when using common and hanging hangers. When bags and briefcases are stored in the cloak room, in addition to outerwear, the area behind the barrier may be increased by 0.04 m^2 per place.

Groups of main premises**,** based on their functional purpose and three-dimensional solutions, can be:

– ***cellular type*** – relatively small area (50 – 100 m^2) and height (3.3 – 3.6 m) and mostly with natural side lighting (for example, school classrooms, treatment rooms, club rooms, etc.);

– ***mixed type*** – relatively small premises (more than 200 m^2), relatively small height (3.3 – 4.2 m), with natural, mixed or artificial lighting (trade and office halls, etc.);

– ***hall type*** – unsupported premises of large area (more than 1000 m^2) and height (6 – 12 m), with large-span structures, with side and top natural or artificial lighting (gyms, indoor markets, cinemas, concert halls, etc.).

Auxiliary and utility premises can also be of the ***cellular type*** (laboratory in schools and higher educational institutions, barns, etc.) or ***large-area premises*** (for example, warehouses of large commercial enterprises, depositories in museums, etc.).

According to the norms, multifunctional complexes have sanitary facilities, which may include a toilet, washroom, shower, bathroom and drying room. It is recommended to place them near the main communications (stairs, lifts) at a distance of not more than 75 m from the most remote place of people permanent residence. Entrances to the toilet are provided through rooms with washbasins. The sizes of cabins are 0.85 x 1.2 m at door opening outside and 0.85 x 1.5 m – inside, the height of partitions should be not less than 2.0 m, a width of passes between two rows of cabins – 1.5 m (more than 6 cabins in a row – 2.0 m), between one row and the wall – 1.3 m.

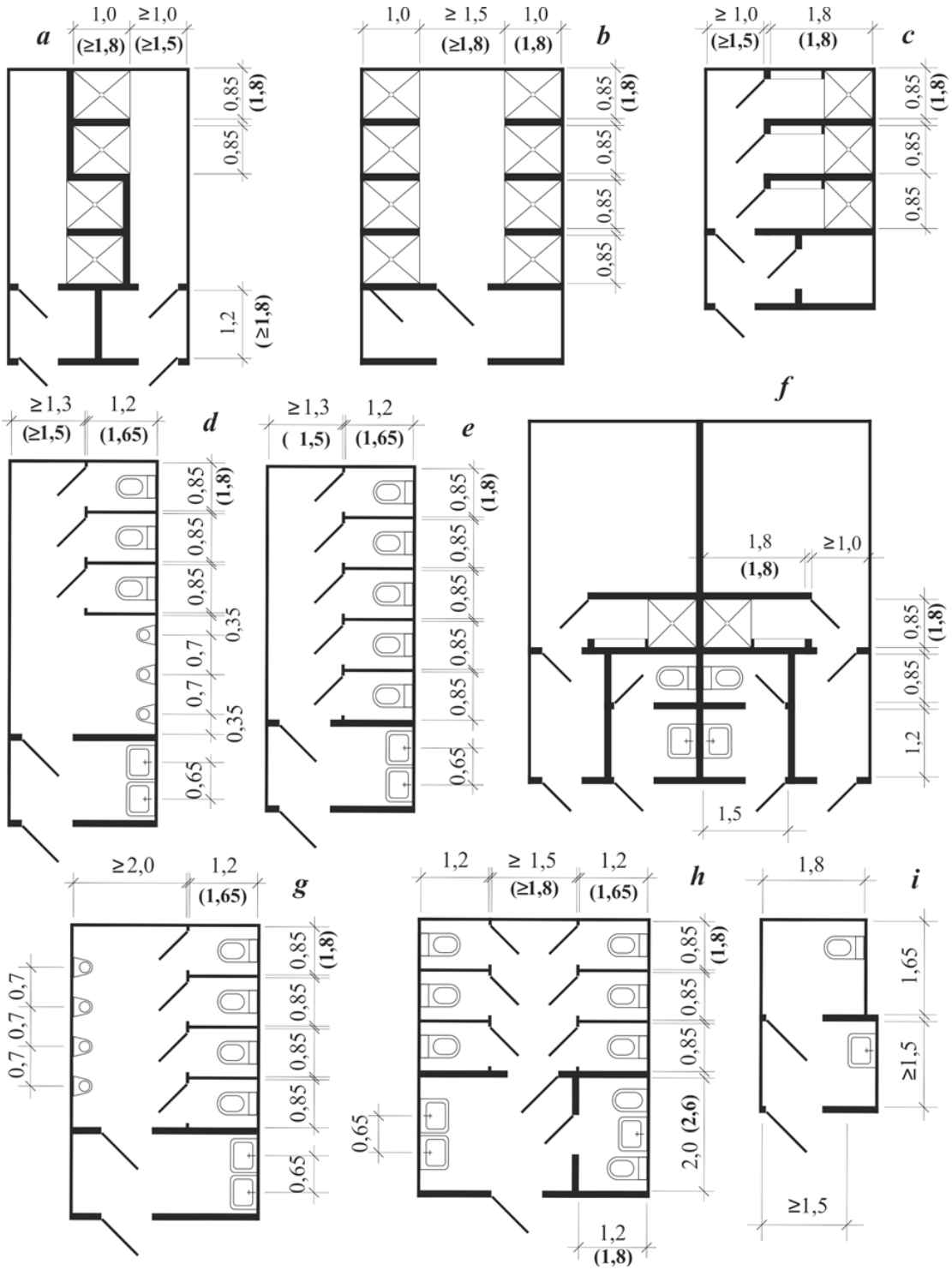


Fig. 2.4. Shower rooms, locker rooms, and toilets of multifunctional complexes (dimensions are given in metres, in parentheses – dimensions for less mobile visitors): a – shower room with single-row placement of open cabins; b – shower room with two-row placement of open cabins; c – shower with single-row placement of the closed cabins; d – men's toilet with a single row of cabins and urinals; e – women's toilet with single-row cabins; f – staff locker rooms; g – men's toilet with a two-row arrangement of cabins and urinals; h – women's toilet with two-row cabins and a cabin for individual hygiene of women; i – single toilet for people with reduced mobility

The number of cabins is determined based on the type of public building. The dimensions of the shower cabins are 0.85 x 1.8 m (0.85 x 1.0 m – without doors). The width of the passage between two rows of showers is 1.5 m, and between one row (up to 6 cabins) and the wall is 1.0 m. The doors of the shower cabins must open to the outside. The width of the passage between two rows of washbasins is 1.6 m, between one row and the wall is 1.1 m, and the distance between the taps of washbasins is 0.65 m. The dimensions of the toilets for the visitor in a wheelchair must be at least 1.65 m wide and 1.8 m deep. The doors must open outwards.

Horizontal communications that provide connections between different groups of rooms within the floor include entrances, corridors, galleries, passages, rest areas.

The main entrances serve as communication routes for the majority of visitors or staff in the multifunctional complex. Service entrances are intended for service personnel or groups of people who provide the main functional process (for example, the staff of a commercial enterprise, theatre artists, etc.).

Corridors are the most common horizontal communications. They are divided into corridors with rooms on one and two sides, mixed type and paired with rooms on the outside and between them. Depending on the shape in the plan they can be straight and curved, with ledges, cross and U-shaped, and from the lighting – through (with natural lighting on both sides), dead-end and with illuminated halls (with lighting on one side).

The length of the corridors with the location of the premises on two sides and lighting from one end is 24 m, from two – 48 m (Fig. 2.5). It is allowed to illuminate the corridor with a second light through transoms in the walls, glazed partitions and doors.

Corridors leading to vertical communications (exits from the house) are the ***main,*** and others – to the ***secondary***. The minimum width of main corridors in clearance is 1.8 m, but it depends on the type of public building (in particular, in the buildings of educational institutions and ward sections of hospitals, respectively, 2.2 and 2.4 m).

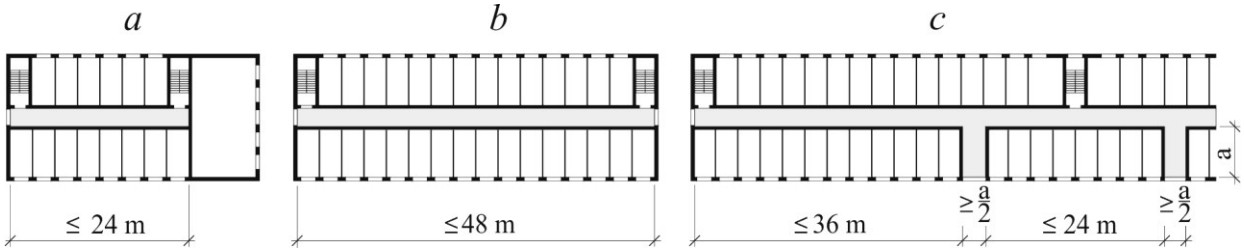


Fig. 2.5. Corridors in multifunctional complexes:
a – when lighting from one end of the corridor; b – when lighting from both ends of the corridor; c – when lighting from the ends of the corridor and the arrangement of light pockets

The minimum width of the rest areas combined with corridors is accepted 2.8 m at an arrangement of rooms on one side and 3.2 m – on two sides.

In corridors at a small difference of floor marks (less than 0.45 m) it is forbidden to arrange stairs, thresholds – only ramps with a slope of not more than 1:12. In rooms that can accommodate 15 or more people at a time, the door should open outwards into the corridor.

In large centres and complexes ***travolators*** can be used.

Vertical communications include stairs, ramps, lifts, escalators. The most common of them are ***staircases (stairways),*** which according to their purpose can be divided into main, service, auxiliary and emergency; depending on the structural solution – on one-, two- and three-flight, as well as multi-flight; by the shape of the staircases – to straight, L-shape, U-shape, T-shape, Z-shape, curvilinear, oval and spiral (Fig. 2.6).

Depending on the location, stairways are divided into external and internal, which in turn are divided into closed (in stairwells) and open. The main staircase can be open, service, and auxiliary – closed. Closed stairways, enclosed by walls, are called stairwells and differ in their location in the plan of the building and the organization of natural lighting (Fig. 2.7).

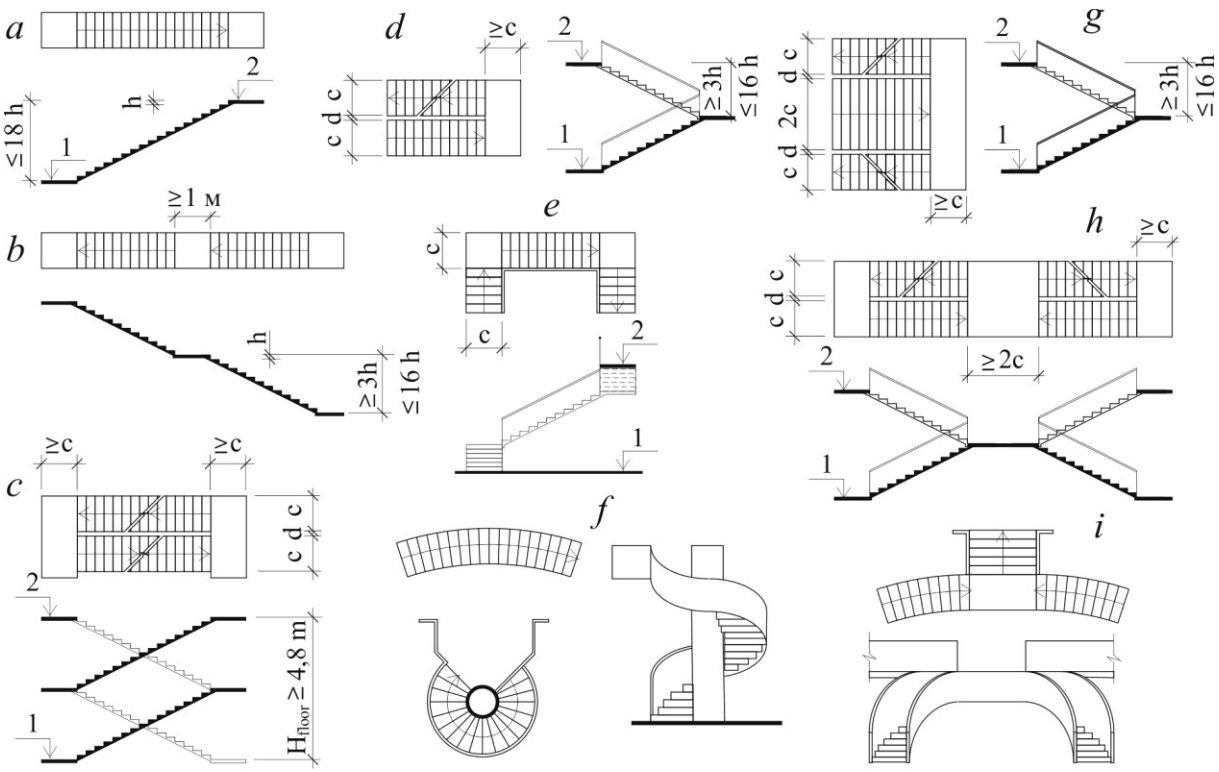


Fig. 2.6. Shapes of staircases:
a – straight; b – U-shape with three flights; c – U-shape with two flights; d – straight with mid-landing; e – scissor exit staircases; f – furcated four-flight; g – combined; h – furcated three-flight; i – curvilinear and spiral (helical)

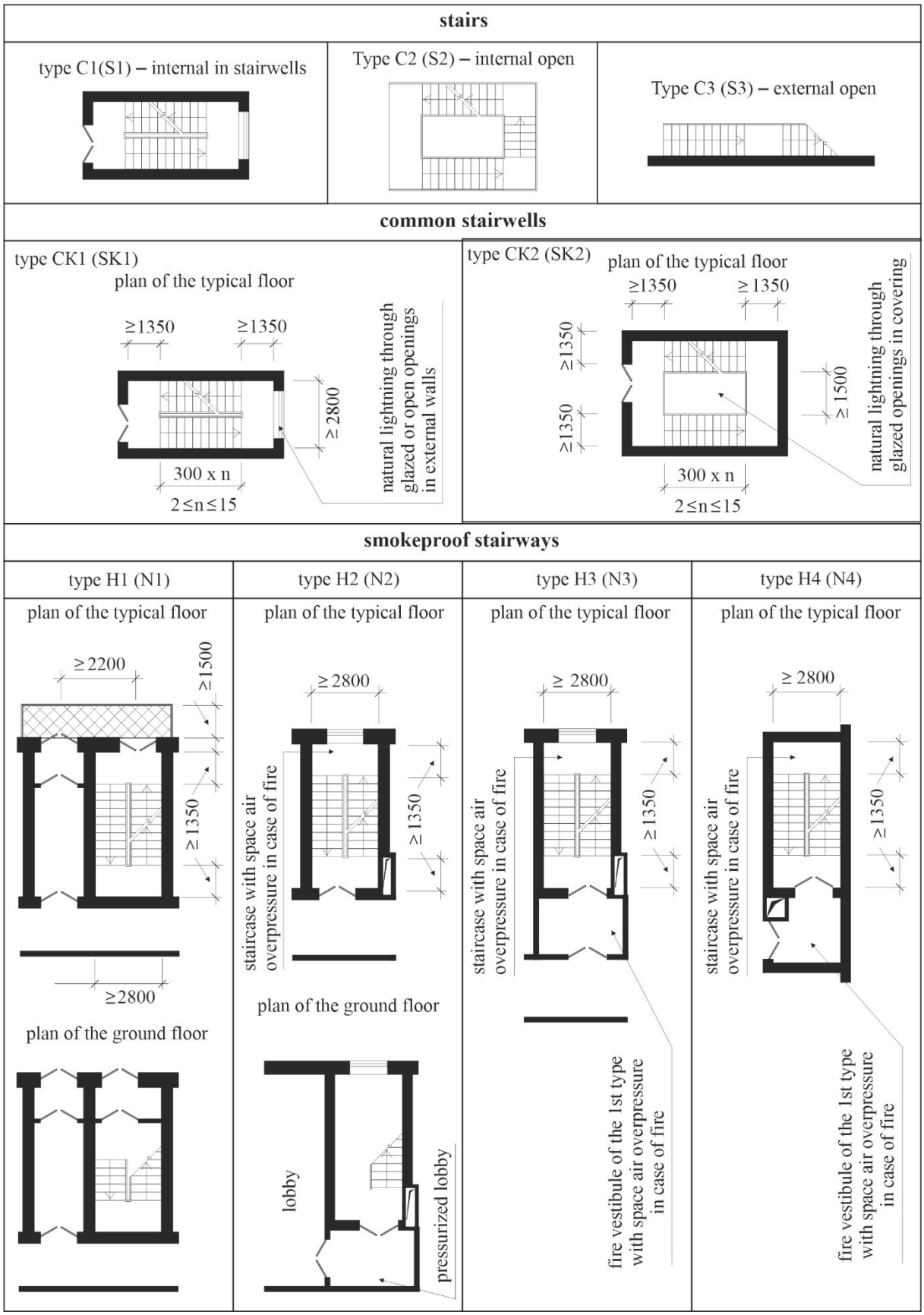


Fig. 2.7. Types of stairs (except external fire ladders) and stairwells according to DBN B.1.1-7:2016 [9]. Dimensions are given in millimetres

The stairwells of the CK2 (SK2) type can be used in buildings with a conventional height of no more than 9 m, and CK1 (SK1) – no more than 26.5 m.

At a floor height of 3.3 m and a slope of flights of 1:2, the minimum depth of the stairwell is 5.4 m, and at a floor height of 3.6 m – not less than 6 m, the minimum width of the flight – 1.35 m (for service and auxiliary staircases – 0.9 m). The maximum width of the flight shall not exceed 2.5 m (with a larger width the flight is equipped with intermediate railings with handrails). The height of the railing with the handrail from the surface of the steps must be not less than 0.9 m. In all stairs the width of the flights must be the same, and the width of the landings – equal to or greater than the flight width.

Stairs with a going of 0.3 m and a riser height of 0.15 m are considered optimal, which means a slope of 1:2 (the slope of external emergency stairs can be up to 60°). In other solutions, going and riser dimensions are determined by the formula $b + 2h = 0.6 \div 0.64$ m, where b is the step going; h is the riser height; $0.6 \div 0.64$ m is the average step size. The number of risers in one flight should be at least 3 and no more than 18, and the distance between two parallel flights of stairs should be at least 0.1 m.

Stairwells should be provided with natural light through openings in the external walls (except for stairs in basements and semi-basements, as well as grate stairs in entertainment buildings). It is forbidden to place any equipment on the landings and stairways, and opening the doors from the premises and stairwells towards the stairwell should not reduce its estimated width.

Ramps are flat sloping structures without steps, in public buildings are designed, as a rule, in terms of service for people with disabilities. Structures of ramps and their protections should be executed from non-flammable materials with a limit of fire resistance of not less than 2 hours.

Ramps and stairs should be provided in places of level difference exceeding 0.04 m, between horizontal sections of footpaths or floors. In exceptional cases it is allowed to provide screw ramps, the value of the inner radius of which is accepted following the norms, but not less than 5.5 m. The slope of each ramp flight must be taken in accordance with the above rules depending on its length, but not more than 8% (1:12). If the difference in floor levels on the roads is less than 0.2 m, it is allowed to take the slope of the ramp no more than 10% (1:10). The width of the ramp in exclusively one-way traffic should be not less than 1.5 m, in two-way traffic – not less than 1.8 m. The length of the intermediate horizontal platforms of the spiral ramp along its inner radius must be not less than 2 m. When changing the direction of movement of the ramp, the width of the horizontal platform must provide the possibility of turning the wheelchair. The dimensions of the platform for turning the wheelchair by 90° – 180° must be not less than 1.5 x 1.5 m. On the outer side edges of the ramp and platforms should provide sides at least 0.05 m high. The ramp used for evacuation from the first floor and the floors above must be directly connected to the outside of the building or structure.

Lifts by their purpose are subdivided into passenger, cargo-passenger, hospital, freight, service and special (Fig. 2.8).

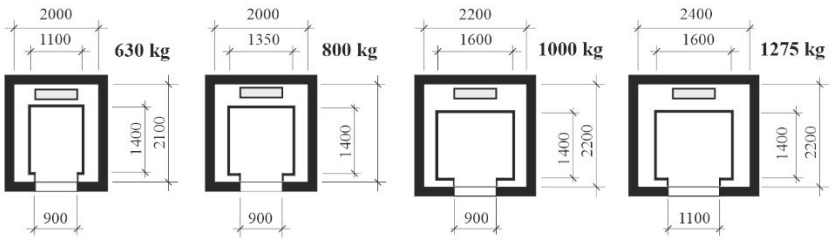
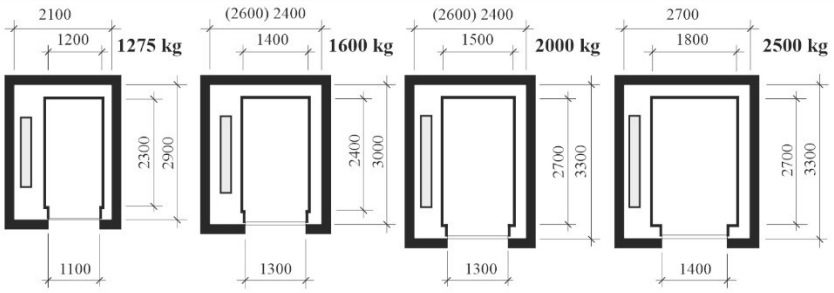
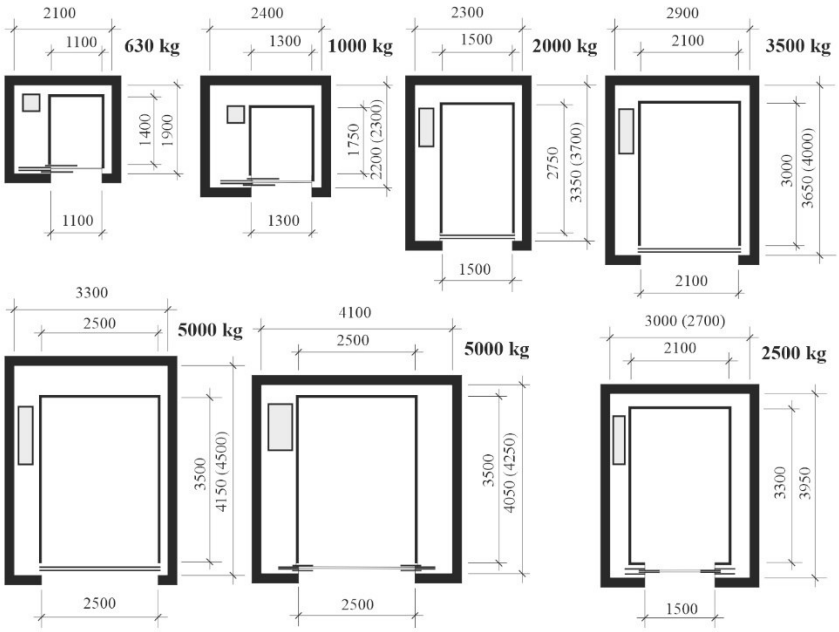
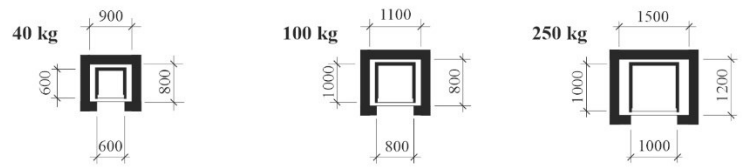
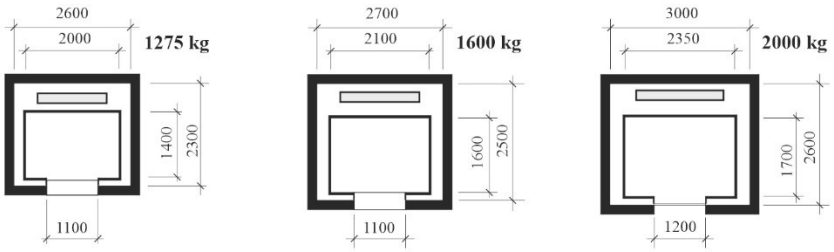
Class	Purpose	Examples of planning schemes of elevators of different carrying capacity
I and II	Respectively passenger and cargo-passenger elevators (with a carrying capacity not less than 1000 kg with a special car interior)	
III	Elevators intended for health care facilities, including hospitals and shelters	
IV	Elevators intended mainly for the transportation of goods accompanied by people	
V	Service (kitchen) elevators intended for the transportation of goods unaccompanied by people	
VI	Special elevators intended for buildings with intensive movement (elevators with a speed of 2.5 m/s and more)	

Fig. 2.8 Electric and hydraulic lifts of different classes according to international norms [23, 24, 25] (for elevators of the III class in brackets the sizes of shafts for hydraulic lifts are given, IV class – when organizing two entrances to the car)

They are stationary lifts of periodic action, in which the vertical movement of passengers or cargo is carried out in the cabin. Depending on the speed of the cab, they are divided into normal (0.71 – 1.4 m/s) and speed (2 and 4 m/s). Structurally, lifts contain a construction part, which consists of a lift shaft and machine room, and a mechanical part in the form of a lifting mechanism, cabin (car), and counterweight (Fig. 2.9). Lift shafts can be both deaf (in brick or concrete walls), and frame with own bases. At a small lifting height, lifts with a lower location of the machine room (so-called "squeezing lifts") are used, which are used more often in trade and catering enterprises (Fig. 2.9 e).

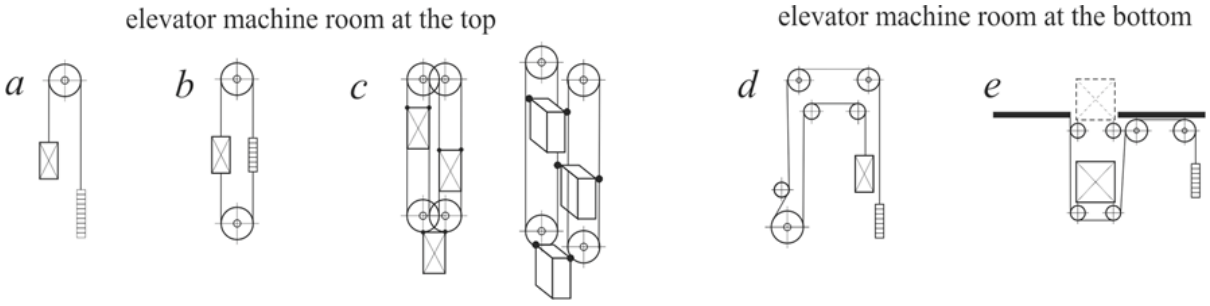


Fig. 2.9. The main kinematic schemes of lifts:
a – usual scheme with a counterweight (the most common); b – with a balancing rope (used in high-rise buildings; c – a continuous lift (paternoster); d – used for heavy lifting; d – ram lift (electrohydraulic lift)

In all multifunctional complexes it is necessary to provide lifts, the cabins of which must have dimensions not less than: width – 1.1 m; depth – 1.4 m; width of a doorway – 0,9 m.

The number of passenger lifts is set by calculation, but may not be less than two. It is allowed to replace the second lift with a freight one, in which it is allowed to transport people if the calculation of vertical transport is enough to install one passenger lift. The distance from the door of the most remote room to the door of the nearest passenger lift must not exceed 60 m.

Exits from passenger lifts should be designed through the lift hall, and in buildings with smoke-free stairwells – following fire regulations. The width of the passenger lift hall must be not less than: with a single-row arrangement of lifts – 1.3 of the smallest depth of the lift car; at a two-row arrangement – double the smallest depth of a cabin, but no more than 5 m (Fig. 2.10).

The location of lifts in the communication system is determined mainly by the architectural and planning solution of the multifunctional complex.

A moving staircase that carries people between floors of a building or structure is called an ***escalator*.** Escalators are often used around the world in places where lifts would be impractical, or they can be used in conjunction with them. Principal areas of usage include department stores, malls, airports, railway stations, and other public buildings (Fig.2.11, 2.12).

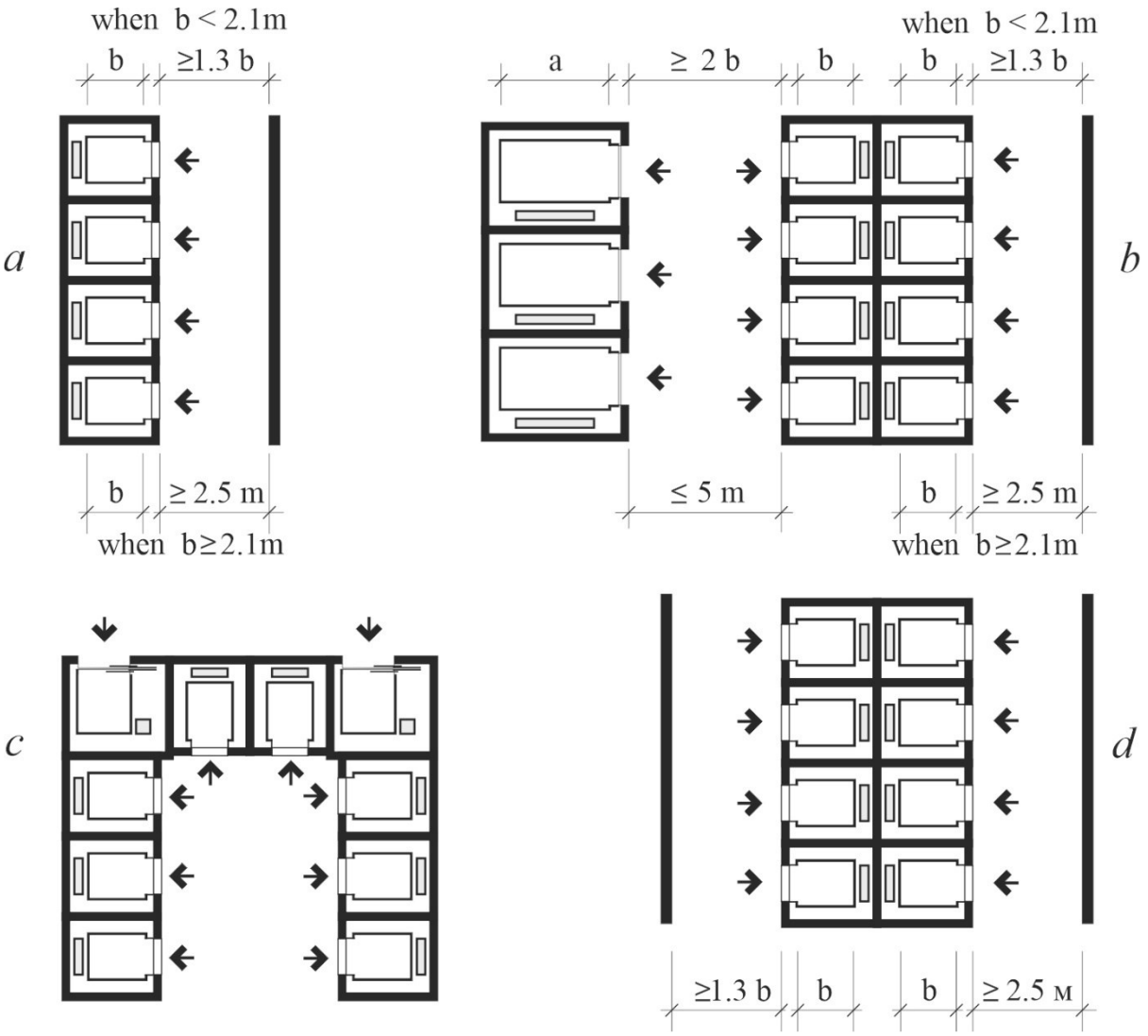


Fig. 2.10. Layout schemes of lifts:
a – single-row; b – multi-row; c – perimeter, d – island

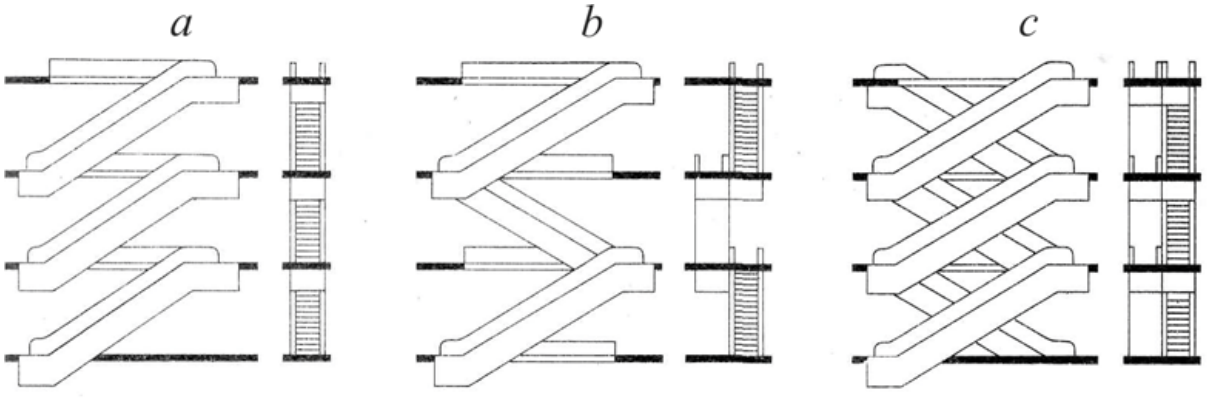


Fig. 2.11. Schemes of escalators placement:
a – parallel; b – consistent; c – cross

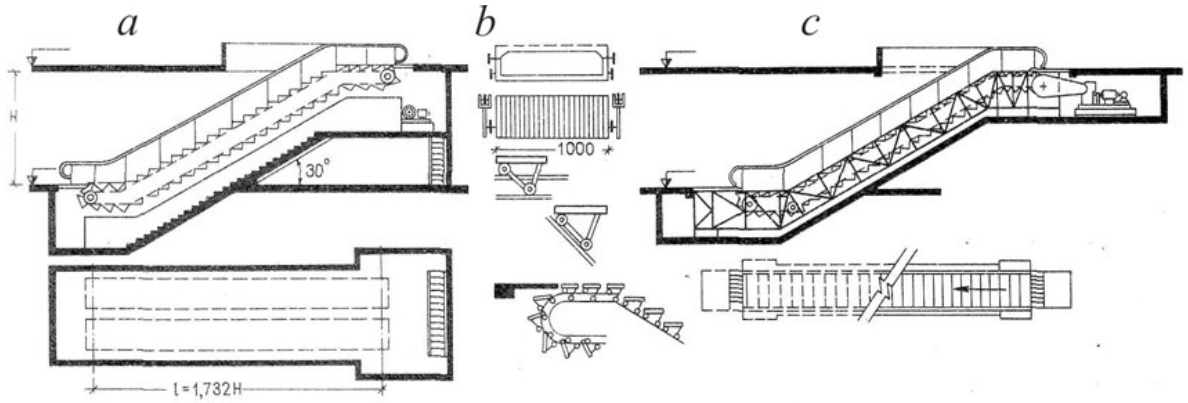


Fig. 2.12. Structure schemes:
a – of escalator on the ground (with a machine room height of 2.5 m); b – of escalator moving stair; c – of interfloor escalator (with a compact engine room or drive inside the load-bearing truss)

The height of the above-ground floors of public buildings from floor to ceiling is accepted in accordance with technological requirements, but not less than 3.0 m. In corridors and halls, depending on the spatial planning solution of buildings, taking into account technological requirements, it is allowed to reduce the height to 2.5 m; in auxiliary corridors and warehouses – up to 2.2 m, and in some auxiliary premises without permanent presence of people – up to 1.9 m.

In rooms with a sloping ceiling or different parts of the height of the room, the requirements for the lowest height must meet the average (reduced) height of the room. In this case, the random height of the room in any part of it must be not less than 2.5 m.

The height of the underground, basement and semi-basement floors from floor to ceiling should be not less than 2.7 m. The height of the technical floor is accepted depending on the dimensions of the engineering equipment and communications located in it. In the passage of service personnel, the height from the floor to the bottom of the protruding structures must be not less than 1.9 m.

The technical underfloor space, in which engineering networks are laid, must have exits to the outside (through hatches measuring not less than 0.6 m x 0.6 m or doors). Evacuation exits from the basement or semi-basement are usually provided directly to the outside.

The main principle of the architectural space organization – the development of connections between the parts while maintaining a clear demarcation is reflected in the various systems of spaces and room grouping, which differ in the degree of individual parts isolation. There are six main schemes (arranged in descending order of the degree of insulation of individual rooms and spaces): ***pavilion, cellular, corridor, non-corridor (atrium), enfilade*** and ***hall***. The combination of two or more basic schemes forms a mixed or combined (Fig. 2.13).

In ***the pavilion scheme***, the main process takes place in separate blocks, which are interconnected by a single compositional solution (for example, the pavilion market, consisting of separate objects: “vegetables-and-fruits”, “meat-and-fish”, “milk” etc. or a rest house with pavilions of dormitories).

The cellular scheme of premises grouping consists of parts in which functional processes take place in isolation in independent, internally completed and functionally independent spatial cells which can have the general communication for communication with external environment (open-air malls).

The corridor scheme consists of small cells, simple in internal organization, in which parts of a single functional process take place, interconnected by a common linear communication – a corridor. Cells can be stirred on one or both sides of the corridor (hotels, office buildings, etc.).

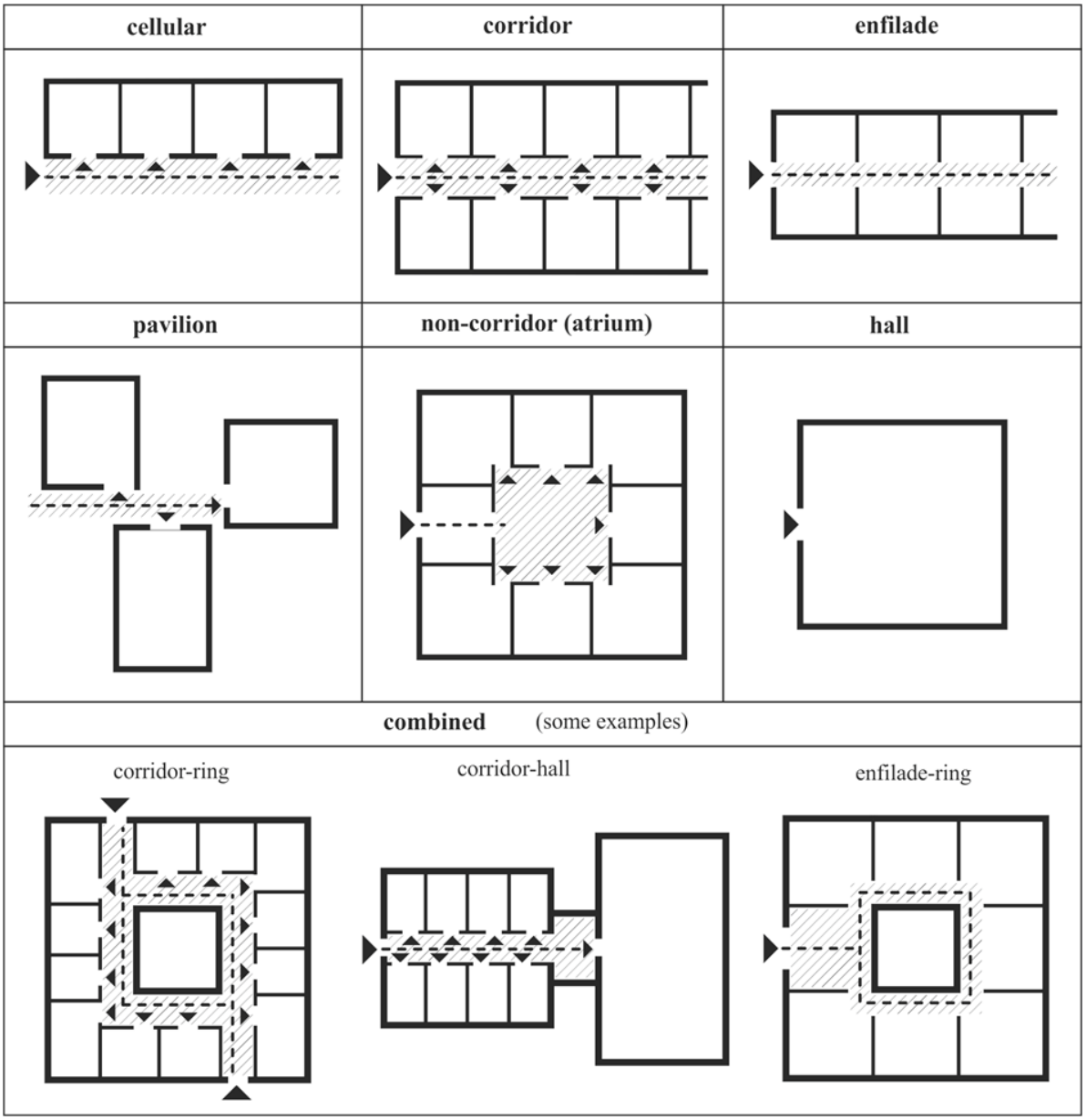


Fig.2.13. Schemes of space/room grouping

Non-corridor scheme is the rooms located around a compact in terms of communication hall. A variant of this scheme is ***the atrium scheme*** – when the premises are grouped around a closed courtyard – the atrium – and oriented into it (some types of hotels, shopping and entertainment centres, etc.).

The enfilade scheme provides for the arrangement of relatively large rooms one after the other on one axis, connected by a through passage (museums, some types of salon buildings, i.e. shops and consumer service enterprises).

The hall scheme provides concentration of all functions of the building in one big room (the covered market, the covered sports arena, etc.).

The combined scheme is created if it is necessary to supplement one of the above schemes with another (for example, a large hall and a group of service rooms, solved according to the corridor scheme – culture centres, libraries, etc.).

All these schemes of space/room grouping of the multifunctional complexesare a basis of formation of their compositional schemes: *symmetrical* or *asymmetric*, and also *compact, linear* and *divided*.

The symmetrical scheme provides for the placement of the core of the composition along the axis of symmetry, and service rooms – around it, with asymmetric – the core of the composition is outside its centre, and service rooms in relation to the core are placed freely. The compact compositional scheme, as a rule, includes hall and combined schemes of room grouping, linear – corridor and enfilade, divided – pavilion.

The composition is usually formed on the basis of rational solution of functional tasks and organization of the object's internal space and the external form. The reverse path from a pre-conceived form of volume to the solution of functional-spatial issues can also be used. But such a path almost always leads to contradictions between functional and aesthetic requirements.

The design task is based on the purpose of the object, its estimated capacity (which is determined by the conditions of operational profitability), the cost of maintenance and the radius of availability. The composition of the premises and their area for each type of building is determined by the design task, norms and standard specifications.

Control questions and tasks

1. List the main groups of premises in multifunctional complexes.
2. What are the basic requirements for planning the entrance group?
3. What are the types of auxiliary and utility premises, based on their functional purpose and three-dimensional solutions?
4. What are the types of main premises, based on their functional purpose and three-dimensional solutions?
5. List the main types of horizontal communications.
6. List the main types of vertical communications.
7. What types of smoke-free stairwells do you know?.
8. Describe the features of room/space grouping in the organization of the internal space of multifunctional complexes.

2.4. Requirements for ensuring the accessibility of multifunctional complexes for people with reduced mobility

A characteristic feature of multifunctional complexes is the simultaneous presence of a significant number of people in them. In extreme conditions, with forced evacuation, the presence of people with reduced mobility (including people with disabilities) in the flow of people can lead to significant complications. The current regulations introduce the concept of ***"people with reduced mobility"*** (PRM), which includes people who have difficulty moving independently, receiving services, necessary information or orientation in space. This category includes people with disabilities (primarily with musculoskeletal disorders, hearing and vision defects), people with temporary health problems, pregnant women, the elderly, people with baby carriages, etc. In the design of multifunctional complexes for people with reduced mobility should be provided with convenience and comfort of the living environment; availability of places for targeted visits and ease of movement inside buildings and structures; safety of paths, as well as places of residence, maintenance and employment; timely receipt of full and high-quality information that allows you to navigate in space, to participate in labour and educational processes. When determining the set of measures necessary to ensure accessibility, the issues of communication facilities, separate premises and other places of accommodation appropriate to the needs of people with disability come to the fore.

Accessibility of the multifunctional complexes is provided first of all by the corresponding organization of movement ways of PRM. The width of the path on the site during the oncoming movement of disabled people in wheelchairs should be not less than 1.8 m, taking into account the overall dimensions of wheelchairs (Fig. 2.14, 2.15).

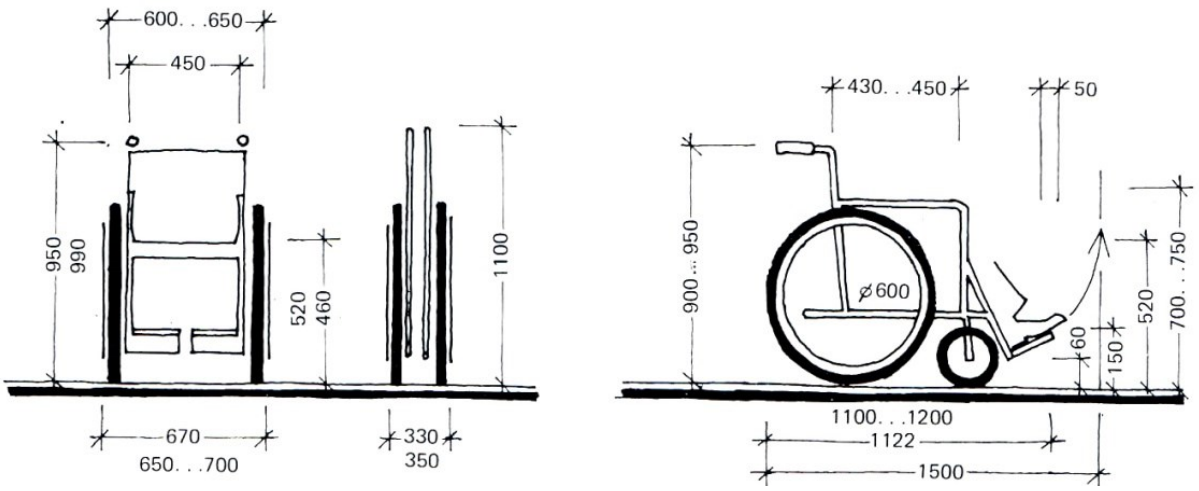


Fig. 2.14. Overall dimensions of wheelchairs

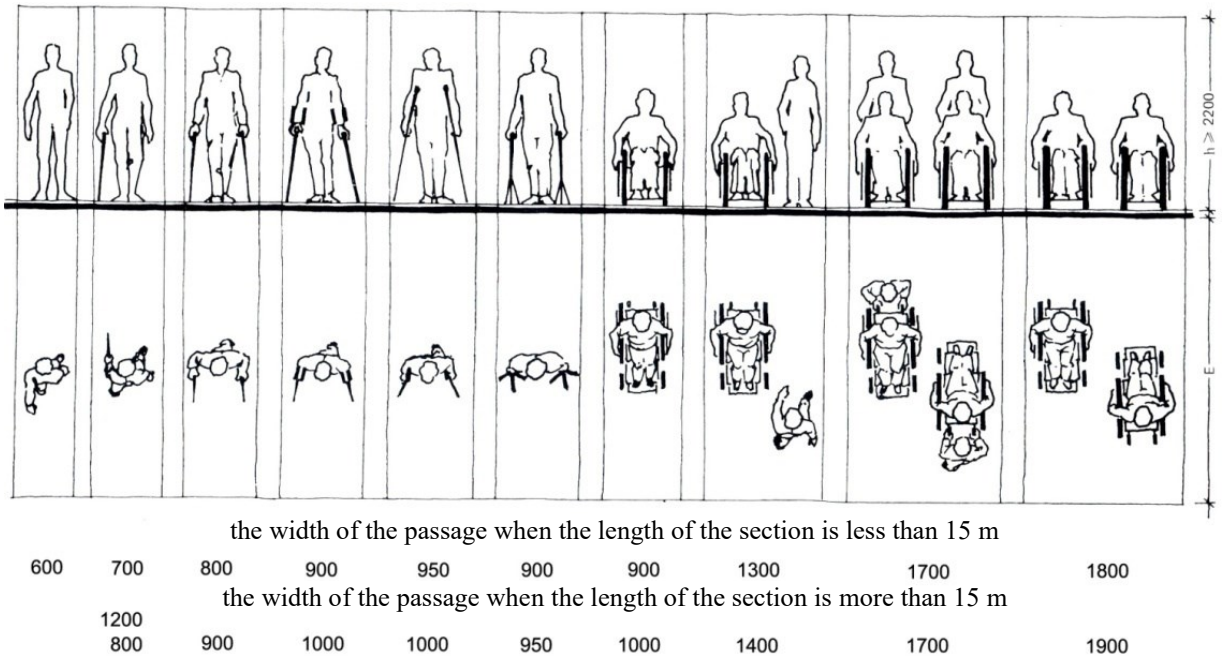


Fig. 2.15. Overall dimensions of traffic areas for people with disabilities

The longitudinal slope of the roadway on which people with disabilities can travel in wheelchairs should not exceed 5%. When arranging exits from the sidewalk near the house and in shady places, the norms allow increasing the longitudinal slope to 10% for not more than 10 m. The transverse slope of the road should be taken within 1– 2%.

Underground and overground passages should be equipped with ramps or lifting devices. For open stairs on relief differences it is recommended to accept treads not less than 0.4 m, risers– no more than 0.12 m. All steps in external stairs within one flight should be identical in the form in the plan, in the sizes of tread and riser. Stairs should be duplicated with ramps or other lifting equipment suitable for people with reduced mobility.

Open parking lots should be arranged near service facilities, where at least 10% of places (but at least one place) should be allocated for the transport of the disabled. The width of the parking area for a PRM's car should be at least 3.5 m. Areas for stopping specialized public transport transporting only disabled people should be provided at a distance of not more than 100 m from the entrances to public buildings accessible to people with reduced mobility.

The entrance area at the entrances to the building must have: a canopy, drainage, and depending on local climatic conditions – heating. Surface surfaces of entrance platforms should be firm, do not allow sliding at wetting and have a cross slope within 1 – 2%. External stairs and ramps must have handrails. For stair widths on the main approaches to the house of 2.5 m and more, additional handrails should be provided.

The entire interior space of the multifunctional complex intended for visitors/inhabitants must be accessible to people with reduced mobility. Therefore, except stairs, it is necessary to provide ramps, lifts, or other devices for movement of PRM.

The depth of entrance vestibules (draught lobbies) must be not less than 1.8 m with a width of not less than 2.2 m. The width of the corridors, galleries, etc. in cleanliness must be not less than 1.8 m (Fig. 2.16). Places of service and (or) permanent stay of people with reduced mobility should be located at the minimum possible distances from the evacuation exits from the floors and from the buildings outside. The distance from the door of the room with the stay of the PRM, which leads to the dead-end corridor, to the evacuation exit from the floor or outside should not exceed 15 m, in other cases – 30 m.

The width of the aisle in the room with equipment and furniture should be at least 1.2 m. Approaches to various equipment and furniture should be not less than 0.9 m, and if necessary, turn the wheelchair by 90° – not less than 1.2 m. The diameter of the zone for self-reversal by 90 – 180° of a disabled person in a wheelchair should be at least 1.5 m. The depth of space for manoeuvring the wheelchair in front of the door when opening "from itself" should be at least 1.2 m, and when opened "to itself" – not less than 1.5 m for width not less than 1.5 m.

The width of door and open openings in the wall, as well as exits from the premises and from the corridors to the stairwell should be not less than 0.9 m. If the depth of the jamb of the open opening is more than 1.0 m, the width of the opening should be taken not less than 1.2 m.

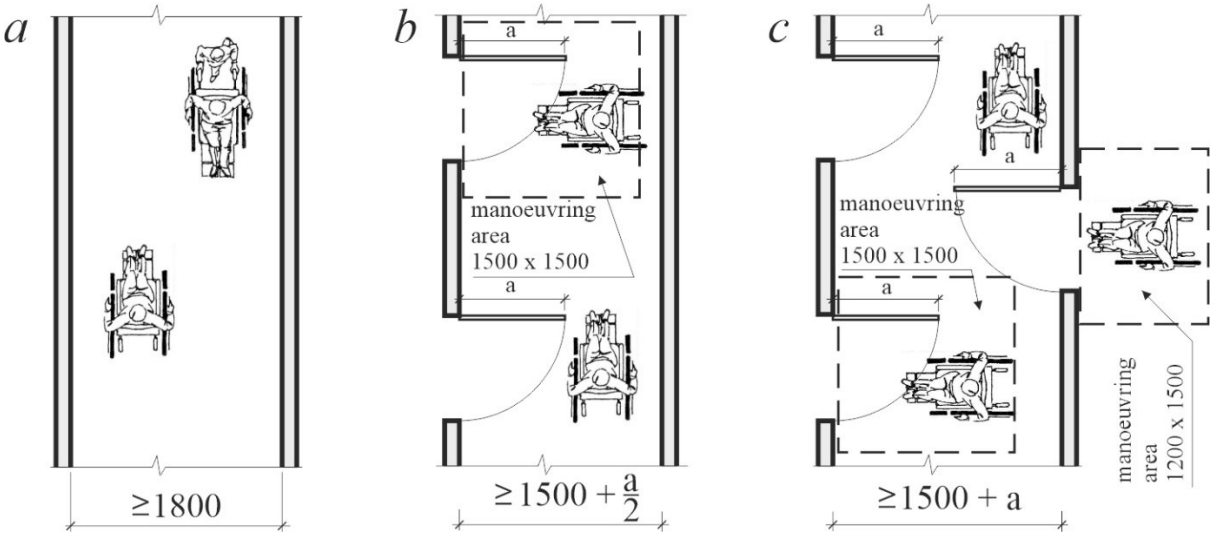


Fig. 2.16. Minimum width of evacuation corridors accessible to people with reduced mobility (according to [9], [19]): a – corridor without doors opening into the corridor; b – corridor with doors opening into the corridor located on one side; c – corridor with doors opening into the corridor located on both sides

Revolving doors and turnstiles with a width of less than 0.85 m are not allowed to be used on the roads of low-mobile groups in buildings and structures. The width of the stairway accessible to people with reduced mobility must be not less than 1.35 m. The maximum height of one flight of a ramp should not exceed 0.8 m at a slope no more than 8%.

In small spaces, the norms allow to provide screw ramps. The width of the ramp in one-way traffic must be at least 1.0 m. The platform on the horizontal section of the ramp in a straight line or on a turn must be at least 1.5 m deep. Along both sides of all stairs and ramps, as well as at all height differences more than 0.45 m it is necessary to install a fence with handrails. Handrails of ramps should be placed at a height of 0.7 and 0.9 m, stairs – at a height of 0.9 m, and in places of mass visitation by young children – also at a height of 0.5 m.

All multifunctional complexes with a height of two floors and above, intended for use by people with disabilities, must be equipped with lifts. The total number of lifts is determined by calculations based on the capacity, number of storeys and type of building or structure, and all lifts must be adapted to the needs of people with disabilities (Fig. 2.17). The lift cabin (car) intended for use by the disabled person on a wheelchair has to have the internal sizes not less than: width – 1.1 m; depth – 1.4 m; the width of the doorway should be not less than 0.9 m. The cabin should be equipped on three sides with handrails located at a height of 0.9 m. The lift control panel should be placed at a distance of 0.5 m from the door at a height of 1.0 – 1.2 m. The deviation of the lift stop level from the established mark should not exceed 0.025 m. Since most people in wheelchairs enter the lift car with their backs, the doors in elevators must be sliding or telescopic.

The following requirements should be taken into account when arranging lifts and stairs:

– the passage to lifts on the lower floor must not have steps and thresholds;

– in front of the elevators should be provided areas for manoeuvring in a wheelchair, free from attachments and protruding beyond the surface of the walls of structures, the size of not less than 1.6 x 1.8 m; the boundary of the shunting area should not be adjacent to the edge of the steps;

– waiting areas near elevator cabins, including wheelchair manoeuvring areas, should not intersect with the routes of visitors and workers;

– in case of bilateral arrangement of elevators in the lift hall it is necessary to provide a passage not less than 1,0 m wide; the minimum distance between opposite lifts should be 2.8 m.

When equipping sanitary facilities, at least one special cabin with dimensions of at least 1.65 x 1.8 m for wheelchair users should be provided (Fig. 2.18). Next to the public toilets, it is necessary to provide a universal sanitary and hygienic room with a separate entrance for using the PRM. This room can be used for persons with disabilities with companions of different sexes, parents with small children of the opposite sex (father-daughter, mother-son), parents with strollers, in particular for twins or triplets.

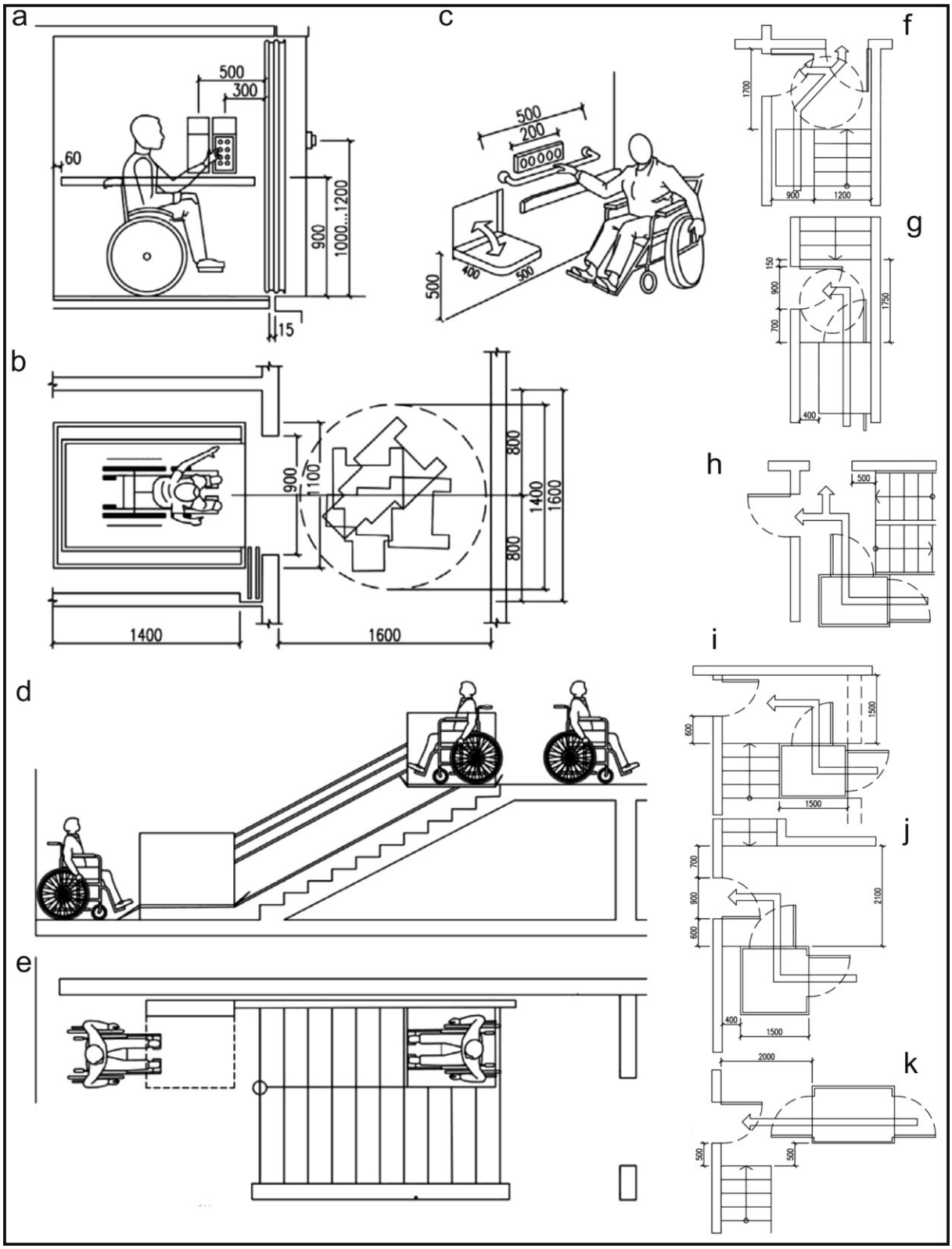


Fig. 2.17. Lifts/stairlifts accessible to persons with disabilities in wheelchairs [19]:
a – c – a lift with car dimensions of at least 1.1x1.4 m; d, e – an individual stairlift, located next to the stairs; f – k – location schemes of individual vertical lifts next to the stairs

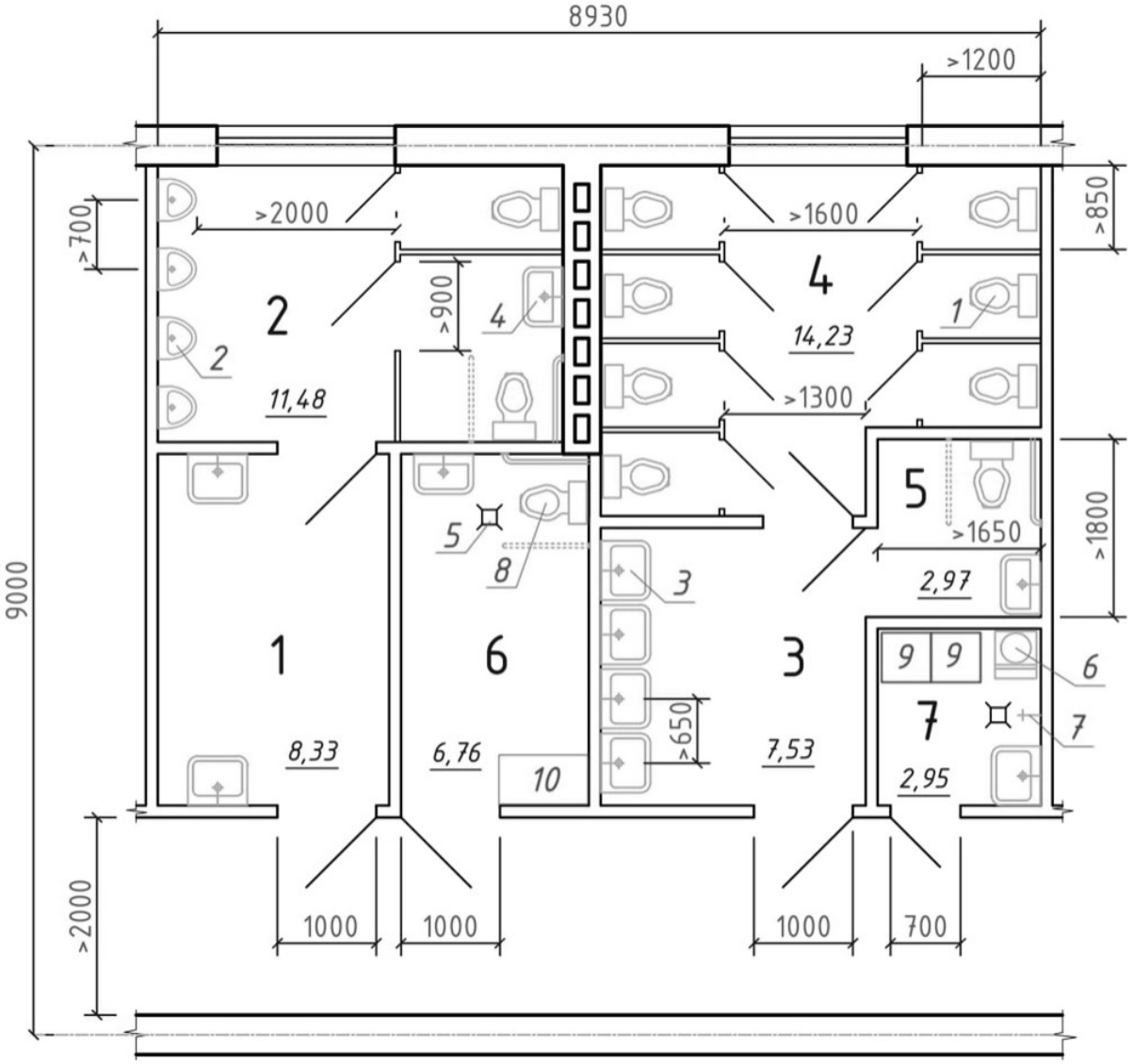


Fig. 2.18. An example of the layout of sanitary facilities for visitors to a multifunctional complex with a display of the main furniture and equipment.
Description of the premises:
1 – men's toilet gateway; 2 – men's toilet; 3 – women's toilet gateway; 4 – women's toilet; 5 – universal women's toilet cabin (accessible for people with disabilities); 6 – universal sanitary and hygienic room for use by people with reduced mobility; 7 – storage room for washing equipment.
Furniture and equipment:
1 – toilet bowl; 2 – urinal; 3 – washbasin; 4 – washbasin equipped for people with disabilities who use wheelchairs; 5 – intercepting trap; 6 – drain for dirty water with a sand trap; 7 – water tap; 8 – toilet with bidet function or equipped with a mixer with a hygienic shower (waterpipe), adapted for use by persons with disabilities; 9 – cabinet for cleaning equipment; 10 – changing table

Sanitary facilities and functional areas used by low-mobility groups (including people with disabilities in wheelchairs) must be at least as large as:

– toilets – 1.8 x 1.65 m;

– cabins of personal hygiene of women – 1.8 x 2.6 m;

– closed showers – 1.8 x 1.8 m;

– open showers with a through passage, cabins of half-showers – 1,2 x 0,9 m;

– benches in the dressing rooms – 0.6 x 0.8 m;

– closets in wardrobes for street and home clothes – 0.4 x 0.5 m.

In sanitary facilities for the disabled, the toilet seat and the bath board must be at a height of 0.5 m from the floor level (at the level of the wheelchair seat). The washbasin should be installed at the height of the upper face 0.8 - 0.85 m from the floor level with free space under it at least 0.7 m high. In front of the washbasin should be provided free space 0.8 m wide and 1.2 m deep.

The width (in clearance) of evacuation routes used by low-mobility groups should be not less than:

– doors from rooms with no more than 15 people – 0.9 m;

– openings and doors in other cases, passages indoors – 1.2 m;

– transitional loggias and balconies – 1.5 m;

– corridors, ramps used for evacuation – 1.8 m.

For each type of public institutions, in addition to the common accessibility requirements for low-mobility groups, specific ones are defined, due to the purpose, functional structure, age characteristics of visitors and other conditions.

Special attention should be paid to *educational institutions* attended by persons with disabilities. Therefore, all educational institutions should be adapted for comfortable stay of visitors, have appropriate architectural and planning solutions that provide their full accessibility for children with disabilities, as well as employees with disabilities (Fig. 2.19). It is necessary to use and rationally place educational equipment in accordance with the anthropometric data of children and adolescents. Appropriate conditions for wheelchairs for children with disabilities should be created in all educational institutions.

Most people with disabilities need medical examinations and assistance in *treatment and prevention facilities*, which include hospitals, clinics, clinics, clinics, sanatoriums, clinics and others. Specially equipped medical and rehabilitation environment should be created in these institutions.

Of great positive importance for people with disabilities are physical education and sports, which promote their physical and psychological rehabilitation, improve the health of the disabled, increase the adaptation of people with disabilities to living conditions and return them to a sense of social worth. For this purpose, it is expedient to jointly use sports and health facilities for the people with reduced mobility and other groups of the population (Fig. 2.20), to ensure the possibility of the PRM's presence as a spectator, which determines the specific requirements for the arrangement of individual rooms and stands.

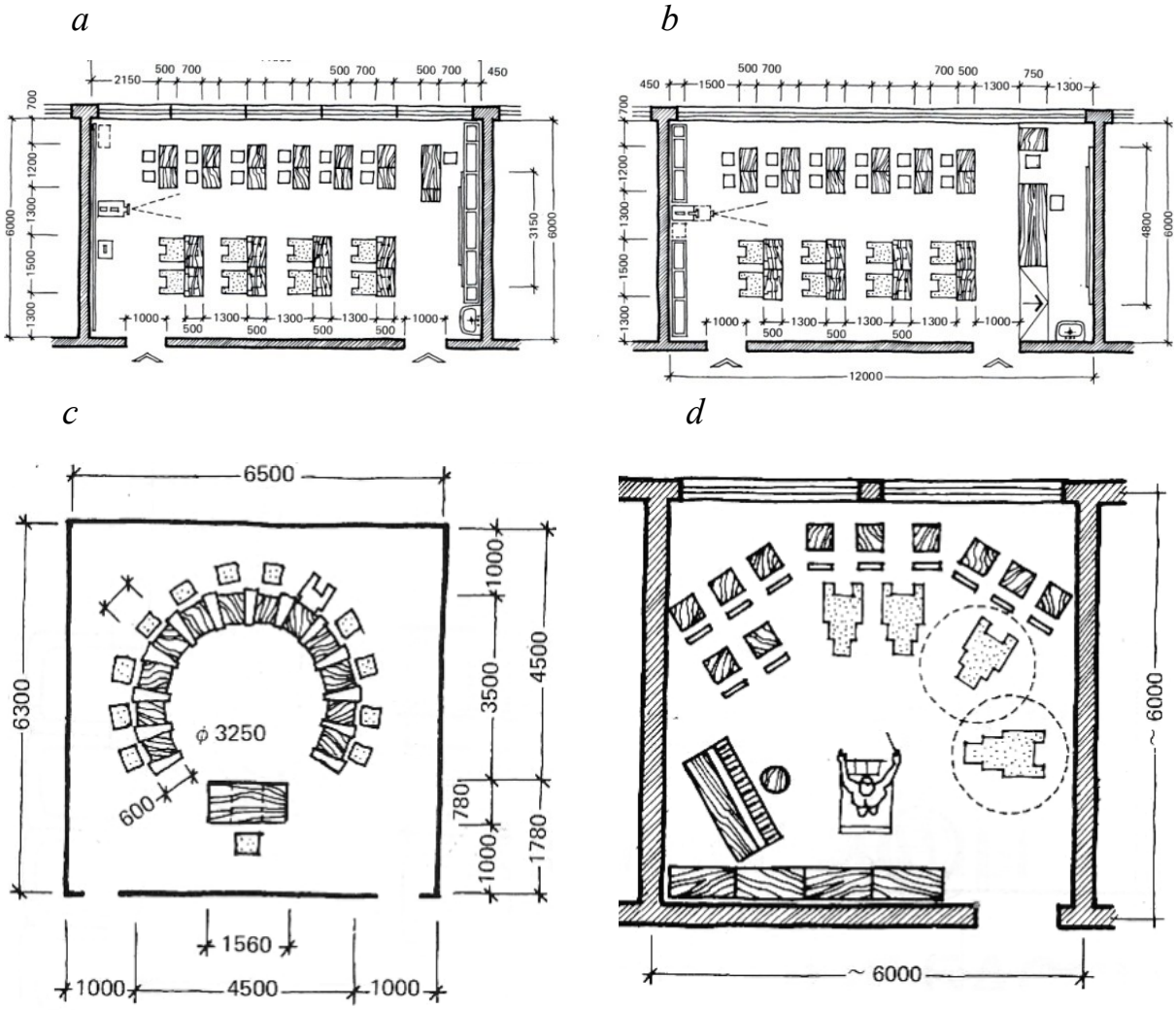


Fig. 2.19. Planning of educational premises with workplaces for students with disabilities:
a, b – classrooms; c – class for art classes or classes in small groups;
d – rehearsal room of the orchestra in the music school

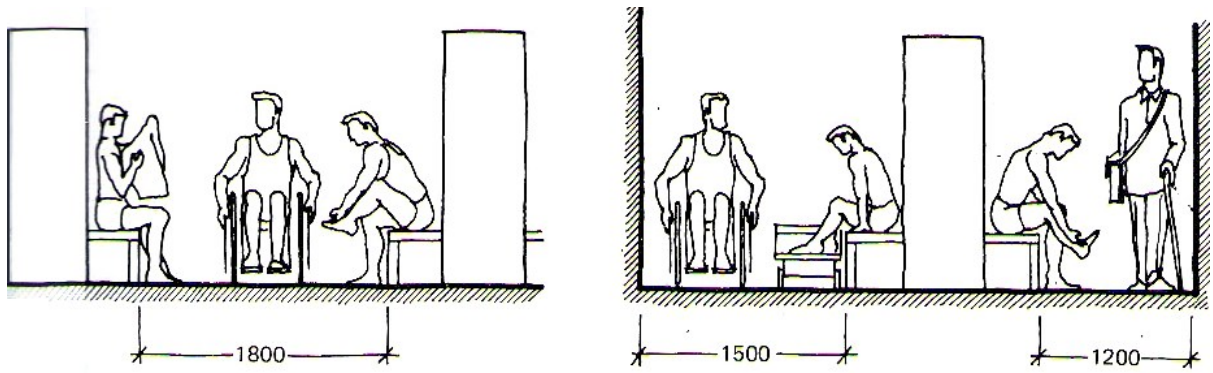


Fig. 2. 20. Locker rooms for athletes with disabilities

It is desirable to place sports areas and other premises used by people with disabilities on the ground floor level. Facilities for sports for people with disability should be equipped depending on the characteristics of the physical injury of users.

For basketball and volleyball in a sitting position, handball, table tennis, bowling, etc., the game room should be 15.0 x 27.0 m. For deaf and blind athletes, it is necessary to provide duplication of sound information with inscriptions on the board.

Seats for spectators with musculoskeletal disorders in the stands of sports facilities and sports and entertainment facilities should be provided in the area immediately adjacent to the exit to the podium.

Locker rooms for athletes with disabilities must also meet special regulatory requirements.

In stadiums along the treadmill, a safety lane at least 1.0 m wide should be provided on the side of the spectator seats, and outside it, a free space at least 3.0 m wide should be provided for wheelchairs. If the treadmill is separated from the seats for spectators by a fence, it should be arranged passages for the disabled at a distance of not more than 100.0 m.

Safety lanes at least 2.0 m wide should be arranged along the areas for wheelchair users, and at least 3.0 m from the ends of the playgrounds.

To ensure the orientation and safety of athletes with complete or partial loss of vision, it is necessary to use as beacons sound beacons to direct movement; along the perimeter of the playgrounds to arrange an orientation strip 1.2 – 1.5 m wide and a safety strip not less than 1.0 m wide; along the tracks for running or running before the jump to arrange an orientation strip at least 2.0 m wide with an adjacent safety strip at least 1.0 m wide; on the treadmill to provide a start zone with a length (in the direction of movement) of at least 5.0 m and a finish zone with a length of at least 25.0 m.

Orientation lanes, as well as turns of treadmills, start and finish areas, push zones during jumps should be distinguished by a textured surface and colour of the surface.

Special requirements for design of indoor and outdoor swimming pools apply to bypass paths, bath boards, devices for lowering disabled people into the water, the path from the locker room to the pool bath. The minimum width of the bypass path of the pool should be 2.0 m. For disabled people with visual impairments on such a path should be allocated an orientation strip with a width of not less than 1.2 m around the perimeter of the pool baths. The minimum size of the pool for those who cannot swim is 6.0 x 12.5 m, and the depth is not more than 0.9 m. The swimming pool must be 25.0 m long and at least 8.0 m wide. The walls of the corridor leading from the locker room through the shower to the pool must be equipped with a one-sided handrail at a height of 0.9 m.

In solving the problem of creating a barrier-free architectural environment, it is important to ensure the cultural activities and organization of leisure for

people with disabilities in *cultural, entertainment and cultural-educational institutions,* which include theatres, concert and exhibition halls, cinemas, circuses, museums, libraries, clubs, etc.

When spending leisure time in appropriate institutions, people with disabilities should feel equal members of society due to the full adequacy of the environment to their needs. To this end, it is necessary to allocate a certain number of special seats in the auditoriums for people with disabilities, the rational arrangement of seats for the disabled, taking into account the conditions of visibility for both the people with disabilities and the rest of the audience.

In *entertainment and sports complexes*, the number of seats for the disabled in wheelchairs is recommended: in halls and grandstands with a capacity of up to 1,000 people – one place for every 250 people; with a capacity of more than 1000 people – four such places for the first 1000 people and an additional one place for every 500 people. In halls with fixed areas for disabled people in wheelchairs, the size of special seats must be at least 1.5 x 0.9 m. In halls with a difference in floor level marks, such places should be designed in the front or rear row, depending on which row is located at the level of the lobby (Fig. 2.21). For people accompanying people with disabilities, it is necessary to provide adjustable free seats located directly next to the wheelchair. The width of the seat is 1.5 m. When arranging seats for spectators, it should be taken into account that the height of the wheelchair seat is 0.05 – 0.10 m higher than the rest of the seats. Seats for the disabled in the auditoriums should be located as close as possible to the entrance, in separate rows, which go to an independent evacuation route that does not intersect with the evacuation routes of other spectators.

When designing museums and exhibition complexes, the specifics of the visual perception of PRM should be taken into account, namely the reduction of the optimal viewing time and the possibility of carrying out this viewing in a sitting position.

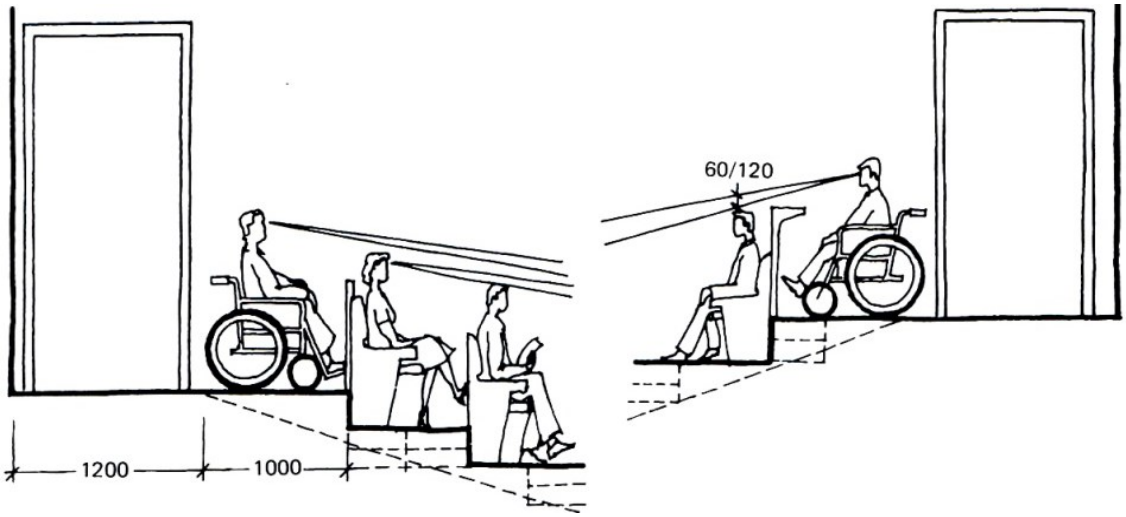


Fig. 2.21. Placement of spectator seats for people in wheelchairs

This leads to the definition of areas of optimal viewing of exhibits, special organization of inspection routes; the need to include in the exposition of recreation areas, etc. To make it possible for disabled people to view the expositions in museums and exhibition pavilions, it is desirable to stir the exhibits so that their conditional centre is at a height of 1.25 m.

Special attention needs to be paid to *enterprises of retail, public catering and consumer services,* which provide for the daily needs of life support (Figs. 2.22, 2.23). For people with disabilities, daily retail and household self-service (purchase of consumer goods, laundry, meals, minor repairs of shoes and clothes, etc.) is a significant challenge.

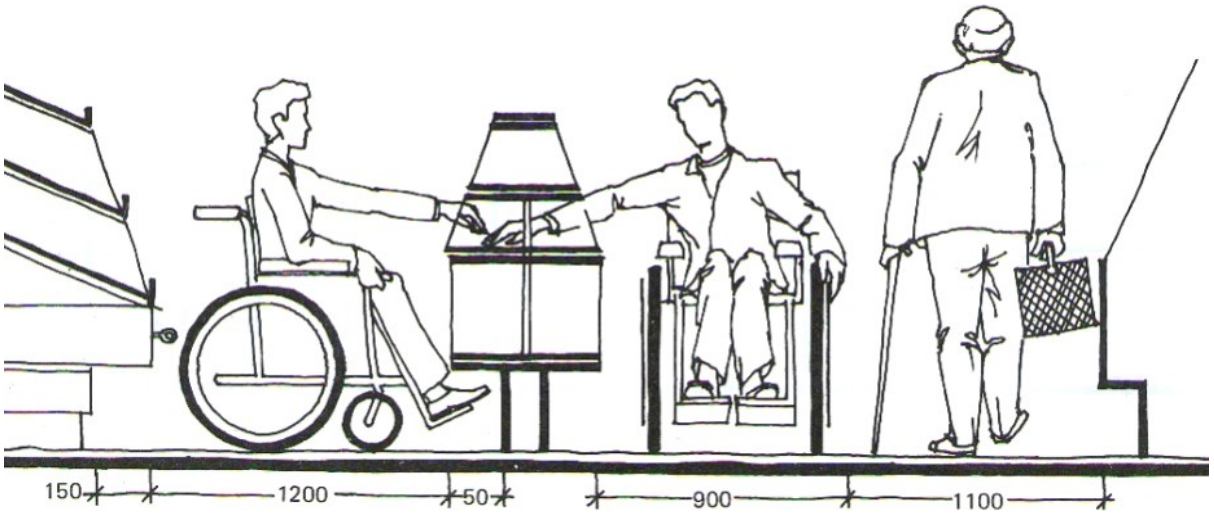


Fig. 2.22. Equipment of retail facilities

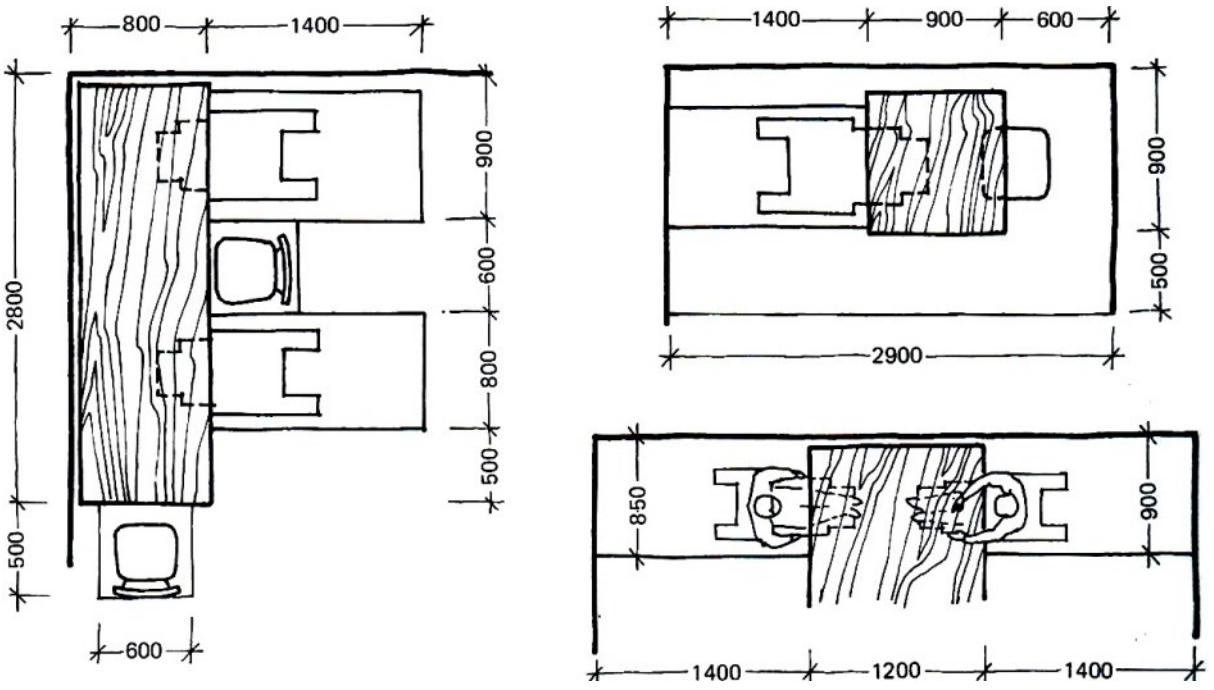


Fig. 2.23. Planning of catering enterprises

In addition to taking into account the general requirements for ensuring the accessibility of commercial enterprises as a whole and all premises, it is necessary to ensure the possibility of free movement and manoeuvring on a wheelchair in all important zones of technological process: near counters, racks or other expositions of goods, near places of settlement and delivery of goods, near places of fitting, etc. In stores with a traditional form of trade, the height of the counter in the areas of cash desks and dispensing of goods should not exceed 0.9 m. In clothing stores, it is necessary that at least one fitting cabin has dimensions sufficient to accommodate a wheelchair and an attendant who assists in fitting. It is recommended to arrange a cabin, the size of which can be adjusted by means of sliding walls.To create conditions for a person in a wheelchair to make normal purchases in self-service stores, it is necessary that within the reach of his hand (about 1.4 m in height and 0.4 – 0.6 m in depth) was, if possible, a full range of goods. The width of the passage in front of the cash register should be 0.8 – 0.9 m. In the trade hall, the width of the passage between the shelves or along the one-sided counter should be not less than 2 m: and between the two counters – 2.0 – 2.5 m.

Catering facilities need to have special dining areas with the shortest and most convenient connections with the lobby group and the lunch place.

The use of catering establishments for people with disabilities in wheelchairs is possible under the conditions of appropriate placement of the required number of tables, namely providing free space in front of them measuring 0.75 x 1.4 m and aisle width of at least 1.4 m. catering, equipped with long tables with benches, as well as bar counters with high seats. Seating (tables) for the disabled in the halls of catering establishments should be located near the evacuation exit, but in an impassable area.

Consumer service enterprises, especially with the reception of visitors for direct service (reception and rental points, workshops, studios, consumer service centres, hairdressers) should be evenly located in urban development with maximum proximity to housing. At the same time, in addition to creating spatial conditions for communication between disabled people – consumers of services and employees, it is necessary to arrange a certain number of workplaces for employees wit disabilities.

Control questions and tasks

1. What are the requirements for land planning used by low mobility groups?
2. What are the features of the organization of entrances, lobbies and corridors in buildings used by disabled people in wheelchairs?
3. Name the requirements for the equipment of lifts and stairs, taking into account the needs of low mobility groups.
4. What are the features of the organization of seats for spectators with musculoskeletal disorders in the stands of sports facilities and cultural and entertainment facilities?
5. What are the features of the planning of trade, catering and consumer services that meet the daily needs of livelihoods of people with disabilities?

3. ARCHITECTURAL AND COMPOSITIONAL ORGANIZATION OF MULTIFUNCTIONAL COMPLEXES

3.1 Volumetric and spatial organization of multifunctional complexes

Based on the analysis of theory and design practice, the foundations of the architectural and planning organization of multifunctional complexes have been developed, which are reflected in the following principles.

The principle of expediency determines the conditions for a rational relationship between possible and necessary needs and costs for construction and operation (therefore, both too primitive and overly complicated architectural solutions should be avoided).

The principle of complexity, according to which multifunctionality consists in the interconnection of many processes occurring simultaneously, the combination of a large number of enterprises and institutions, ensuring a comfortable stay for visitors with different goals and needs under the conditions of an appropriately organized multifunctional structure of the building.

The principle of interconnectedness, according to which the premises, nodes and zones of the complex are considered as an organic unity while maintaining their clear demarcation and the possibility of autonomous functioning, that is, the correspondence of the architectural organization of the multifunctional complex to the needs of the population within the zone of influence, which is determined by the time of optimal accessibility.

The principle of diversity, which dictates the need for variability of internal spaces or the shape of the building due to the foreseen development reserves through transformable structures, use of underground space, joining adjacent buildings or their parts, adding floors or adding additional blocks (taking into account the diversity of types and forms of public services following economic, social, cultural and other needs).

The principle of interaction, which involves the connection of internal and external spaces of a multifunctional complex based on the optimal organization of entrances and exits, regulation of the microclimate, interpenetration of natural elements and the interior, and the creation of visual spatial effects.

The spatial formation of a multifunctional complex involves the placement of functional and planning elements in the volume and the selection of the principles of their spatial integration. The schematic diagrams of the external form formation of multifunctional complexes determine the approaches to their volumetric and spatial organization, taking into account functional, aesthetic and constructive requirements.

The symmetrical scheme involves the balanced arrangement of the volumes of the complex relative to the central axis (vertical, horizontal or diagonal). This solution ensures the balance of the architectural form. It evokes a sense of order, stability and aesthetic completeness. It is easily adapted to the neoclassical architectural style. It can be used for complexes with equivalent functions or in a

historical environment where consistency with the general appearance of the city is required.

The asymmetrical scheme involves an uneven distribution of volumes, which creates a dynamic and modern look. The form is built on contrasts of volumes, heights and proportions. Creates an innovative, non-standard appearance that attracts attention. Opens up more opportunities for integration into complex urban development.

The compact spatial organization of multifunctional complexes involves grouping all functional volumes within one large central block with a clear and closed form. Such a scheme optimizes the use of land, as it allows you to build a high volume in a relatively limited area, ensuring effective integration of different functional zones. It also contributes to the convenient organization of internal connections between rooms, as the volumes are concentrated in one block, which allows you to minimize the cost of engineering communications. The compact scheme is especially appropriate for urban conditions, where there is limited space and high land value. However, one of the main problems of this organization is that it can create a feeling of monotony and "closure" due to its closed form, which sometimes negatively affects the perception of the building. In addition, interior spaces may suffer from limited natural lighting, as the volume of the block can block the access of light to some internal zones. It is important to take these shortcomings into account when designing such complexes, especially in the context of ensuring comfort and aesthetic appearance.

An example of a compact spatial organization of a multifunctional complex is the Guggenheim Museum in New York (Fig. 3.1).

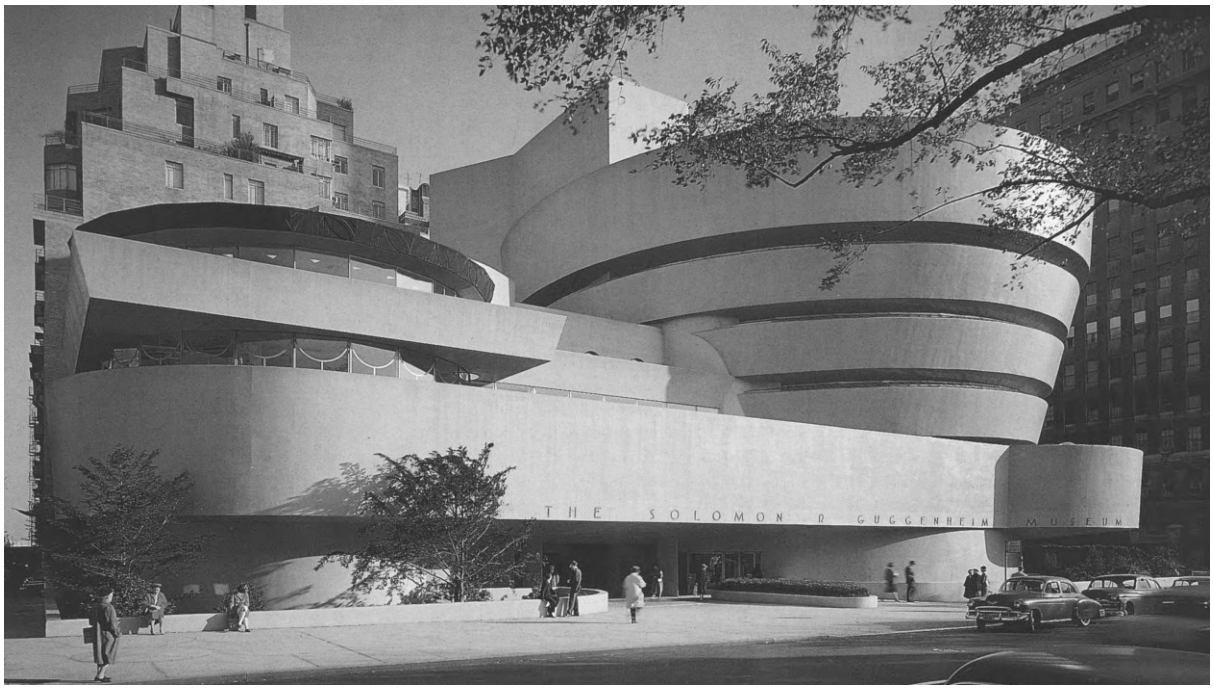


Fig. 3.1. Solomon R. Guggenheim Museum in New York by Frank Lloyd Wright

This building, designed by Frank Lloyd Wright, is an example of a compact organization, since all functional volumes are collected within one large central block, which has a clear and closed form. The building, in addition to the museum, also includes other functions such as shops, cafes and administrative premises, which creates a complex space for visitors. All these functions are organized within a single volume, which allows for efficient use of the land area and creates convenient internal connections between different zones. An important feature is the organic connection between the spaces due to the spiral shape of the building, which allows visitors to move naturally between levels.

The block spatial organization of multifunctional complexes involves the formation of a complex from separate volumes-blocks, each of which performs its own specific function, for example, office premises, residential areas or retail spaces. The blocks can be connected by internal or external communications, which ensures functional interaction between different parts of the complex. Such a scheme provides high flexibility in design and allows you to take into account the need for future expansion or transformation of functional areas. In addition, the block organization improves natural lighting and ventilation, since each block can have enough external facades to ensure the access of natural light and air circulation. The block scheme is ideal for large facilities where it is important to maintain the independence of functional areas and ensure their autonomous functioning. However, the main disadvantage of such an organization is the increase in costs for engineering communications and infrastructure, since each block has its own system of connections, which complicates the organization of internal communications and requires additional costs for engineering support. An example of a block-based spatial organization is the Reykjavik Conference Center in Iceland.

Linear spatial organization of multifunctional complexes involves the arrangement of functional objects along one or more interconnected lines, which creates an elongated composition. Such a scheme is particularly convenient for integration with transport infrastructure, as it can be easily incorporated into highways or next to railway lines, which provides convenient access to the complex. Linear arrangement allows you to effectively organize access to various functional areas, reducing obstacles to the movement of people and transport. Such an organization is widely used for objects located along important transport arteries, such as airports, railway stations or other large transport hubs. However, the main disadvantage of the linear scheme is the increase in distances between individual areas of the complex, which can complicate their use and reduce convenience for users. The longer the distances between functional areas, the more time and effort is required for their movement, which can negatively affect the comfort and efficiency of using the complex.

The divided spatial organization of multifunctional complexes involves the creation of a complex of separate volumes, arranged in a free order, but united by a common compositional idea or style.

Fig. 3.2. Harpa Reykjavik Concert Hall and Conference Center in Iceland

Such a scheme allows you to create an expressive architectural composition, where each volume or block has its own individuality, while maintaining harmony with the surrounding environment. This ensures natural integration into the landscape, especially in large areas or areas with uneven relief, where it is important to preserve the natural features of the landscape and take them into account in the project. The disjointed scheme also provides the opportunity to create more diverse functional zones, each of which can have its own unique shape and purpose. However, the main disadvantages of such an organization are the complexity of organizing a unified system of connections between individual volumes and increased infrastructure costs. Separate planning of volumes requires additional investments in the organization of communications and engineering networks, which can affect the overall economic efficiency of the project.

The point type of spatial organization of multifunctional complexes involves the formation of a volume in the form of one or more high-rise buildings, which can be located separately or interconnected at lower levels. This solution is often used in conditions of limited land area, where it is necessary to use vertical space as efficiently as possible. The complex consists of several high towers or towers that can be located side by side and connected on the lower floors, with the possibility of performing different functions for each tower or block (office premises, retail space, residential areas). The point type of organization is usually

characterized by a vertical emphasis and a focus on vertical development of space with minimal use of land area. The advantage is the efficient use of a limited area and the possibility of organizing convenient access through transport infrastructure, such as roads and metro, with high accessibility to different parts of the complex. The point type is used in urban conditions with limited space, such as highly popular urban areas or megacities, where land plots are expensive and limited. An example is the International Business Center in Kyiv, which includes several towers located on a limited area of land and is a typical example of the point type of organization of a multifunctional complex.

The perimeter spatial organization of multifunctional complexes involves the location of the main volumes or buildings along the perimeter of the land plot, forming a closed or semi-closed contour around the internal space of the complex. Such an organization creates a certain barrier to the external environment and provides an internal courtyard or open space that can be used for recreational areas, parks, squares or other functions. The main building volumes (towers, buildings) are located along the perimeter of the plot, leaving open space inside for common or recreational functions. This allows you to create a closed courtyard or open area protected from external noise and chaos of the urban environment, usually used for organizing green areas or for recreation. The buildings that make up the perimeter can include various functional areas, such as offices, housing, retail premises, providing the opportunity to integrate different types of activities. The advantages of the perimeter organization include the security of the internal space, since the perimeter arrangement of buildings creates natural protection from the external environment, improving the privacy and security of the internal courtyard. This organization also contributes to the efficient use of space, since by creating an open internal space, it is possible to organize recreation areas, parks or other functions, which improves the comfort of residents and users of the complex. In addition, the internal space can be used for landscaping and recreational functions, which has a positive effect on the environment and improves the microclimate. Perimeter organization is popular for large multifunctional complexes that include large residential and commercial areas, and is often used in large areas or in conditions with uneven terrain, where it is important to maintain privacy and organize a comfortable environment for residents or users. A typical example of perimeter spatial organization is residential complexes with closed courtyards or corporate campuses, where buildings form an open courtyard or pedestrian zone around the center, providing convenient access to various functional areas and a high level of comfort.

The specifics of the volume formation of the complex are largely determined by the spatial schemes of development of the sites: free placement on the territory, a stylobate complex, integration into the surrounding development, placement above transport highways and technical territories, use of landscape elements and underground space.

Free placement on the territory involves the location of the complex's objects without rigid binding to existing lines or axes. Each volume can be organically placed on the site following its features, relief and functional requirements. Such a solution allows for maximum flexibility in planning and creating open or green spaces between buildings. Free placement also provides the opportunity to optimize the orientation of buildings to the sun and winds, which contributes to convenience and energy efficiency. However, such a scheme can complicate the organization of internal communications and increase infrastructure costs.

A stylobate is a structure that serves as a foundation or basis for the location of functional volumes. In this case, many objects of the complex are located on one common stylobate, which may have different levels of elevation. Typically, a stylobate is used to organize commercial, administrative, or technical premises, leaving space for residential or office areas on the upper levels.

Integration into the surrounding development involves organically fitting the complex into the existing urban fabric. Architects strive to ensure that the building does not disrupt the overall composition of the urban space and naturally fits into the surrounding environment. This may include the use of similar stylistic or material solutions, as well as the preservation of street lines or other architectural elements. Integration can also mean preserving important functions for the local community, for example, creating spaces for public events or public spaces, which allows for maintaining a connection between the new complex and the local community.

In cities with high building density, ***underground or above-ground spaces*** are often used to organize multifunctional complexes. Placing objects on or above transport highways, such as motorways, railways or metro, allows for maximum use of limited urban areas and reduces the load on the earth's surface. This approach allows for the integration of various functions without disrupting the existing infrastructure and ensuring convenient access to vehicles. The main challenge in this case is the technical support of such buildings, in particular noise protection and vibration insulation.

Incorporating natural landscape elements into the structure of a complex allows for a harmonious combination of the natural environment and architecture. This can be through the use of green areas, water features, or landscaped parks as part of the overall design. Extensive use of landscape design provides an aesthetic appearance to buildings and improves the quality of life for residents or users of the complex, creating a healthy, environmentally friendly environment.

The use of underground space to accommodate part of the functions of the complex is an important element of modern urban planning, especially in conditions of limited land plots in densely built-up cities. Underground levels can include parking lots, technical premises, warehouses, as well as commercial or cultural areas. This solution allows you to free up the above-ground part for open spaces or residential areas, while maintaining the necessary functions for

communications and public spatial elements on the ground surface. Underground levels provide convenient access for users, but also require high technical requirements for ventilation, lighting and security.

Control questions and tasks

1. Name the main principles of architectural and planning organization of multifunctional complexes
2.What does the compact spatial organization of multifunctional complexes imply?
3. What does the block spatial organization of multifunctional complexes imply?
4. What does the linear spatial organization of multifunctional complexes imply?
5. What does the disjointed spatial organization of multifunctional complexes imply?
6. Name the main spatial schemes for developing the area of a multifunctional complex.

3.2. Techniques for forming an expressive figurative and compositional solution for multifunctional complexes

External shaping consists in expressing the role of multifunctional complexes as places of concentration of public life of the population by creating external attractiveness and expressiveness. The architectural characteristics of these objects are determined within the framework of the general compositional regularities of a single urban planning concept.

The complexity of modern multifunctional centres requires special means of spatial expressiveness: sharp contrasts of dense and sparse spaces, complex group rhythms, complex relationships of vertical dominants, "pulsating" spaces – of different heights, disjointed, compositionally active and emotionally saturated. The expressiveness and imagery of multifunctional complexes is manifested in the active silhouette, the interaction of architectural and plastic accents, the nature of stylistic interaction with the urban environment, the choice of colon scheme and the principles of lighting of facades and interiors, etc. The main elements that form the composition of facades include arched passageways, skylights, window openings of various configurations and sizes, stained glass windows, galleries, canopies, visors, windbreaks, pergolas, walkways, arcades, shop windows, terraces, and open or closed staircases.

The formation of a figurative-compositional solution of multifunctional complexes is subject to the general principles of architectural composition.

Repetition of the whole in parts, highlighting the main part among the parts. This principle is based on the idea of rhythm and repetition of key elements in the structure of the building. Repetition ensures harmony between the whole and the parts, creating compositional order. An architectural object, using this principle, can have a regular alternation of identical or similar elements of the facade (windows, columns, panels), which emphasize the unity of the general concept. The allocation of the main part involves the accentuation of one or more elements that become compositional dominants. For example, the entrance group,

the central volume can serve as such accents around which other parts of the building are organized.

Subordination of parts to the whole. This principle assumes that all elements of a building perform different functions, but in an architectural composition they should work towards a single goal. The parts of a building should differ in meaning and expressiveness: the main one should attract attention, the secondary one should emphasize the main one, and the additional one should harmoniously complement the composition. The main elements (facade, central volume or main axis) determine the general character of the building, the secondary elements (for example, side parts or decorative elements) support the dominant one, and the additional elements (stairs, pergolas, balconies) perform a functional and decorative role.

Proportionality of parts. Proportionality ensures harmony between different parts of a building, coordinating their proportions, sizes and rhythms. This principle takes into account the ratio between the height, width, length and mass of the elements in order to create integrity and visual balance. Proportionality of parts and the whole can be achieved by applying methods of proportioning, for example, the “golden section”.

Balance is a key principle of architectural composition that ensures harmony between different parts of an object, creating a sense of stability, equilibrium and integrity. It consists in achieving visual and structural balance of the elements of a building, regardless of whether the composition is symmetrical or asymmetrical. Balance is a fundamental condition for the perception of architecture as a harmonious and complete phenomenon.

Regularly formed centre of composition. The centre of composition is the main part of an architectural object or ensemble, which performs the role of a semantic, functional and visual accent. It is the dominant around which the entire compositional structure is built, uniting various elements into a harmonious whole. The principle of a regularly formed centre consists in its logical arrangement, selection and subordination of all other parts of the composition. The centre stands out among other elements of the composition through scale, shape, colour, texture or decorative design. This ensures its perception as the main element. The centre of composition usually has to perform a key function in an architectural object. For example, it can be the main entrance, atrium, a square in front of the building or a central tower. The compositional centre is the carrier of the main idea that the architect seeks to convey through the object. It can symbolize the importance of the object, its significance or role in public life.

The principle of integrity synthesizes all the above principles, ensuring a harmonious combination of the form, structure and function of the building. Architectural unity is achieved through the integrity of the overall structure (all elements are correlated and work towards a single goal), functional coherence (architectural forms emphasize and support the functional purpose of the

building), interaction with the environment (the building harmoniously integrates into the urban or natural environment).

The architectural and artistic qualities of public complexes can be revealed when taking into account the interaction of the volumetric form and landscape elements, are achieved by organic combination and direct contact with natural elements, artificial creation of bright landscape elements in their absence or by organizing visual connections with the natural environment of urban significance. The choice of methods for forming an expressive appearance of multifunctional centres largely depends on the degree of openness of the structure of the complex to the external environment. There are several types of compositional schemes that determine the interaction of multifunctional complexes with the external environment.

One of them is ***the introverted scheme***, which involves isolation from the surrounding space. In this case, internal functional processes and interactions are limited by the internal spatial structure, which is closed to the outside world. The complex has a minimum of external connections, which creates a certain autonomy and security, but may limit interaction with the urban environment and accessibility for users.

The extroverted scheme, on the contrary, involves the openness of the complex to the environment. Internal spaces actively interact with the outside world: large display windows, passages, open spaces or even individual parts of the building can be integrated into the urban development. This approach provides convenient access for visitors, creating an impression of "openness" and contributing to the development of the urban environment, particularly in areas with high traffic. The number of connections with the external environment increases, which allows the building to better fit into the urban context.

The polyverted scheme combines the advantages of both approaches. It allows you to combine closure and openness, creating a multifunctional complex that has a closed internal structure, but at the same time includes several important entrances and exits that connect the building with the environment. This allows you to ensure a balance between privacy and accessibility, allowing different users to easily navigate the space and have access to the complex without violating its internal integrity. Such a scheme is suitable for large and complex objects, where it is important to maintain functional diversity, without losing connections with the outside world.

The compositional solution of a multifunctional complex is associated with solving the issue of the scale characteristic of the building. This is due to the fact that different parts of the complex may have different architectural scales. For example, the volumes in which residential premises are located have a small scale. This is explained by the fine-grained structure of the internal layout, which forms a small, uniform system of windows, which makes the facades fragmented, small-scale. At the same time, the public part, which is usually formed by large rooms, has large divisions of blind planes and is solved on a different scale. On the other

hand, the modern city with its wide highways, large spaces of squares and residential complexes requires an increase in the scale of the building. An increase in the scale of the building can be achieved, for example, by alternating glazed and blind parts of the facade, dividing it into large parts horizontally with the help of the necessary rhythm of loggias or balconies.

At the same time, a person should be comfortable moving in and around the building space. Tall, closed or bulky objects can look uncomfortable if the correct relationship between the scale of the building, its elements and the size of a person is not maintained. For residential or mixed complexes, it is important to provide interiors and spaces that correspond to the human scale, and external facades should be proportional to the size of the street or square.

As means of creating an expressive image of a multifunctional complex, silhouette, plasticity, mass and space, texture, texture, color should be considered.

The silhouette plays a key role in forming the composition of multifunctional complexes, as it determines the visual perception of an architectural structure at different levels – from a distant panorama to close contemplation. Its influence can be considered in several aspects.

The silhouette creates a characteristic identity for a building or complex, helping to distinguish it from other objects in the urban environment. This is especially important for large multifunctional complexes, where a variety of functions can be visually unified through the features of the form and silhouette. A clearly defined silhouette helps to easily identify the building from different perspectives and determine its role in the urban context. The silhouette changes depending on the angle of view and distance, which creates a dynamic composition. This is important for multifunctional complexes, where there can be different volumes and shapes that interact with each other, creating different visual effects. Depending on how the volumes and their silhouettes are formed, interesting spatial emotional effects can arise: for example, fractures of contours or mixing of masses, which increases the expressiveness of the architecture.

The silhouette interacts with the surrounding landscape and urban environment. Tall, vertical forms can contrast with the horizontal lines of the surrounding buildings, which adds significance to the architectural object. At the same time, complexly organized or soft contours can be part of the landscape composition, and the silhouette itself is a way to integrate the building into the natural environment. The metaphorical structure of the silhouette has the ability to evoke emotional reactions. It can convey certain associations or conceptual ideas that are important for the functioning of the complex. For example, angles, fractures, vertical forms can symbolize development, progress, or dynamism, which reflects the functional composition of multifunctional complexes. The silhouette helps to visually perceive the volume of the building and its internal functions. Thanks to the silhouette, you can imagine not only the exterior, but also the internal organization of the space, as well as the interaction of functional areas.

For multifunctional complexes, where different functions are mixed, the silhouette can indicate the types and scales of space inside the complex.

Plastic is an important means of architectural and compositional organization of a building, as it determines the visual and emotional appeal of the architectural form, shaping its perception at different levels. Plastic of architectural volume is a set of compositional means consisting in the sculptural and relief processing of volumes or external surfaces to achieve a certain aesthetic expressiveness. Plastic solutions in architecture are a tool for creating an artistic image and revealing the idea and content of an object. The characteristics of the plastic means themselves are based on the process of perceiving the form of an object, which is explained by its location in space, silhouette, proportions and basic structural divisions that ensure its unity. Plastic processing makes the building complex and multidimensional, thanks to which the structure is well perceived from any point of view. Plastic as an architectural and artistic technique develops and concretizes the author's idea, reflecting the internal structure of the volume and its constructive solution through decorative, symbolic or geometric interpretation.

Plastic allows you to add dynamism and movement to the architectural form. The use of sculptural elements, relief surfaces, curved lines and volumes creates the impression of a "living" building that responds to changes in lighting and viewing angle. This is especially important for multifunctional complexes, where it is necessary to combine different functions, creating a unique look for each zone and harmoniously integrating them into one holistic structure. Plastic forms can evoke certain emotional associations. Soft, rounded shapes create a feeling of softness and harmony, while sharp corners and vertical lines can convey dynamism, progress or industrial aesthetics. For multifunctional complexes, plastic helps to enhance the feeling of functional diversity and multifacetedness of space.

The use of plastic to emphasize different functional zones of the complex is an important architectural technique. For example, individual parts of the building can be decorated in different plastic forms to visually separate some functions from others, which facilitates orientation in space. You can highlight main entrances or important functional areas by changing the shape or surface relief, giving them a more expressive and noticeable appearance.

Plastic forms can help to organically integrate a building into its environment. Soft, rounded forms can be better compatible with the natural landscape, while aggressive vertical forms contrast well with other elements of urban development. The use of plastic also allows you to create smooth transitions between the building and the natural environment or neighboring buildings. Plastic directly affects the appearance of the building's facades. It can include relief elements (sculptural forms, three-dimensional decorations), curved surfaces, architectural details that give the building individuality and character. This is important for multifunctional complexes, where it is necessary to

emphasize the aesthetic and practical functions of different parts of the building. The plastic of the building interacts with other architectural elements, such as columns, arches, window openings, roofs and materials. The use of relief elements in the composition allows you to organically combine architecture with the surrounding space, ensuring the visual integrity of the building. This is important for creating a harmonious architectural composition that includes different functional areas in one object.

Mass and space are elements of architecture that determine the visual perception of form. The mass of a building is a characteristic of material volumes that determine its weight, volume, scale and strength. When considering mass as a property of spatial form, the amount of material that fills the space within the visible geometric form is meant. The main task of architectural form formation is the issue of organic combination of mass and space in artistic form. Determining the ratio of mass of volumes and space is based on a visual comparison of these components. It is known that the more monolithic the building, the greater the visual massiveness it has, and vice versa. In multifunctional complexes, mass can be used to achieve several effects.

Creating the impression of stability. The mass of a building can give a feeling of confidence and stability, which is important for large objects that must convey the impression of reliability and durability. For example, massive foundations can be used to create a sense of fundamentality of the complex, especially in the context of important commercial or administrative functions.

Impact on the surrounding environment. The mass of a building is crucial to how it will be perceived in the context of its environment. Tall, massive blocks can dominate an urban environment, while less massive, open structures can provide a harmonious coexistence with the surrounding buildings and landscape.

Texture plays an important role in the architectural and compositional organization of multifunctional complexes, as it shapes not only the aesthetic appearance of the building, but also affects its perception from different perspectives. In architecture, texture determines the nature of the surface of materials and affects how the building interacts with its environment and how its form is perceived.

Surface texture (smooth, rough, textured) can create different tactile impressions, which contributes to the creation of an emotional effect. For example, rough or natural materials (stone, wood) can convey a sense of stability and reliability, while smooth surfaces made of metal or glass can create a feeling of lightness, modernity and technologicality. Texture also affects how a building interacts with the urban context or natural landscape. For example, textured facades can “dissolve” in the surroundings, creating the effect of unity with the environment, or vice versa, a sharp contrast of textures can emphasize the building, making it a dominant element. Texture can have symbolic meaning, reflecting the functional purpose of the building or its connection to cultural or historical contexts. For example, the use of materials with a certain texture, which

are associated with a specific history or symbolism, can help emphasize the function of the complex or its role in the city. Texture creates a play of light and shadow that can change the perception of volume and shape. For example, the relief surfaces of facades can change the appearance of a building depending on the time of day and lighting conditions, giving it a dynamic, changing appearance. Texture can also be adapted to the functional requirements of the building. For public or office spaces, smooth and "clean" materials are often used, emphasizing functionality and simplicity, while for recreation areas or cultural complexes, more textured and expressive materials are used, creating an atmosphere of comfort and coziness.

Texture as a means of artistic expression is used to denote, and sometimes imitate, the applied building or finishing material. The effect of texture is primarily used to convey the natural properties of the material, to reveal its aesthetic originality, so that each new surface is unique in its own way. Surfaces with a textured image, which realistically reproduce the visual properties of certain materials, can be both a background and a dominant in the architectural composition of a building. The texture of surfaces should be selected taking into account the dimensions of the building and the size of the space in which it will function. If the texture of the material is very expressive, its effect on the observer may be stronger than the effect of the object itself. However, excessive brightness of the texture can "destroy" the architectural form and disrupt the compositional balance.

The use of different textures on the facade can emphasize entrance areas or define the boundaries of certain functional areas, such as retail spaces or recreation areas. Texture can change the perception of the scale of a building. Large, expressive textures can emphasize the monumentality and massiveness of a building, while smaller textures can make it a lighter and more transparent element in the urban environment. This is especially important for large multifunctional complexes, where it is necessary to balance the importance of the object and its integration into the urban context.

Colour in architecture is an objective property of any form, which is an active means of its organization and a key factor in creating the image of an architectural object. Color compositional tasks are solved by using the natural color of building and finishing materials, painting surfaces during the construction of buildings, or manufacturing individual structural elements in a factory. The tasks of the color solution are: ensuring psychophysiological comfort, creating optimal conditions for performing certain visual work, organizing communication and information systems, compensating for adverse environmental influences, and forming a positive emotional and aesthetic impact. In addition, color is the easiest way to distinguish a building from the general mass, to make it special to some extent without using unique volumetric and spatial and constructive techniques. Color is also able to effectively "unite" disparate buildings into a

single logically constructed ensemble, to integrate a separate structure into the local cultural environment.

An important means of forming a figurative and compositional solution is the use of structures in the construction of the form, because they not only provide the physical stability and functionality of the building, but also serve as a powerful artistic tool. The use of structures as an aesthetic element allows the architect to emphasize the form, rhythm, scale and unique character of the building, creating an image that carries an ideological, semantic and emotional load. The structure becomes part of the aesthetic solution if its elements are open and integrated into the exterior of the building. For example, open trusses, beams, arches or columns can be an accent in the composition. This approach is often used in high-tech, brutalism and constructivism styles.

The integration of interactive and mobile facades into multifunctional complexes allows not only to solve functional and aesthetic problems, but also to create innovative buildings that interact with the environment and users. Interactive facades change depending on external conditions, such as lighting, temperature or humidity, can transmit information through dynamic lighting or digital displays, and can optimize energy use by adapting to environmental conditions, for example, using photochromic or thermochromic materials.

Mobile facades are systems that have movable elements that allow the appearance of the facade or its functionality to change depending on the needs of users or external conditions. Such facades can change to create different architectural images during the day or in different seasons, mobile elements allow you to change the level of ventilation, sun protection or transparency of the facade, ensuring the adaptation of the building to changes in functions or user requirements.

The artistic characteristics of multifunctional public complexes are determined by their uniqueness, role in the urban environment and impact on the surrounding space. The combination of volumes, silhouette, proportions, choice of texture, colour and other compositional means used in the architectural and compositional solution of a multifunctional complex should form ensembles that create a holistic and harmonious impression on the consumer.

Control questions and tasks

1. What general principles of architectural composition govern the formation of the figurative and compositional solution of multifunctional complexes?

2. Name several types of compositional schemes that determine the interaction of multifunctional complexes with the external environment.

3. What are the means of creating an expressive image of a multifunctional complex?

4. What visual effects can the mass of a building be used to achieve in multifunctional complexes?

4. FEATURES OF THE ARCHITECTURAL AND PLANNING ORGANIZATION OF MULTIFUNCTIONAL COMPLEXES OF VARIOUS TYPES

4.1. Multifunctional residential complexes

A multifunctional residential complex (MFRC) is one of the most promising forms of organizing a residential environment, as it enables a modern city dweller to meet the needs of housing, work and recreation. In it, *residential functions* are combined with *public,* and often also with *production* functions.

Multifunctional residential complex in the modern sense is a group of buildings and structures, different in functional purpose (housing, public institutions, offices, etc.), but united by one compositional and planning concept. Various functional processes in the MFRC occur independently of each other, and their size, building density, and functional composition depend on location in the city, socio-economic situation, and other factors.

The development of multifunctional residential complexes in the middle of the 20th century was due to the high cost of urban land and the desire to overcome the negative consequences of excessive functional specialization of peripheral and central areas of cities. It led, on the one hand, to depopulation and loss of social control after the end of the working day in the central administrative and business districts, and on the other hand, to a decline in the activity of public life in the evenings in the peripheral "bedroom areas".

At the early stage of its development, the MFRC had the features of super-urbanized formations with the maximum coefficient of territory use. The multi-level arrangement of functional zones and transport communications led to the appearance of several artificial levels (Fig. 4.1).

Multi-level residential complexes quickly became widespread in world urban planning practice. They differ significantly in terms of size, set of functions, and number of floors, but always retain such basic features as a high coefficient of use of the territory, vertical zoning of functions, radical separation of pedestrians and transport, etc.

Due to the high cost of such multifunctional residential complexes, medium-story complexes, which, unlike the early examples, were mostly not connected to transport hubs, later became more popular [1] (Fig. 4.2).

Like any object, MFRC can be classified according to various characteristics: ***size*** (small, medium, large); ***number of floors*** (low-rise, medium-rise, and high-rise); ***location in the city*** (central and peripheral); ***construction conditions*** (new construction or under reconstruction); ***functional composition***; ***type of public services*** (closed or open); according to the social and age composition of residents (intended for different social and age groups: young people, elderly people, singles, small families, etc.); ***the level of family budget and comfort*** (elite, middle-class, social housing); and others.

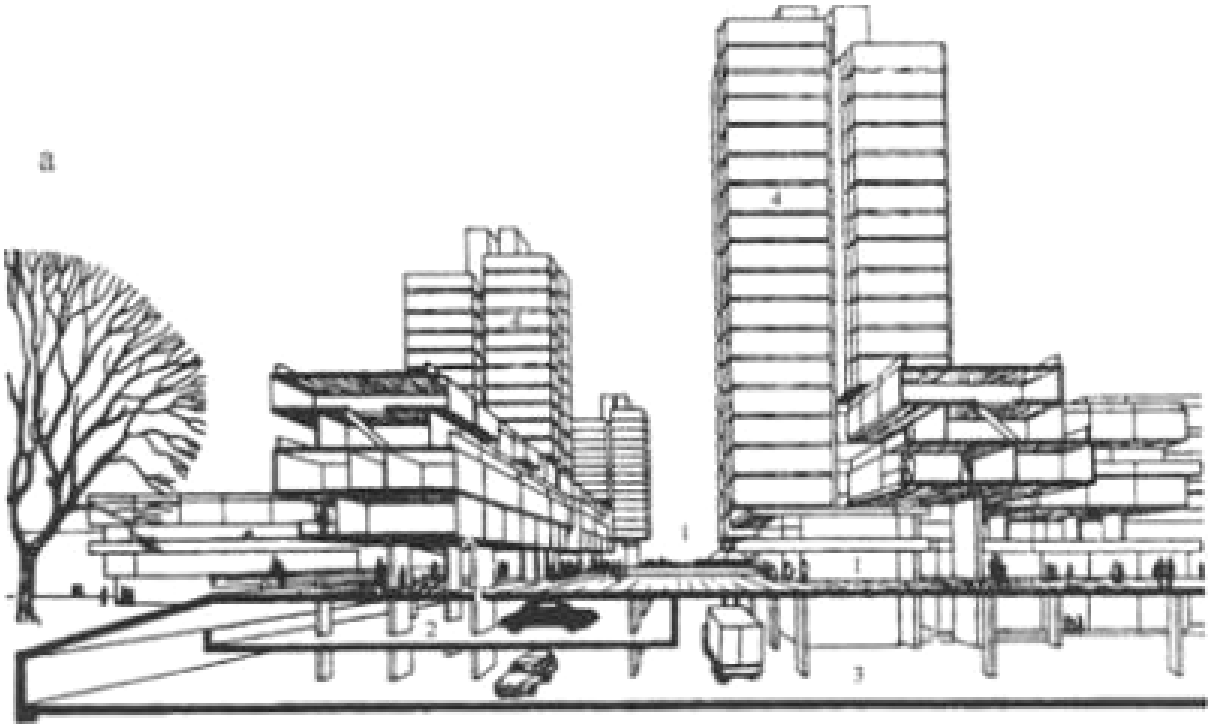


Fig. 4.1. Multi-level public centre in Chelsea neighbourhood in London (Great Britain): 1 – upper pedestrian platform; 2 – second tier (cultural and household service facilities, parking lots); 3 – the third level for passage, warehouses and parking lots; 4 – residential buildings

Fig. 4.2. A multifunctional residential and office complex in the city of Jena, Germany (designed by architectural bureau J. Mayer H., 2008 – 2014). Section

Belonging to one or another classification group has a significant impact on the design features of MFRC. For example, the presence of a closed type of service (intended only for the residents of this MFRC) necessitates the provision of convenient connections for the service premises with all its apartments. Therefore, in cases of using closed types of services, residential buildings of the corridor, gallery or corridor-sectional or gallery-sectional type are more appropriate. In the conditions of Ukraine, the use of gallery (gallery-sectional) buildings is expedient, first of all, in the IV architectural and construction climatic region (according to Appendix B [8]).

The main factor determining the functional composition of the MFRC is its ***location in the city structure***.

In the central part of the city, as a rule, MFRC are being built under conditions of reconstruction. Depending on the conditions of reconstruction, they can be commercial and residential, administrative and residential, and other types of institutions; depending on the size and their location in the structure of the reconstructed building – can be small and occupy part of a block (***local***), an entire block (***block***), several blocks (***fabric***), develop along the street front (***linear***) or occupy significant areas along the street front with adjacent quarters (***developed highways***).

In the peripheral areas, the nature of MFRC changes significantly. Here, depending on specific conditions, public centres of micro-districts or residential areas (respectively, 12 – 20 thousand and 20 – 40 thousand inhabitants) can be designed in the form of public-housing complexes with a group of public institutions designed for the micro-district or district level of service.

The creation of a more diverse, socially effective environment in peripheral areas is possible only if residential, public and administrative institutions are united into a single organism. It is important to take into account the urban planning situation, the approach of the public sector to transport hubs and stops. The main advantage of public and residential complexes is the functional and spatial consolidation of the building, which more fully corresponds to the modern trends of social and urban development of peripheral areas (increasing the density of the building, individuality and aesthetic expressiveness, the complexity of its implementation in the order of construction).

Thus, there are always at least three functional blocks in the structure of the MFRC: ***residential, public service***, ***garage.*** Depending on the location conditions, an office block, a hotel, an entertainment or sports complex, etc. may also be added to the city structure.

According to the current master plan of the city, it is expedient to place MFRC primarily in zones intended for the placement of multi-storey residential buildings, or on the border of this zone and the zone of public institutions, or in areas subject to comprehensive reconstruction. The most expedient is the location of MFRC in areas with the highest urban planning value, near transport hubs.

As a rule, MFRC provide a fairly high population density – up to 450 people per 1 ha. Such a high density, as well as the combination of many functions on a limited territory, determine the use of specific methods of functional and planning organization of the MFRC site.

When calculating the required area of the land plot, it is advisable to calculate separately the area of the residential part of the complex (houses + adjacent territory, based on the area norm indicated in table 2.1), and separately – the public part, based on the relevant standards for various types of public institutions. At the same time, it is possible to take into account the use of operated roofs of buildings and structures.

Table 4.1

The specific dimensions of the plot for placing the residential part of MFRC and the recommended maximum land-use ratio (according to [8])

Residential part of the MFRC, storeys	Plot area, m^2 per person	Maximum land-use ratio, %
4 – 5	20,2 – 17,0	45
6 – 8	15,3 – 13,9	40
9 –10	12,2 – 12,0	35
11 and more	by interpolation, but not less than 10.5	30

** in the case of placement of sections and individual buildings of different number of floors on the site, the average number of floors should be determined during calculations.*

*** the total building area of the MFRC residential part, including the roofs of the stylobate parts, underground and semi-underground structures used for landscaping for residents, as a rule, should not exceed 70% of the land plot of the residential part of the complex.*

The main feature of the MFRC site organization is its clear division into public and residential parts with provision of independent entrances and approaches to each of them (Fig. 4.3).

At the same time, in Ukraine (as well as in post-Soviet countries in general) it is customary to maximally isolate residential living space from public spaces and transport highways, in contrast to the countries of Western Europe, where residential living space can be combined with public one. According to existing regulations, pedestrian through passages should be arranged every 100 m in the building.

Ukrainian regulations [8] directly prohibit the use of adjacent residential space for organizing the loading of service and trade enterprises. It is advisable to arrange such loading either from the ends of the service block, or from a closed space with an entrance from the side of the main facade, or from an underground space.

Options are possible with the arrangement of an underground parking lot under almost the entire outbuilding space. The problem in this case is the placement of trees that cannot be placed on its roof.

For the climatic conditions of most of Ukraine (with the exception of the southern regions), for insolation and aeration of the yard space, it is optimal to open it to the south and close it from other directions. In the case where a transport highway is located from the south, the yard space can be closed from it by a relatively low service block that does not interfere with insolation.

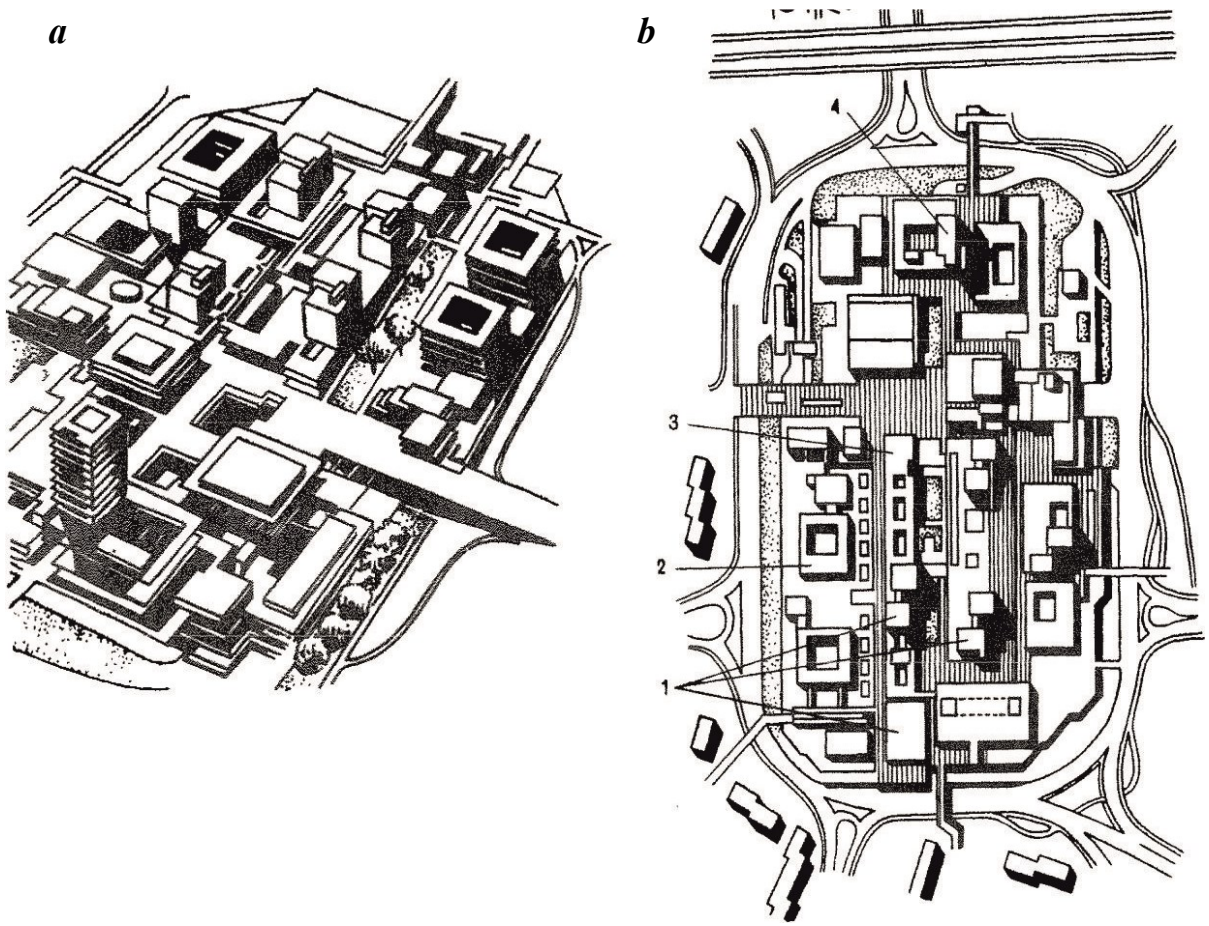


Fig. 4.3. Nordweststadt multifunctional complex in Frankfurt am Main (Germany):
a – axonometry; b – master plan: 1 – housing; 2 – offices; 3 – trade gallery; 4 – hotel

Based primarily on functional requirements – the combination of many functions with their clear separation at the same time – the most common scheme of the volume-spatial composition of modern MFRC is the combination of a high-rise part (in which apartments, hotels, offices, etc. can be located) with a 1–3-story stylobate, in which can accommodate public service establishments (retail, entertainment, catering ones, etc.). This scheme quite well provides vertical

functional zoning and isolation of the adjacent living space from transport highways, and the stylobate acts as a “fence”. The stylobate roof can be operated and used for both residential and public parts of the complex.

At the same time, the high part can be solved both in the form of “plates” (with a rectangular or stepped facade) and in the form of separate “towers” (Fig. 4.4). The most radical subtype of such a compositional scheme is the stylobate, which occupies almost the entire area of the site, on the roof of which there are outbuildings and high-rise residential (office, hotel) buildings.

Fig. 4.4. An example of the MFRC volume-spatial composition – the combination of the high part with the stylobate (arch. M. Shvets, Kyiv, Ukraine, 2007)

However, in the conditions of a significant shortage of territory, the compositional scheme of the so-called “horizontal skyscraper”, first proposed by El Lissitzky in 1926, is increasingly used (Fig. 4.5). According to El Lissitzky’s design proposal, the skyscraper consisted of three frame supports, inside which there were stairwells and lifts, and a horizontal 3-story volume that resembled the letter “h” in plan. One of the vertical shafts went underground between the subway lines and served as a station, the other two were designed to be tram stops.

In essence, the “horizontal skyscraper” is a further development of the “building on pylons” concept proposed by Le Corbusier. This composite scheme allows you to protect residential blocks well from noise and ensure their insolation, and at the same time creates significant areas of usable roofs, which can partially compensate for the deficit of the territory at ground level.

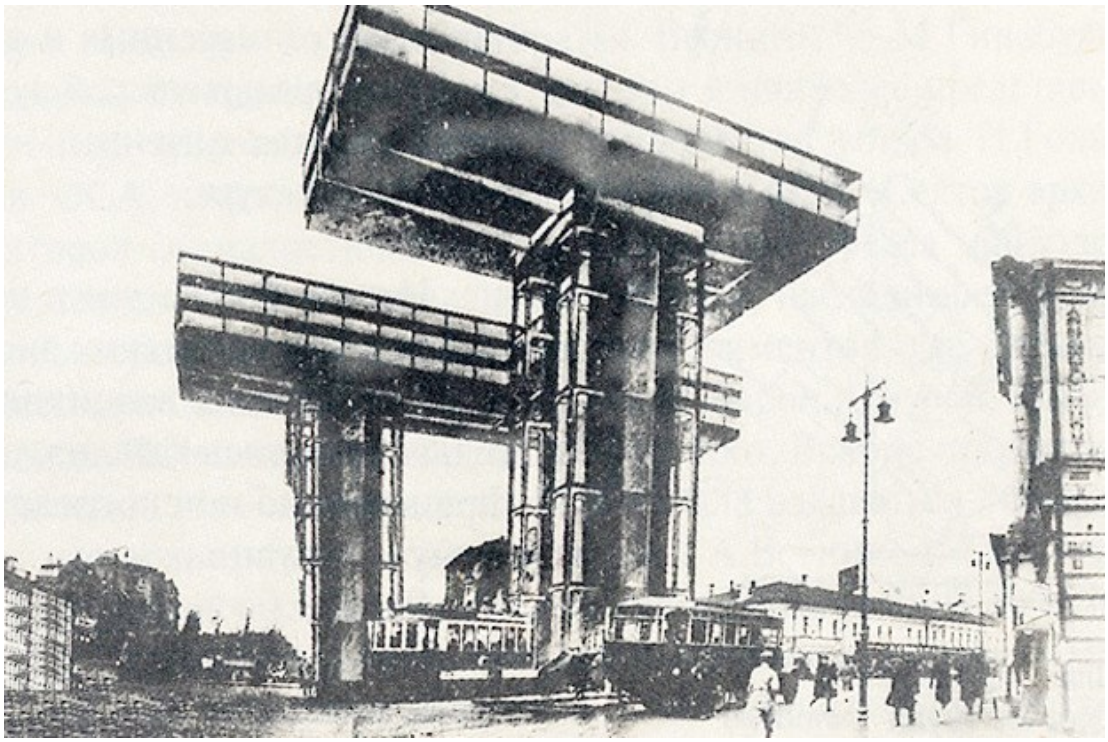


Fig. 4.5. The concept of a “horizontal skyscraper” (El Lissitzky, 1926)

The modern implementation of this idea is a horizontal skyscraper designed by Steven Holl Architects and completed in 2009. It is a mixed-use building on the outskirts of Shenzhen, China, which includes offices for Vanke Co., a conference centre, a restaurant, an assembly hall, a hotel, and apartments. The site has been transformed into a large public park (Fig. 4.6, 4.7).

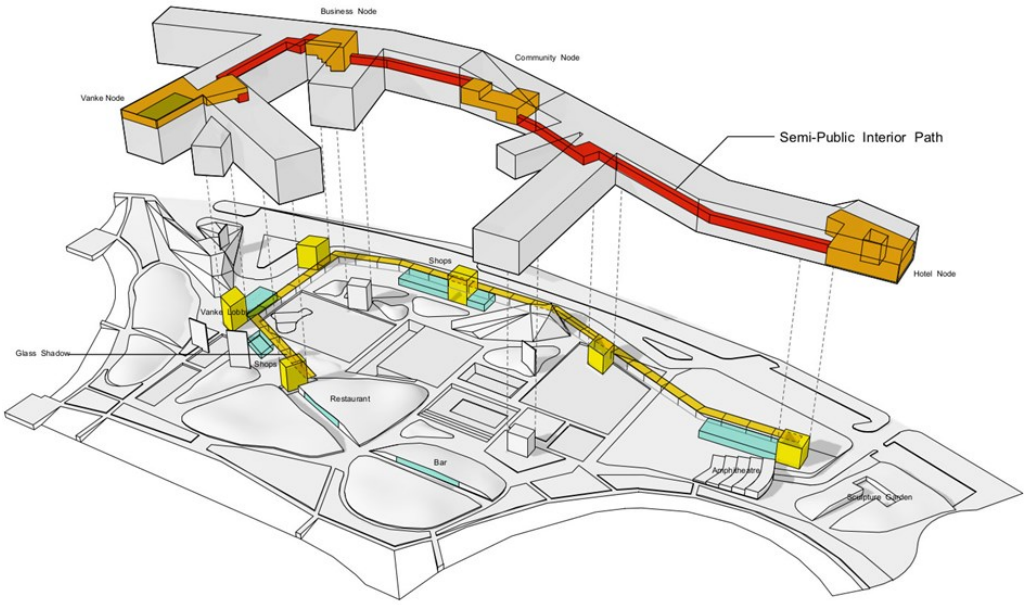


Fig. 4.6. Vanke Center in Shenzhen, China (Steven Holl Architects, 2009). Communication scheme [28]

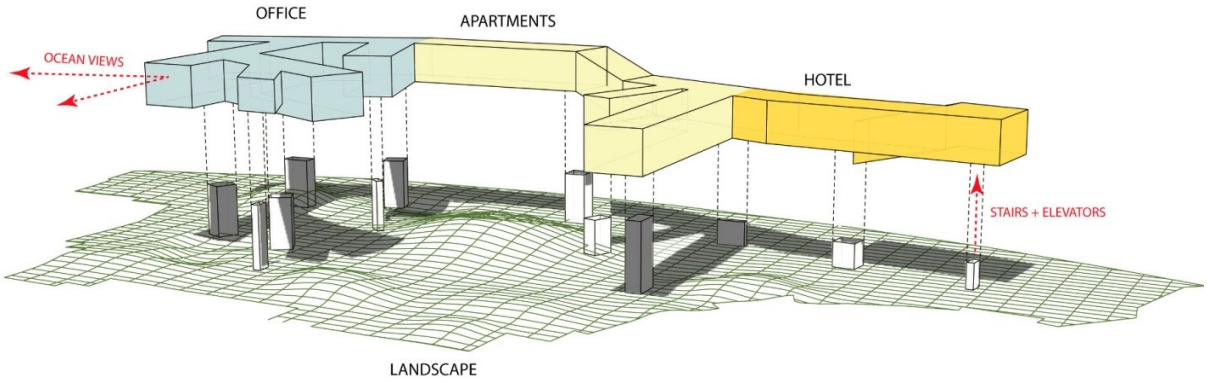


Fig. 4.7. Vanke Center in Shenzhen, China (Steven Holl Architects, 2009). Functional zoning scheme [28]

Multifunctional residential complex can also be a set of high-rise towers connected by horizontal ties both at ground level and in the air. This is the Linked Hybrid complex (Steven Holl Architects, 2009) located in Beijing, China, which includes apartments, a hotel, a cinema, a kindergarten, a school, an underground parking lot, commercial areas, and a green area for public use (Fig. 4.8).

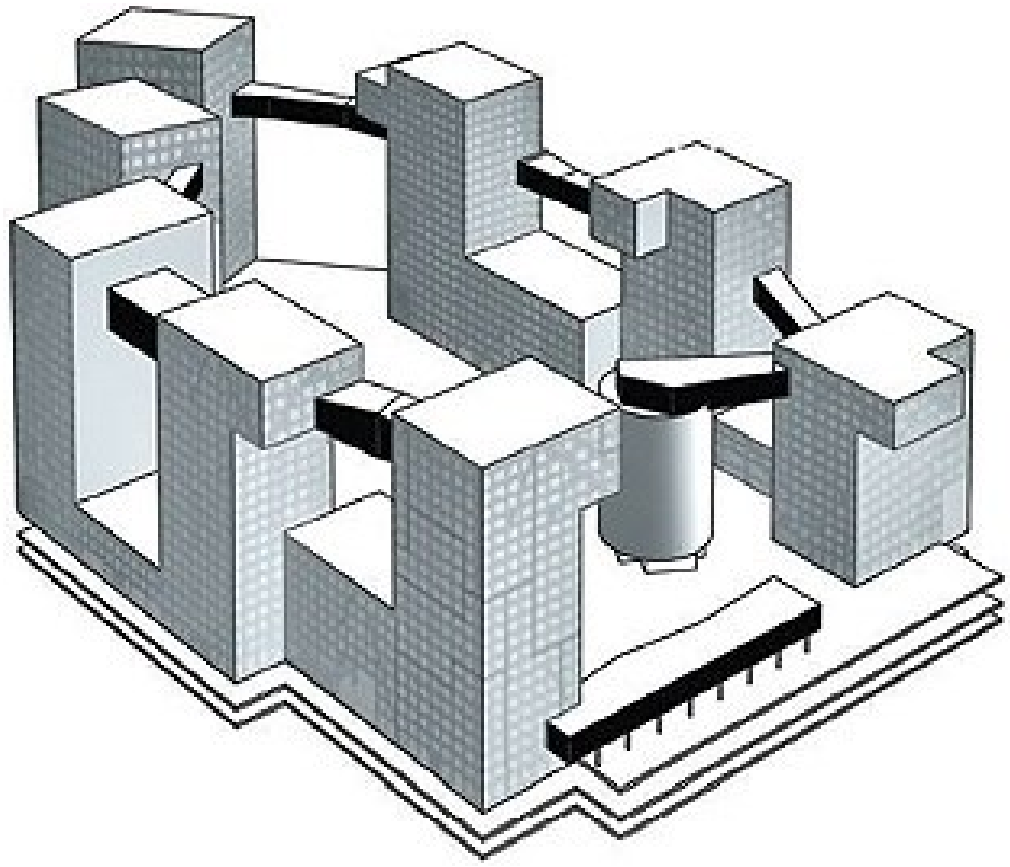


Fig. 4.8. Linked Hybrid multifunctional complex (Steven Holl Architects, 2009) in Beijing, China. Axonometry [28]

The location of MFRC, as a rule, near transport highways and transport hubs makes it necessary to protect the residential part from noise, exhaust gases, etc., while the complex as a whole cannot be moved away from the highway deep into the quarter. At the same time, the type of public service (open or closed) is also a significant factor that determines the degree of development of internal connections between the public and residential part of the MFRC and, accordingly, the type of residential building used for the residential part.

Residential buildings of any type can be used for non-residential premises. But at the same time, the specific requirements of the features of the functional organization and constructive solution of such buildings should be met. For example, if for service premises of a closed type, that is, intended only for residents of this building, it is necessary to provide convenient connections with all its apartments, then for premises of general city service, their *maximum isolation* from the residential part of the building is required. Therefore, in cases of using closed types of services, residential buildings of the corridor, gallery or corridor-sectional or gallery-sectional type are more appropriate. Otherwise, it is advisable to place residential apartments in the quietest area of a corridor-type building. For this purpose, a protective zone can be created from administrative or business premises. They can occupy half of a residential building vertically to its entire height and be located on the noisy side. Apartments are being designed in the second, parallel half of the building. At the same time, a corridor system with two parallel corridors on each floor can be used (if the organization and size of the apartments allows) or alternating corridors located one above the other across the floor, one of which belongs to the dwelling (for two-level apartments), and the other to office premises. This technique is sometimes called a *sandwich*.

Another way to protect housing from noise is to use the ground service floor as a screen, strongly protruding in front of the facade of the building. The roof of the ground floor can be used as pedestrian spaces leading to the entrances to the residential building. This method requires separate structural systems for the residential part of the building and the ground service floor, and can also be used in any of its types (multi- and single-section, corridor, etc.).

The unification of different purposes premises in the MFRC building imposes such important requirements on its structure and planning as the separation of human flows directed to housing and service institutions. Staircase and elevator sections, lobbies, corridors, and other communications serving these flows must be isolated from each other. The underground level can be adapted both for garages and parking lots and for the placement of service facilities.

The multi-level functional zoning of the MFRC determines the need to use such volume-planning and constructive solutions of buildings that allow different functions to be placed on different floors.

If there are no significant complications with the stylobate part, except for the need to coordinate the parameters of the column grid with the requirements for the parking lot (if the parking lot is placed under the service block), then the

choice of the planning scheme of the high part requires more detailed consideration.

The compositional scheme of MFRC is quite common, where high-rise "towers" of residential, office, or hotel purposes, plastic shape in plan, for example, round, rise above the 2-3-story stylobate of a calm (mostly rectangular) shape in plan.

In world practice, the central part of such a building is allocated for placement of vertical communications and auxiliary premises, and the perimeter is for premises of the main purpose. Ukrainian regulatory documents [9, 14] stipulate the need for at least one stairwell with natural lighting (SK-1), and for high-rise buildings, there is also a transition through an open loggia (type N1). Therefore, placing at least one of the stairwells (with which the elevator for transporting fire departments is often blocked) close to the perimeter of the building can significantly affect both its layout and appearance (Figs. 4.9).

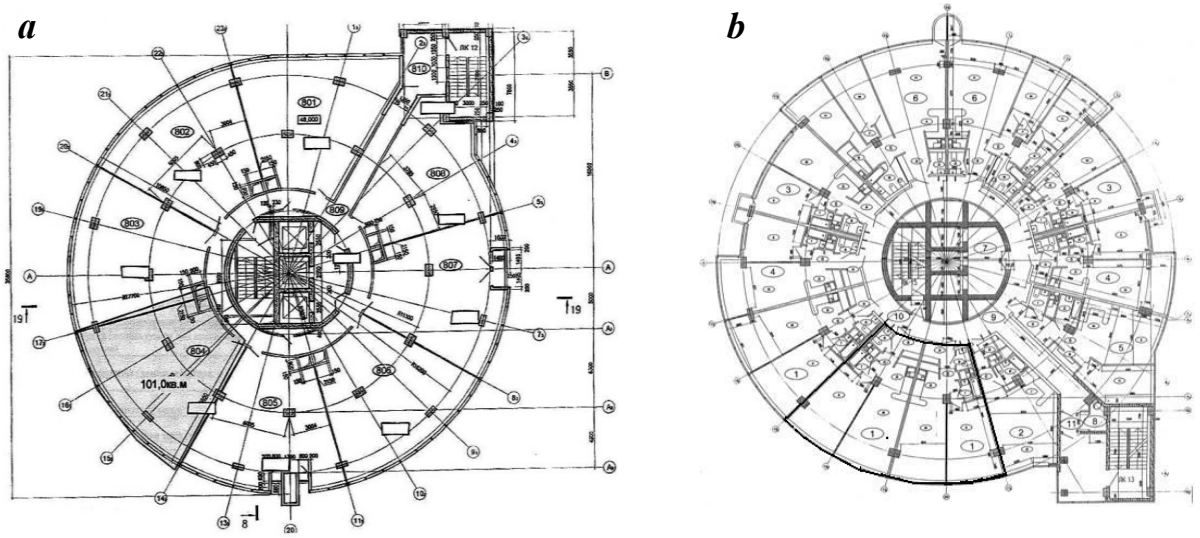


Fig. 4.9. Typical floor plan of the high-rise part (a – office building, b – residential building) of the MOST CITY multifunctional residential complex in Dnipro, Ukraine (designed by Zadoia and Ar.Co group, 2006)

When placing the MFRC close to the transport highway, to protect the residential part from noise, its complicated shape in the plan can be used, which ensures the orientation of most of the premises away from the highway (Fig. 4.10). At the same time, it is advisable to place vertical communications between residential buildings, and when planning apartments, avoid orientation of the windows of the living spaces of the apartments to neighboring apartments.

When using 9-10-story buildings, as a rule, they strive for maximum loading of the stair-lift unit. For this purpose, the number of apartments per floor increases to 5-8 (provided that their total area per floor does not exceed 500 m^2) [8].

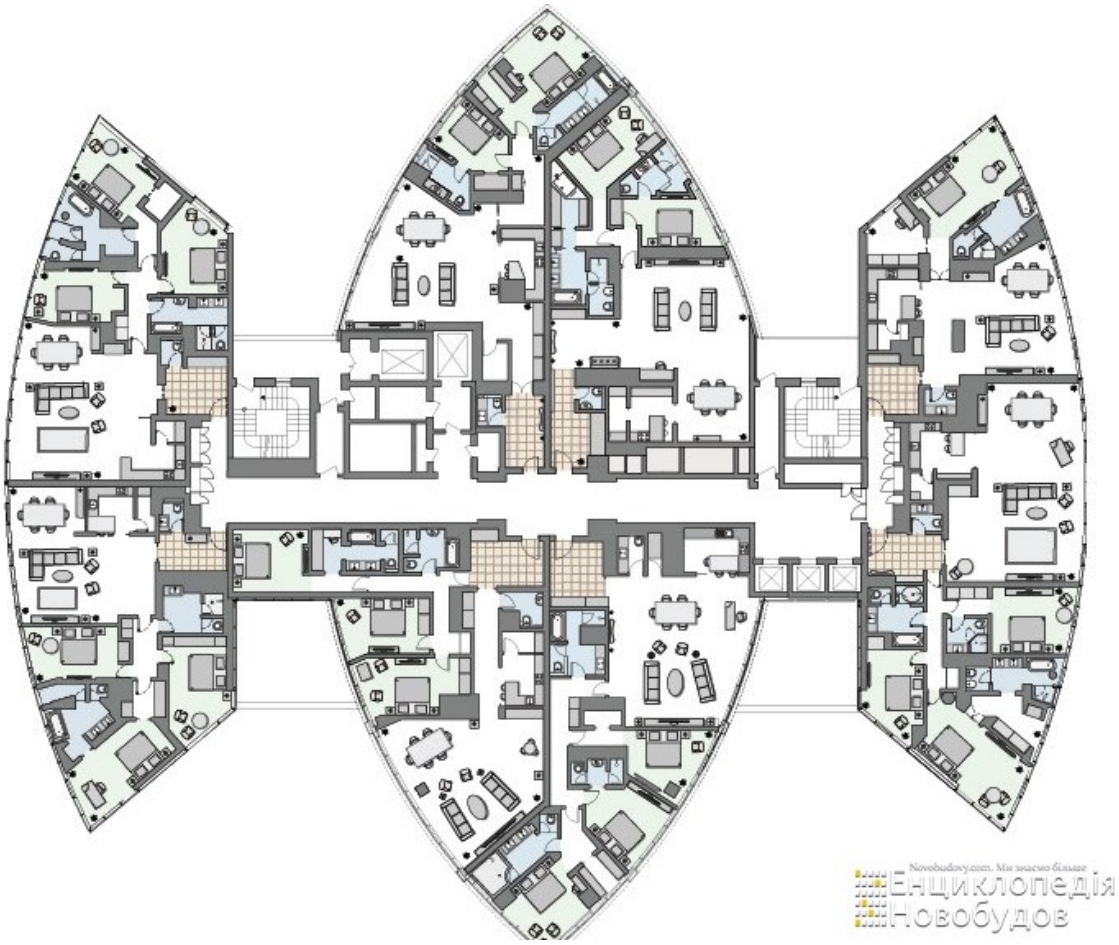


Fig. 4.10. Hotel and residential complex H-Tower on Tarasa Shevchenka Boulevard, Kyiv, Ukraine (designed by Sifert Architects LLC, 2013). Plan of a typical residential floor [26]

In such corridor-sectional blocks, both single-level (Fig. 4.11, a) and two-level apartments (Fig. 4.11, b, c) can alternate. Such solutions require a coordinated location of kitchens and sanitary units because the placement of the latter above living rooms is not allowed by domestic regulations. The location on the last two floors of the building of two-level apartments is often used in order to get an additional living floor while avoiding the increased requirements for stair-lift nodes, which are imposed on buildings with a conventional height of more than 26.5 m.

In one MFRC, sectional residential buildings can be combined with corridor buildings, including those with a conventional height of more than 26.5 m (Fig. 4.12). At the same time, the maximum use of the light perimeter of the building with a simultaneous increase in its width can be achieved by using a two-corridor scheme, when one of the stairwells (type N4) and an elevator hall with elevators are located in the central part of the building, and the stairwell of type N1 is located at the end of the building. In single-section buildings as part of MFRC, the number of apartments in a section may exceed 10 (Fig. 4.13).

Fig. 4.11. An example of a 9-10-story residential building with apartments on one (a) and two levels (b, c). Floor plans. Residential complex “Yaskravyi Lviv” (“The Bright Lviv”), Lviv, Ukraine [26]

Fig. 4.12. An example of the use of a two-corridor scheme in a corridor residential building of the MFRC (residential complex “Yaskravyi Lviv” (“The Bright Lviv”), Lviv, Ukraine [26])

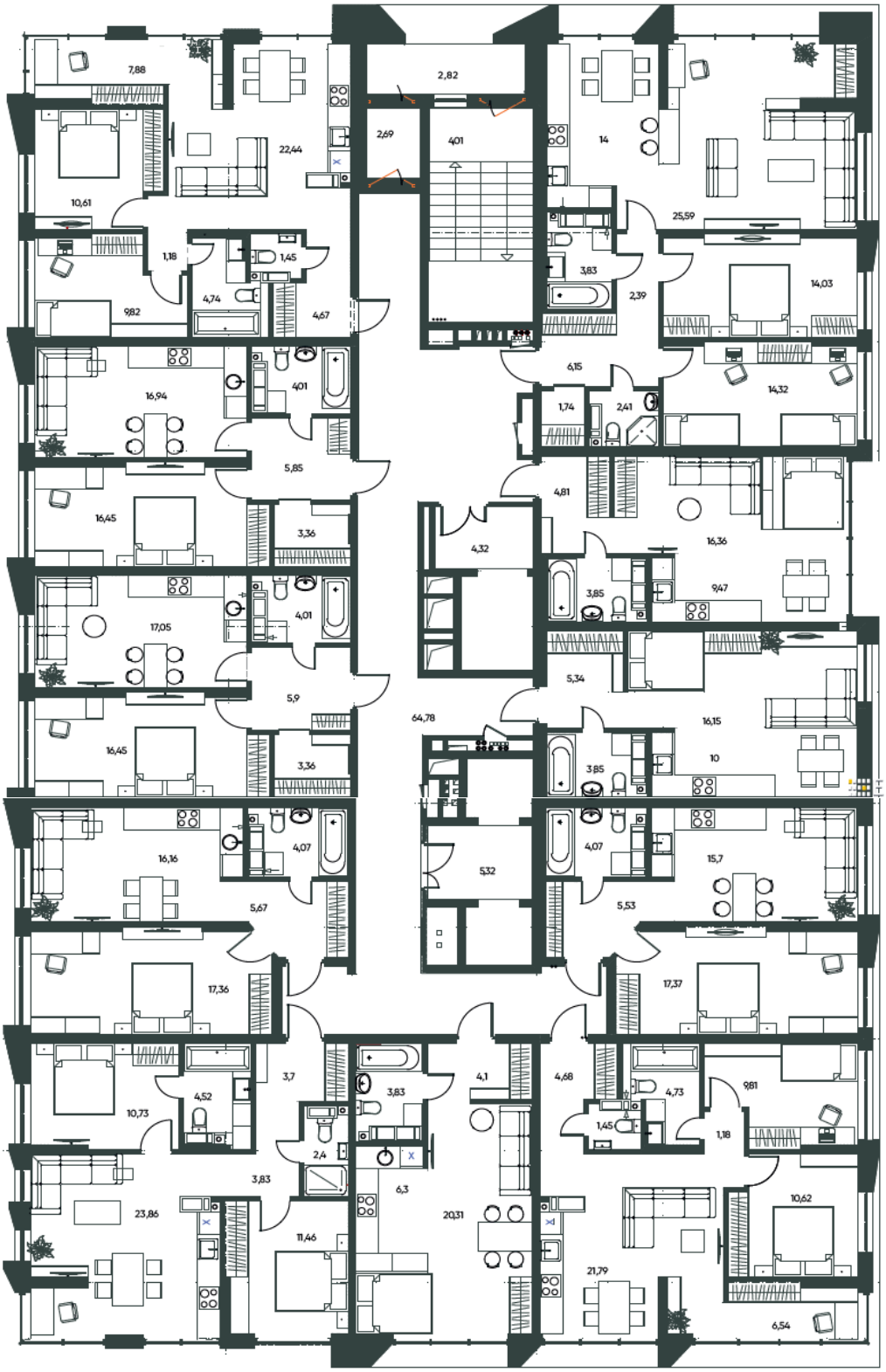


Fig. 4.13. Corridor-section single-section residential building (11 small apartments per floor). Typical floor plan. Residential complex Central Hills, Kyiv. Design organization: LLC Ukrainian Engineering and Innovation Company, chief architect of the project V.M. Mykhalchenko [26]

Often, the large sizes of MFRC (especially their high-rise parts with fine-cellular internal structure) cause a certain monotony in the facades. In modern design and construction practice, several main ways of solving this problem can be identified.

The first and probably the simplest is the use of painting. Colour highlighting of different floors (following the internal structure or without maintaining such correspondence) is still one of the most common composition techniques.

For facades of smaller-sized MFRC, it is quite effective to use a compositional technique, which consists in complicating the repetition-based composition (enlargement or grinding of the repeated step horizontally or vertically) (Fig. 4.14).

Fig.4.14. An example of the use of the complicated repetition-based facade structure

a ***b***

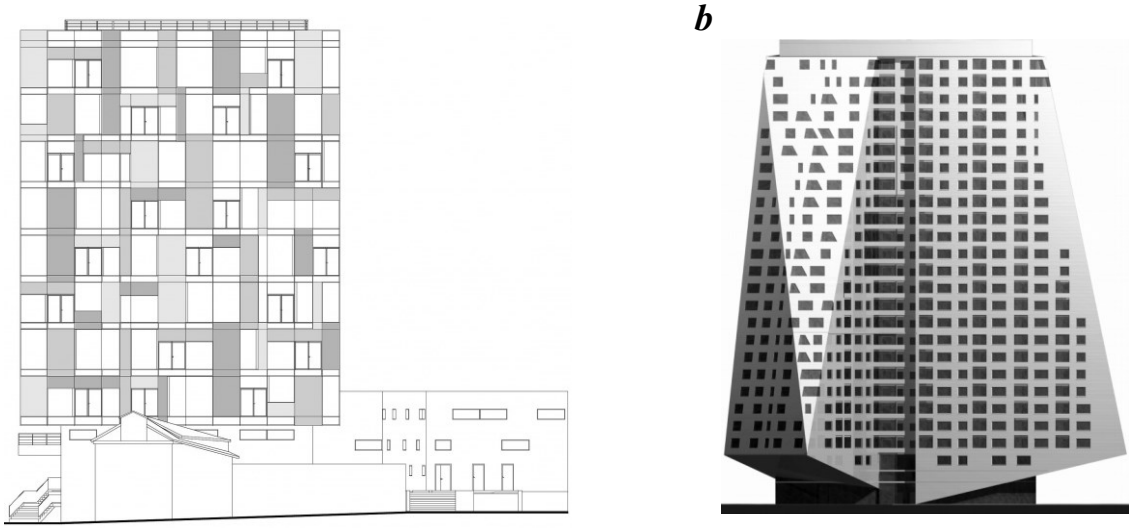


Fig. 4.15. Examples of solving the facade of the MFRC using the adoption of an irregular structure

Relatively new is the compositional technique of the imaginary irregularity of the facade. It can be implemented through the structure of the hinged facade system (Fig. 4.15, a) or due to the use of window openings of different sizes and shapes (Fig. 4.15, b). The widespread use of the frame structural system (mainly from precast monolithic or monolithic reinforced concrete) in the construction of MFRC made the use of this technique quite simple from a constructive point of view. It is also possible to use accents superimposed on the regular structure of the facade, which in this case is perceived as a kind of texture (Fig. 4.16). It is expedient to use a similar method on the facades of high-rise buildings of MFRC of sufficient height and length. Structural elements found on the facade can be used as such accents (Fig. 4.17).

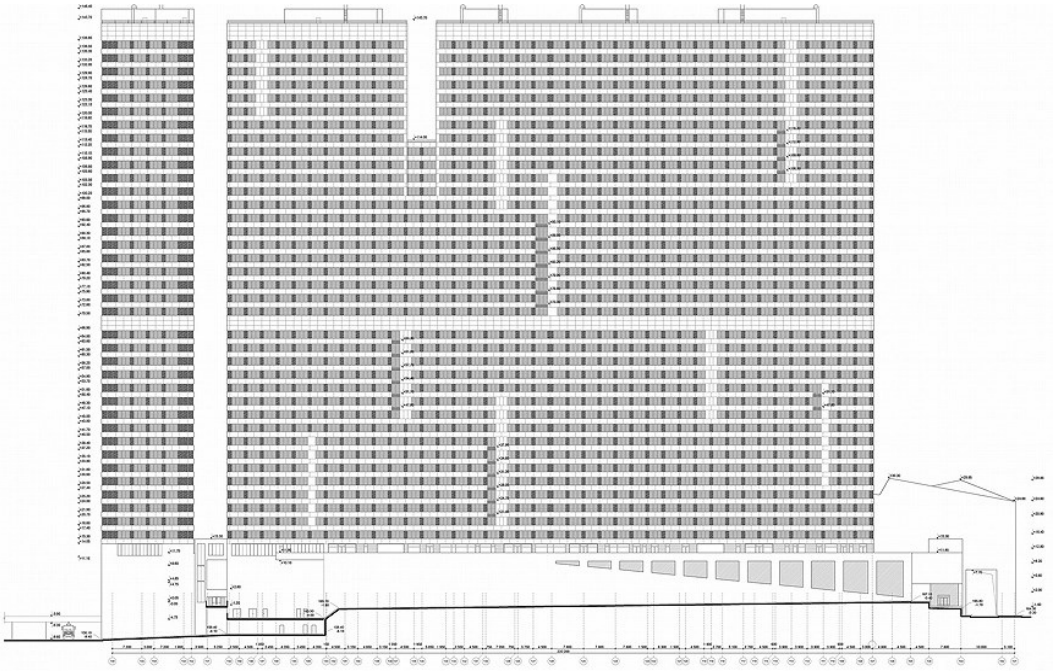


Fig. 4.16. An example of the accents superimposed on the regular facade structure

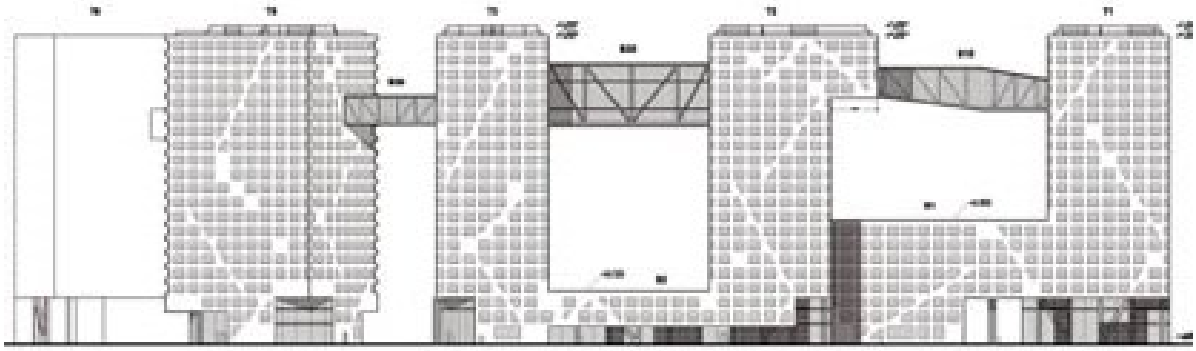


Fig. 4.17. An example of the facade-placed diagonal ties used to diversify the MFRC facades of significant sizes. Multifunctional complex Linked Hybrid (Steven Holl Architects, 2009) in Beijing, China [28]

Control questions and tasks

1. What is a multifunctional residential complex?

2. What were the prerequisites for the development of multifunctional residential complexes in the mid-20th century?

3. By what criteria are multifunctional residential complexes classified?

4. What is the main factor that determines the functional composition of a multifunctional residential complex?

5. What are the main functional blocks that are distinguished in a multifunctional residential complex?

6. How is the maximum number of residents of the residential part of a multifunctional residential complex calculated?

7. What is the main feature of the planning organization of the site of a multifunctional residential complex?

8. What is the most common scheme of the volume-spatial composition of modern multifunctional residential complex?

9. Explain the essence of the concept of a "horizontal skyscraper". Give examples of its implementation in modern conditions.

4.2. Shopping and entertainment centres (complexes)

A modern ***shopping and entertainment centre*** (SEC) is a multi-story building in which, in addition to shops, cafes, bars, casinos, cinemas, bowling alleys, and other entertainment facilities can be located.

As a rule, it is equipped with escalators, and elevators, provided with parking for personal transport of buyers and is located near metro stations and public transport stops or in sleeping areas of the city. A shopping and entertainment centre can be considered as one of the varieties of a shopping centre.

The wide distribution of objects of this type is explained by their greater attractiveness for buyers due to a wider range of goods and services than in ordinary stores, the combination of the process of buying goods (shopping) with various entertainment.

As a rule, shopping (retail and entertainment) centres and complexes include two types of establishments: so-called *anchors* (or *magnets*), which are especially attractive to visitors (supermarkets, department stores, entertainment establishments (in particular, cinemas, fitness centres etc.) and other, smaller establishments, as a rule, are located near the paths of the traffic of visitors to establishments of the first type. Establishments of these two types in the shopping centre exist in a kind of symbiosis, mutually increasing the sales volume of each other.

Today, in the world there are several options for the classification of shopping centres by sales area and functional features. Thus, in the USA, the classification developed by the American Urban Land Institute (ULI) is used, while in Europe, the classification of the International Council of Shopping

Centers (International Council of Shopping Centers, ICSC) is mainly used (Table 4.2). In Ukraine, companies can usually use one or another classification depending on specific circumstances.

Table 4.2

The classification of shopping centres according to ICSC [29]

Type	Concept	Typical anchor(s)		Anchor ratio
		Number	Type	
Neighbourhood Centre	Convenience	1 or more	Supermarket	30 – 50%
Community Centre	General Merchandise; Convenience	2 or more	Discount department store; super-market; drug store; home improvement; large specialty/discount apparel	40 – 60%
Regional Centre	General Merchandise; Fashion (Mall, typically enclosed)	2 or more	Full-line department store; junior department store; mass merchant; discount department store; fashion apparel	50 – 70%
Superregional Centre	Similar to Regional Centre but has more variety and assortment	3 or more	Full-line department store; junior department store; mass merchant; fashion apparel	50 – 70%
Fashion/Specialty Centre	Higher end, fashion oriented	N/A	Fashion	N/A
Power Centre	Category-dominant anchors; few small tenants	3 or more	Category killer; home improvement; discount department store; warehouse club; off-price	75 – 90%
Theme/Festival Centre	Leisure; tourist-oriented; retail and service	N/A	Restaurants; entertainment	N/A
Outlet Centre	Manufacturers' outlet stores	N/A	Manufacturers' outlet stores	N/A

The ULI classification is slightly different from it. In particular, some additional formats of shopping centres are described separately:

– Super Community Centre, which corresponds to the profile of the district center, but has an area of more than 23 thousand m^2 (in some cases, their area reaches 90 thousand m^2); this class also includes a Power Centre.

– specialized shopping centers (Specialty Centres), which include subtypes of other, "traditional" types of shopping centres, which differ in the composition of "anchors".

Possible themes of specialized shopping centres are:

– Entertainment;
– Retail-Entertainment;
– Off-price;
– Home improvement;
– Historical;
– Megamall;
– Lifestyle.

By market area (area served by commercial centre), shopping centres could been distinguished according to follow sub-classifications [29]:

– Commercial Strip Centres;
– Neighbourhood Centres;
– Community Centres;
– Regional Centres;
– Super Regional Centres.

By pattern, shopping centres could be distinguished according to follow sub-classifications [29]:

– L-Shaped Centres;
– U-Shaped Centres;
– Cluster-Design Centres;
– T-Design or Triangle Centres;
– Dumbbell or Double Dumbbell Centres.

Shopping centres could be classified by merchandising, with the following sub-classifications:

– Fashion/Specialty Centres;
– Outlet/Off-Price Centres;
– Power Centres (Retail Parks).
– Mixed Use Developments
– Theme/Festival Centres
– Lifestyle Centres

Market Area Classifications. The classification by market area, which serves a certain shopping centre, is very important, as it is directly reflected in its size and other important qualities.

The shopping complex developers usually divide marketplaces into primary, secondary (middle), and tertiary and they can see growth prospects in all

of these markets. The typical examples of primary markets are the largest metropolitan areas' downtown, inner city, and suburban shopping centre markets. Secondary (middle) market deals with less crowded urban regions. The tertiary or other type of market is related to tiny marketplaces in more rural or localized urban contexts, possibly with neighbourhood market size. The main factors taken into account when conducting a market analysis of the neighbourhood are the follows: the median family income, demographic distribution within the trading radius, the local traffic patterns, and the level of competitiveness. Some examples of shopping centre types according this classification are: One-Stop Shopping, Neighborhood Centres, Community Centres, Regional and Super Regional Centres etc.

Commercial Strip Centres usually appeal all demographic groups. They provide a wide range of goods and services, typically have 4 to 10 shop spaces and range in size from 930 to 2790 m^2.

Neighbourhood Centre is most likely the nearest retail mall that provides that good or service, such milk, bread, etc. It is believed that regular customers who live or work nearby will spend no more than 5 minutes to reach such a shopping centre (on foot or by car). A megamarket and a pharmacy are used as the main "anchors", and in total, the centre usually includes 6 to 8 shops and other facilities. The largest examples may be up to 92,000 m^2 in size, have 15 to 20 stores on about 1.21 ha of property, and draw clients from up to 2.4 km away.

Such centres are characterized by a compact layout, require a relatively small area of land – 1÷1.5 hectares and therefore can be located in the central areas of the city next to densely populated residential areas and in the suburbs near residential and business areas. City planners often allocate plots of land next to residential areas specifically for such small shopping malls. Areas where such malls are located can serve as a kind of buffer between residential buildings and transport highways, industrial zones. In general, it is believed that 1,000 families are enough to ensure the sale of goods and services of such a mall.

Community Centre is a retail complex where the "anchor" is a supermarket or a department store smaller in category or ordinary stores offering significant discounts (so-called discounters). Such a shopping centre usually requires a plot of land with an area of about 4 hectares and consists of 20÷70 trade and service establishments. The service radius reaches 8 km, i.e. 10÷15 minutes by car (using your own car), and at least 5,000 families (households) must live in the service radius. The typical size of the community centre ranges from 13,800 m^2 to 27,600 m^2.

The number of community centres is smaller than neighbourhood ones, because they stand higher in the hierarchy of the service system, serve larger areas and are designed for a larger number of the served population.

The requirements for placement are similar to the placement of neighbourhood centres, as they are usually located near relatively densely populated areas of multi-apartment residential buildings or in the suburbs – in the

service centres of large low-rise and mixed-floor residential development. It is desirable to place such shopping centres on the corner of streets or roads, as this simplifies access for drivers and ensures visibility of the building from at least two directions (this increases the advertising potential). In the complex or near it, it is recommended to place cinemas and food establishments, taking into account the large flow of visitors.

Regional Centre contains up to six large department stores, along with food stores, satellite stores that sell a variety of general products, restaurants, banks, and other facilities depending on its size. Such a shopping centre can include from 70 to 225 shops and other establishments, it serves a population of between 50,000 and 150,000 people in a radius of 8 to 24 km. The total area of such objects ranges from 27,600 to 73,600 m^2.

Super Regional Centre (also known as mega regional shopping centre) is the biggest type. It is usually designed as an indoor mall with heating, air conditioning, etc. It is usually located in the central part of the city or in the suburban area near the intersection of at least two main highways. The total area of such an object can reach 138,000 m^2 or more. Such objects can be built in stages. The parking lot can be covered above ground or incorporated into the structure of the building in one or more levels.

Following subtypes of specialized shopping centres are a result of a specific merchandising strategy.

The Fashion/Specialty Centre is for higher priced specialty goods and services targeted at certain limited categories of consumers who are willing to travel further to obtain them.

Outlet/Off-Price Centre is an example of on the discount concept realization. Such malls are usually located near important transport routes, outside small and medium-sized cities. Most of the tenants here are international corporations that offer a wide range of goods at reduced prices, including non-standard goods, or "seconds".

The first of them to appear historically was discount department store using a number of merchandising tactics. The another such is so called closed-door discount shop which it only permits specific clients (for example, government personnel).

Power Centres as a specific kind of specialist retail centre have some specific features. First, the tenants here are mainly represented by stores of the largest national retail chains, each of which can play the role of an "anchor" in a regular mall. Secondly, such shopping centres are characterized by a large area – from 27,600 to 92,000 m^2. Thirdly, the companies represented in such a centre, as a rule, are leaders in their fields, and therefore each product is represented in only one category.

Power centres are not malls in the full sense of the word (where the visitor is forced to pass a number of ordinary small shops on the way to the "anchor"); rather, they are designed so that the shopper can get to the big store he needs by

the shortest route. Each of the so-called “anchors” usually has its own large-capacity parking lot – at least 6 parking spaces for every 90÷100 m^2 of the total area for rent.

Mixed-Use Developments (MXD) consist of a mix of commercial, residential, and office space. Such placement creates a potential opportunity to live, work, get the necessary goods and services without leaving the complex and can reduce the need to use a car or public transport. Most of such complexes limit the possibility of dominance of any one function. Recently, such complexes began to include hotels.

Theme/Festival Centres are actually theme parks designed primarily for tourists. Examples can be the Disney World Epcot Center, where theme retail establishments are located, or the Bristol Renaissance Faire, featuring several theme shops based on simulating Queen Elizabeth I's visit to the port city of Bristol in the year 1574. As a rule, for such centres are characterized by a common architectural concept, which is partially reflected in sales strategies and the use as “anchors” cafes, restaurants, entertainment facilities, and sometimes (as in Galena, Illinois, and St. Augustine, Florida) also restored buildings and structures of historical and cultural significance.

Lifestyle Centres are designed mainly for wealthy visitors and are intended not only and not so much for shopping as for leisure. Sometimes they are characterized as “boutique malls”. Even if they are located in elite residential suburbs, most often they are shopping centres with open communications that imitate the urban environment and create a cozy urban atmosphere.

Pattern Classifications reflect the general shape of the shopping centre in plan and placement of the main “anchors”. The main design patterns are as following ones.

L-Shaped Centre is a variation on the straight strip centre, which often has anchor tenants at each end.

U-Shaped Centre also could be considered as a variation of straight strip centre, and it can have up to three “anchors”, one at each end of the U and the main anchor store in the centre of the strip.

Cluster-Design – the mall is a rectangle surrounded by parking spaces around the perimeter. The “anchor” is usually located along one of the sides of the rectangle and continues to its centre.

T-Design or ***Triangle*** – as a rule, three main “anchors” are located at the ends of a triangle or T-shaped structure. This scheme is used both for enclosed as well as for open-air malls. Parking spaces are located on all sides of the mall.

Dumbbell or ***Double Dumbbell*** is one or two parallel rows of stores, at the ends of which are placed “anchor” tenants (two for a Dumbbell or four for a Double Dumbbell). Each dumbbell segment's malls come together to form a center court. Both varieties are characterized by longitudinal and transverse movement of visitors. This planning can also be used both for enclosed as well as

for open-air malls., single-story and multi-level. As in previous cases, parking spaces are placed around the perimeter on all sides.

The location and solution of the architectural and planning structure of the SEC are influenced by specific urban planning conditions – on free territory, on planned sites, in the conditions of reconstruction of the city centre, in cases of using existing objects for other purposes, etc. It is highly desirable to choose a new plot of land for the SEC on the condition that it is located on elevated points of the landscape and is easily accessible from the main service roads. Wherever the complex is placed, it should harmoniously fit into the urban landscape and be an organic part of it from both an aesthetic and social point of view. The SEC will influence and be influenced by the infrastructure of the city district in which it is located in terms of providing it with engineering systems (electricity, gas, and water supply, sewage, etc.) and convenient communication with the city's transport system.

Shopping and entertainment centres (complexes) are usually located in the city-wide public centre, in public centres of planning, residential areas, micro-districts, as well as outside the city near the main transport highways. The last option of accommodation is more common abroad, especially in the USA. For buyers who do not have personal transport, in this case, a pick-up by a special bus can be arranged.

It is possible to distinguish two main options for the formation of a shopping centre (SEC), which differ significantly in the approach to the organization of the site.

When creating a shopping and entertainment centre (complex) under conditions of reconstruction (as a rule, in the central part of the city), one of the main tasks performed during the design is the creation of pedestrian paths for the movement of visitors, their separation from traffic, the organization of loading of individual parts of the shopping centre and organization of parking lots with sufficient capacity (Fig. 4.18). Often, at the same time, additional transitions between individual buildings are arranged, courtyards can be covered with glass, turning into atriums. Covered docks can be arranged for loading, underground space can be used for parking and loading stores. There are cases where the new development integrates into traditional urban shopping streets with existing "anchors", then the new development may include a supermarket or specialty shops, etc. The placement of accents on long pedestrian streets can be ensured by the arrangement of passages leading to places of rest or cafes, kiosks, and green areas.

When creating a shopping centre through new construction on a cramped area in the central part of the city, first of all, it is necessary to ensure the connection of external, already-formed pedestrian paths with the designed internal pedestrian connections of the new facility (Fig. 4.19). At the same time, parking and loading of trade are often arranged on underground floors.

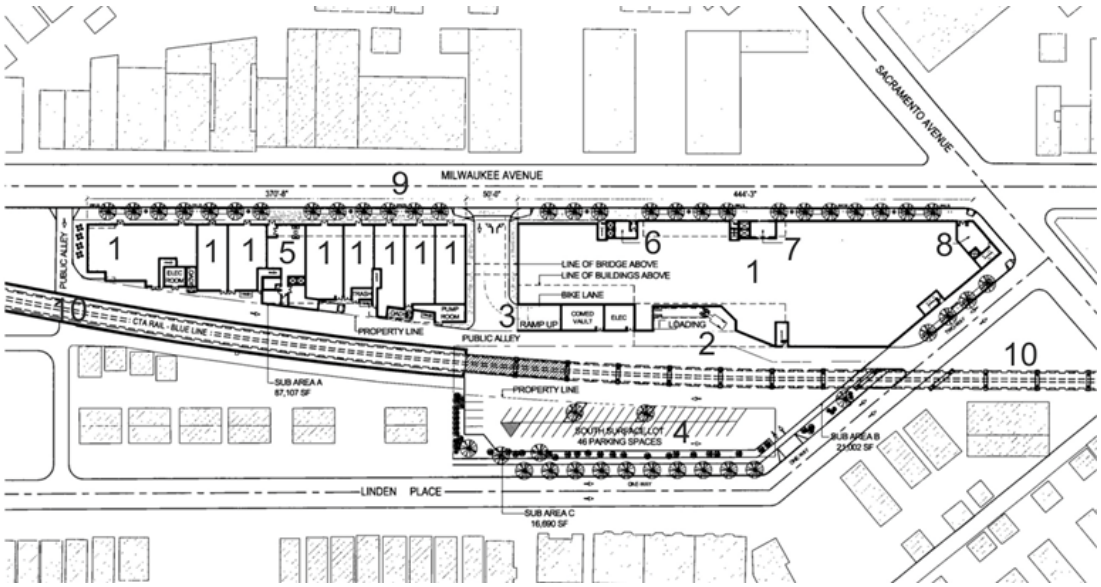


Fig. 4.18. An example of the master plan of a multi-functional linear complex under reconstruction conditions (complex on Milwaukee Street, Chicago, USA): 1 – trade; 2 – loading; 3 – entrance to the underground parking lot; 4 – parking lot for 46 places; 5 – 8 – lobbies located on the upper floors: 5 – housing, 6 – restaurant; 7 – trade establishment; 8 – fitness centre; 9 – a city street with intense pedestrian traffic; 10 – overpass of the city railway

Fig. 4.19. An example of the interconnection of internal and external pedestrian spaces of a shopping and entertainment complex (mall). Thaihot City Plaza Mall, Fuzhou, China, 2012 – 2015, designed by Spark Architects

When a shopping centre is located on the outskirts or outside the city, its commercial success largely depends on the high-quality planning and functioning of its parking lot, which can become an attractive element of the entire complex. If it is located on the ground level, it should be carefully planned, landscaped, and clearly marked.It should be borne in mind that as the size of the shopping centre increases, the specific need for parking spaces per 100 m^2 of retail space increases.

Thus, for trade enterprises with an area of sales halls from 2000 to 5000 m^2, this indicator is 3–5 places/100 m^2, for more than 5000 m^2 – 5–8 (i.e. 150 – 200 m^2). Thus, in large malls, when the ground parking lot is located on one level, its area is comparable to the building area of the mall building itself. In order to save space, the issue of creating a multi-level or underground parking lot, as well as the possibility of placing it on the roof of the complex, should be considered. The parking lot for staff and administration is placed separately, while the entrance should be provided from the service area. With any variant of the parking lot, the maximum distance from the parking place of the buyer's car (or public transport stop) to the main shops should not exceed 200 m.

The organization of the internal space of shopping and entertainment centres and complexes is determined by three main factors.

The first of them is the number of floors. On the one hand, the higher the height of the building, the more retail space can be placed on a given plot of land, and the higher the efficiency of capital investments. On the other hand, the higher the shopping establishment is located, the less willing potential buyers are to visit it. Lifts, escalators, and the placement of "anchors" (for example, cinemas) on the upper floors are widely used to encourage potential buyers to visit the upper floors of the shopping centre. Nevertheless, the number of floors of most shopping malls is not too significant – mostly from 3 to 4 to 7 floors.

The second factor is the mutual location of the so-called "anchors" and ordinary stores. Anchor stores can occupy all premises on one floor, for example, a general store on the 3rd floor and department stores in the basement or semi-basement. In such cases, escalators and elevators become important elements of attracting customers. The layout system around the "anchors" can be different. The successful location of small stores is just as important as in the case of large magnet stores. The location of small shops along the paths of movement of shoppers between the entrances to the complex and "anchors" should be aimed at ensuring that the main flow of shoppers passes by the largest number of shops. The appropriate nomenclature of small shops according to specialization, different prices for goods are necessary factors for the successful operation of shopping malls. As a rule, "anchors" occupying an entire floor should be located in the basement or on the upper floor. On the intermediate floors, "anchors" are placed as far as possible from the main node of vertical communications to direct the flow of visitors along the small shops. Taking into account the volumes and periodicity of goods loading, it is advisable to locate food retail establishments on the ground or basement floors (Fig. 4.20).

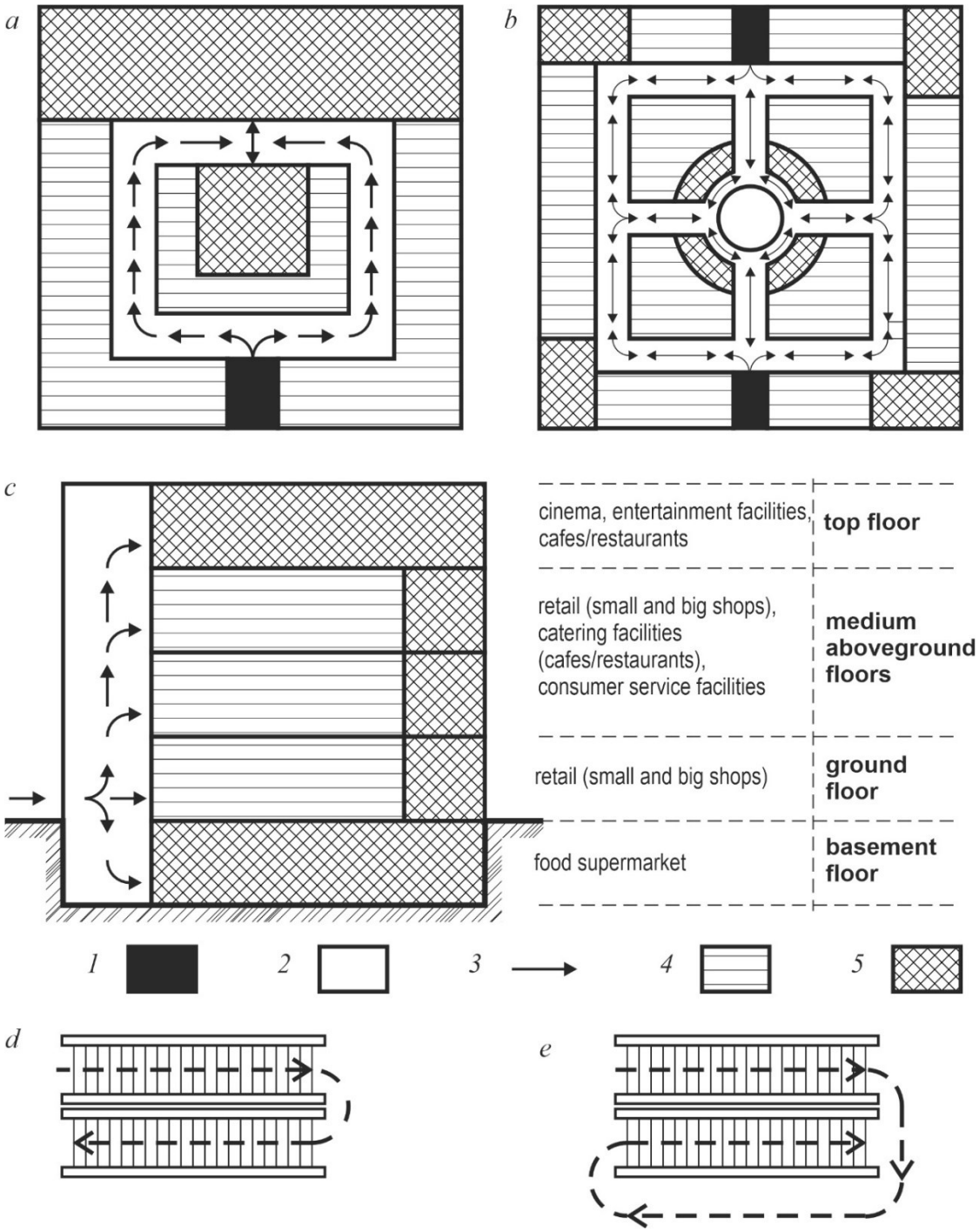


Fig. 4.20. Schemes of the principle location of vertical communications, centres of attraction for visitors (the so-called "anchors") and other institutions in the volume-planning structure of shopping and entertainment centres:
a – schematic plan of a simple structure; b – schematic plan of the complicated structure; c – schematic section; d – non-recommended placement of escalators; e – recommended placement of escalators; 1 – the main node of vertical communications; 2 – communications (horizontal and vertical); 3 – direction of movement of visitors; 4 – ordinary trade establishments; 5 – "anchors" (large stores – supermarkets, department stores, etc. and catering enterprises, leisure and entertainment facilities)

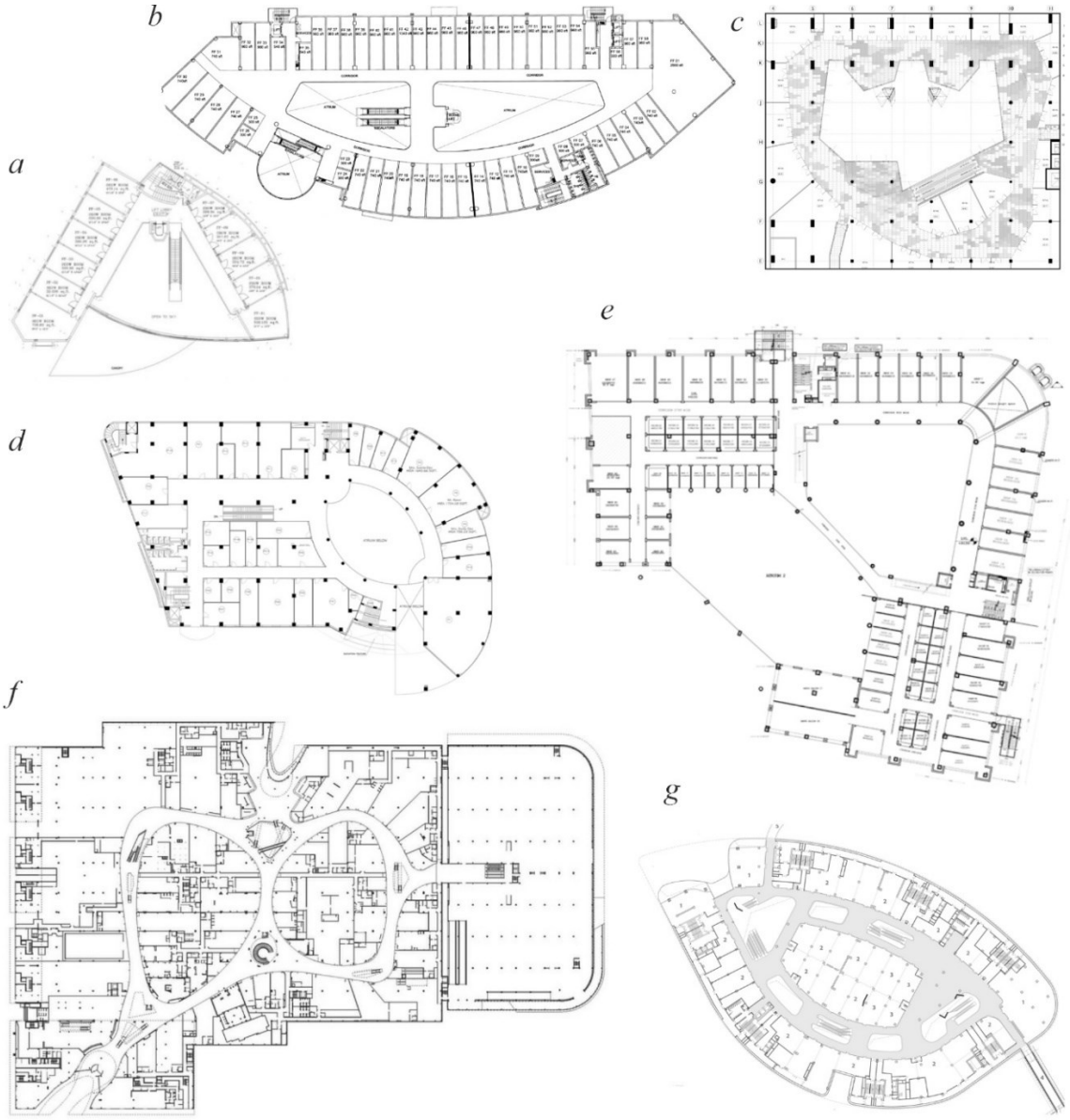


Fig. 4.21. Types of internal communication (information and distribution) spaces of shopping and entertainment centres:
a – c – examples of shopping and entertainment centres (malls), the interior of which is mainly grouped around atrium spaces of various shapes (plans of the 1st floor): a – the premises are located on two adjacent sides of the atrium space (JMD Kohinoor Mall, New Delhi, India); b – the premises are located on all sides around the atrium space (Retail Mall, Kuala Lumpur, Malaysia); c – premises are located mainly on two opposite sides of the atrium space (Jalsa Mall, Jaipur, India); d – e –examples of shopping and entertainment centres (malls), the interiors of which are grouped around both ring-shaped corridors and atrium spaces (plans of the 1st floor): d – Omaxe Celebration Mall, Gurgaon, India; e – Casts Mall, Ajmer, India; f – g – examples of shopping and entertainment centres (malls), the interior spaces of which are grouped mainly along ring-shaped corridors (plans of the 1st floor): f – Emporia Shopping Center, Malmö, Sweden; g – Shanghai Greenland, Shanghai, China

The third important factor is the organization of the system of pedestrian paths inside the mall. Often, a shopping center's main communicative and compositional node is the atrium space (compact or elongated), around which service establishments can be grouped on one, two, three sides, or along the entire perimeter (Fig. 4.21, a – c). It should be taken into account that in the presence of atriums, according to domestic fire regulations, an alternative escape route from each room on the floor should be provided, bypassing the atrium, which may lead to the appearance of additional evacuation corridors and/or an increase in the number of evacuation stairwells.

Grouping around atriums can also be supplemented by grouping around ring-shaped corridors (Fig. 4.21, d – e). You should avoid using dead-end corridors, or make them short, wide enough and place “anchors” at the end of them.

Service facilities inside shopping malls can also be grouped mainly around ring-shaped corridors. Atriums in this case may be absent at all, or play the role of local accents in communication nodes (Fig. 4.21, f – g).

The width of internal footpaths varies from 5 – 6 m to 9 – 12 m, in some cases – up to 15 m, with resting places with benches, kiosks, etc. placed in the middle of them.

For visitors with children, shopping malls often provide special children's rooms, located on the first floor near the main entrance, where the child can be left under the supervision of a special educator while the parents (or one of the parents) make purchases. Such children’s rooms usually have sets of toys, play equipment, a separate bathroom, and a hygiene room. They should be used for quick evacuation of children in case of fire.

Public toilets in shopping malls are recommended to be designed with a minimum of 1 sanitary device per 600 m^2 of retail space. They should be designed separately for men and women, providing each of them for the needs of people with reduced mobility (PRM) at least:

– one cabin measuring 1.65 m x 1.80 m for wheelchair users;

– one cabin with handrails located on the sides, for disabled people who use crutches for movement;

– one urinal, located at a height of no more than 0.4 m with vertical handrails on both sides – for wheelchair users;

– one sink in washrooms, located at a height of no more than 0.8 m from the floor and at a distance of no less than 0.2 m from the side wall, with side rails.

All premises for public use in the shopping centre must also be accessible to PRM.

It is recommended that separate toilets be provided in catering establishments and entertainment establishments that are part of shopping malls in accordance with the design norms of these types of establishments.

The height of the floors of shopping and entertainment centres (complexes) is accepted to be at least 3.3 m (at least 3.0 m from floor to ceiling). Under the

condition of necessary substantiation (mechanization, equipment, structures), it is allowed to increase the height of floors with a sales hall with an area of more than 400 m^2 to 3.6 m, and for more than 1000 m^2 – to 4.2 and 4.8 m (according to the design task).The height of the floors of shopping and entertainment centres (complexes) is accepted to be at least 3.3 m (at least 3.0 m from floor to ceiling). Under the condition of necessary substantiation (mechanization, equipment, structures), it is allowed to increase the height of floors with a sales hall with an area of more than 400 m^2 to 3.6 m, and for more than 1000 m^2 – to 4.2 and 4.8 m (according to the design task). The minimum height of two-story shopping halls in the presence of mezzanines is allowed to be 4.8 m. In the presence of air conditioning, the height of floors should not, as a rule, exceed 4.2 m. In corridors, warehouses, and utility rooms, the height of the rooms from the floor to the ceiling can be reduced to 2.2 m, in technical rooms without the permanent presence of people, the height of the passages to the equipment located in them – up to 1.9 m.

Control questions and tasks

1. What is a shopping and entertainment centre (complex)?
2. What is an "anchor" in the shopping and entertainment centre?
3. What are the two main classifications of shopping and entertainment centres?
4. What are the main design patterns of shopping centres?
5. Name the main features of the organization of the site of a shopping and entertainment centre (complex) in the conditions of reconstruction.
6. What are the three main factors that determine the organization of the internal space of shopping and entertainment centres and complexes?
7. What are the main types of internal communication (information and distribution) spaces of shopping and entertainment centres?

4.3. Shopping and office centres (complexes)

Shopping and office centres (complexes) are multi-story (often high-rise) buildings and complexes in which trade, service, public catering establishments, entertainment and entertainment facilities, fitness centres, etc. are combined (located, as a rule, on the lower floors), as well as office premises, hotels, sometimes housing, which respectively occupy the upper floors (Fig. 4.22). In a somewhat simplified way, a shopping and office centre can be defined as a shopping and entertainment centre and a business centre (as well as, in some cases, a hotel, fitness centre and other establishments) combined by blocking. Unlike shopping and entertainment centres (complexes), the number of floors of such objects can be significantly higher, which means that the economic efficiency of using the building site is also higher. Therefore, shopping and office centres (complexes) are mainly built in the central part of the city, in areas of high business activity with high land value (Fig. 4.23). To ensure the viability of such an object, its structure must be capable of adaptation based on the following principles:

– universality;

– changes in functional priorities - functional dominance, which provides a mechanism for flexible transformation of functions;

– functional, compositional, figurative orientation on the real and on the potential addressee;

– a single universal model for organizing conditions for work and communication.

Predominantly, shopping and office centres (SOC) are built on areas of limited area, such as in the central parts of cities under conditions of reconstruction or the so-called “sealing” buildings, as well as in specially created business districts on vacant lots. The percentage of development of the plot in such conditions can be very high – from 70 to 90%, which conditions the active use of the underground space (in particular, for the arrangement of parking lots).

It should also be taken into account that in front of the entrances to the shopping and office parts of the shopping and office centre, areas for the accumulation of people in the event of evacuation should be provided at the rate of 0.3 – 0.5 m2/person. To ensure the work of fire departments, it is necessary to organize the possibility of a circular detour of the entire complex, especially its high-altitude part. The mutual location of the stylobate and the elevated part should not create an obstacle for extinguishing the fire and evacuating people from the latter.

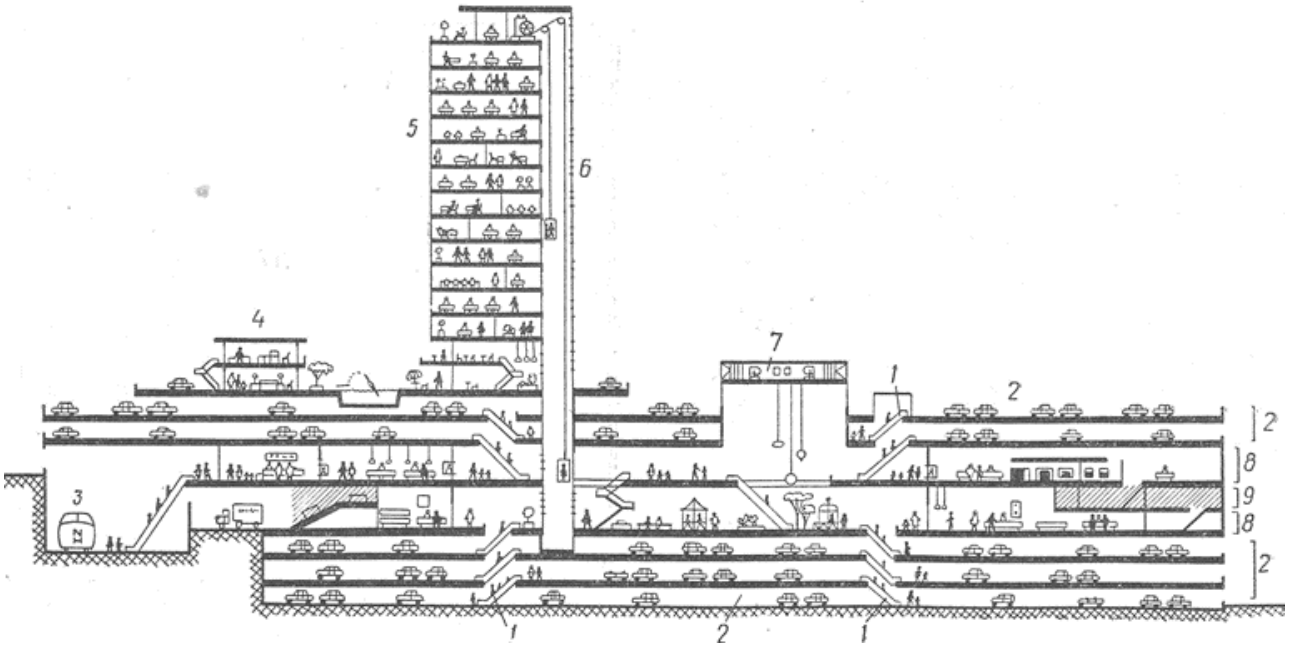


Fig. 4.22. An example of vertical functional zoning of a shopping and office centre (when integrated with transport facilities):
1 – escalators; 2 – car parking; 3 – railway station; 4 – car service station; 5 – office block; 6 – lift; 7 – landscaped atrium; 8 – commercial premises; 9 – service premises

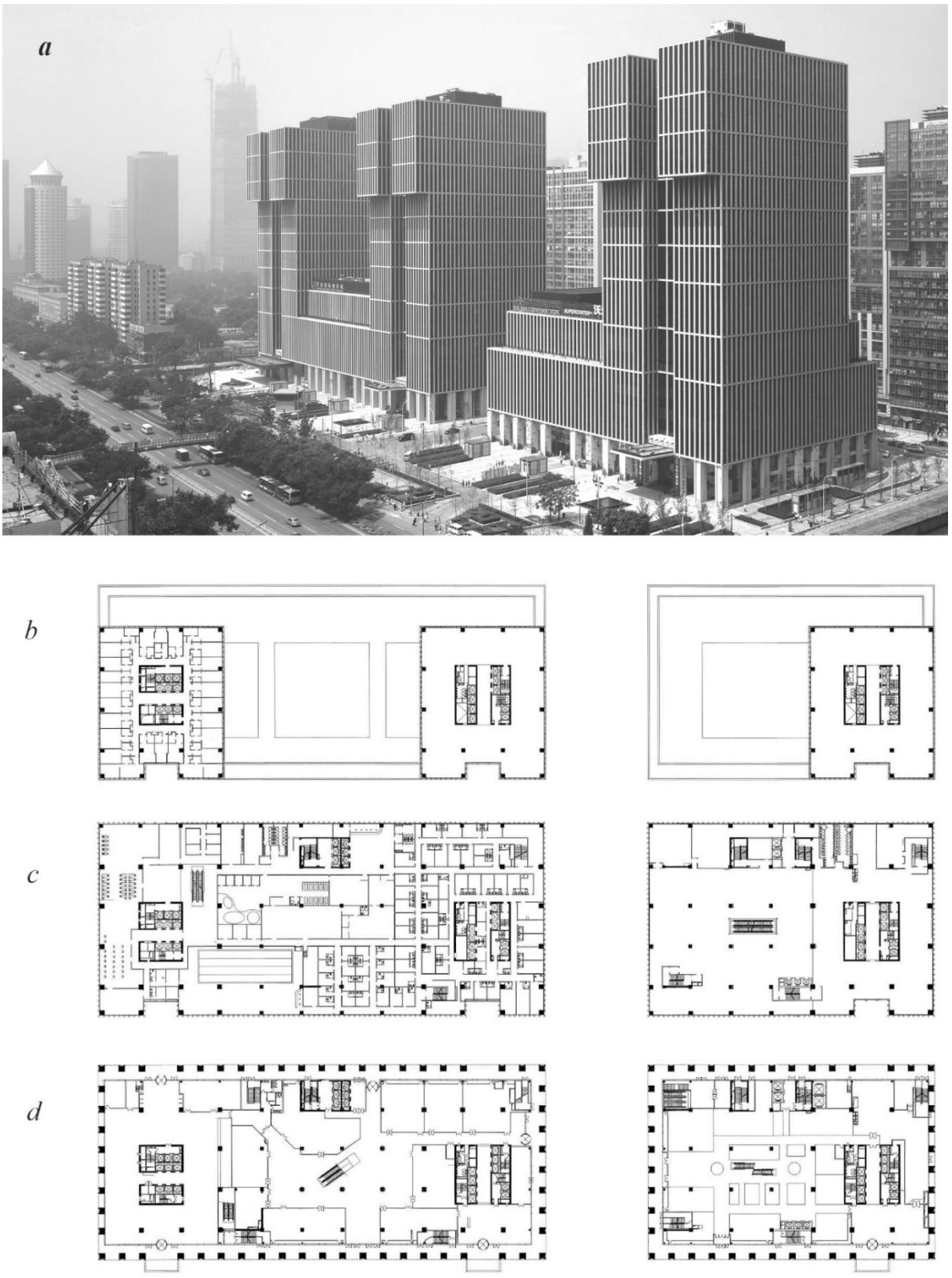


Fig. 4.23. Shopping and office centre Wanda Plaza, Beijing, China, 2005 – 2007, designers: Volkwin Marg, Hubert Nienhoff, Christian Dorndorf, Martin Duplantier:
a – general view: b – plans of typical floors of the elevated part; c – plan of the 2nd floor; d – plan of the ground floor

The combination of two parts – retail and office – in one object, each of which has different requirements for volumetric planning solutions, determines the compromise nature of the composition of the shopping and office centre. The most successful solution is to allocate the retail part in the stylobate, and the office part – in the high part. Solving the shopping and office centre as a single volume inevitably leads to compromises: either the retail establishments are located in a too narrow building, or a large part of the office premises remains without natural lighting due to the wide building.

Most often, vertical zoning is used to separate various functions in the shopping and office centre. At the same time, the retail part often occupies the lower ground floors (from two to 7 – 8), and the office part is located higher. Underground floors are most often used for parking lots.

A separate task is the use of a stylobate roof, the area of which can be quite large. The range of possible solutions is quite wide – from passive landscaping to the parking lot placement.

In the conditions of high-density development, part of the ground floor can be used as a kind of covered arcade in front of the entrances to the building.

Nodes of vertical communications, as a rule, are arranged separately for trade and office parts.

Control questions and tasks

1. What is a shopping and office centre (SOC)?

2. What institutions can be included in a shopping and office centre?

3. What are the features of vertical functional zoning of a shopping and office centre building?

4. How can the functional flexibility of a shopping and office centre (complex) building be ensured?

5. What spatial planning solution is most often used when designing a shopping and office centre building?

4.4. Sports complexes

Sports complexes include indoor sports facilities with one or more sports halls (if there is only one hall, it contains a multifunctional arena) as well as one or more swimming pools.

The gymnasiums are designed as specialized (for one sport) and multi-purpose ones, which can house activities in several kinds of sports due to the replacement of sports equipment.

Sports buildings (Fig. 4.24) are intended for training in several sports. They may include a swimming pool. The athletics and boxing halls are usually located on the ground floor. Spaces for spectators may be provided on balconies or in collapsible stands.

Swimming pools are facilities that include a bath (or several baths), ancillary facilities and equipment necessary for the technical operation and maintenance of those involved (Fig. 4.25). By their purpose, pools are divided into bathing, training, sports and mixed type, which are designed on natural and artificial reservoirs.

Techniques of pools planning solutions are defined by mutual placement of the basic bathtub and the block of auxiliary premises. Thus, their placement can be from the main hall; along one of the sides of the hall (longitudinal); around the perimeter of the hall (perimeter); baths for jumping, jumping and swimming training are located in separate blocks combined by common utility rooms (blocked). In limited areas, multi-storey pools are being built, where baths and utility rooms are placed on different floors, one above the other.

Specific sanitary and hygienic conditions determine the schedule of movement of visitors and placement of the premises of the pool in the following sequence: lobby with wardrobe for common clothes (common for men and women), reception, dressing rooms, preparation hall, showers with baths, foot baths, and main pool hall.

Separate entrances should be designed in swimming pools equipped with spectator stands. The paths and locations of athletes and spectators (except pools with few spectators) should be separated.

The preparation hall should be placed between the locker room and the bath (because they are used for water lessons) and take the dimensions 12 x 18 x 4,5 – 6 m with a bath length of 25 m, 12 x 24 x 6 m with a bath length of 50 m.

The width of the bathtub is determined by the number of swimming lanes accepted by international rules 2.5 m wide (but in some cases it can be reduced to 1.8 – 2 m). The universal bath, which can be used for swimming, water polo and jumps in water, should have a minimum size of 25 x 8 m, depth at the jump tower 4.5 – 5 m and a gradual transition to a depth of 1.2 – 1.8 m below an angle of not more than 30°. A roundabout walkway of at least 1.5 m wide (in indoor pools) is envisaged around the bath, and at least 3 m wide in the area of starting tables.

The complex of jumping equipment consists of a tower with bridges at height of 10, 7.5, 5, 3, 1 m and two pairs of jumps at height of 3 and 1 m under the bottom of the projecting overlapping structures.

The main difference between bath designs is the way they are grounded. They can rely entirely on soil or artificial supports and have a combined solution (the deep part rests on the ground and the shallow part – on the supports).

The width of evacuation paths in indoor sports facilities shall be not less than 1 m for horizontal aisles and stairs, and for hatches in the stands no less than 1.2 m. The maximum carrying capacity of one hatch is 600 people. The maximum length of evacuation routes from the farthest location to the nearest exit is taken at a horizontal path of 32 m, at evacuation up stairs – 23 m, down – 20 m.

The stands are divided by radial passageways into groups and sectors. There should be no more than 50 radial passes in each row, and no more than 25 places

for one-way evacuation. The norms for the calculation of evacuation routes for indoor sports facilities can be accepted from 400 to 500 people per 1 m of the escape passage width.

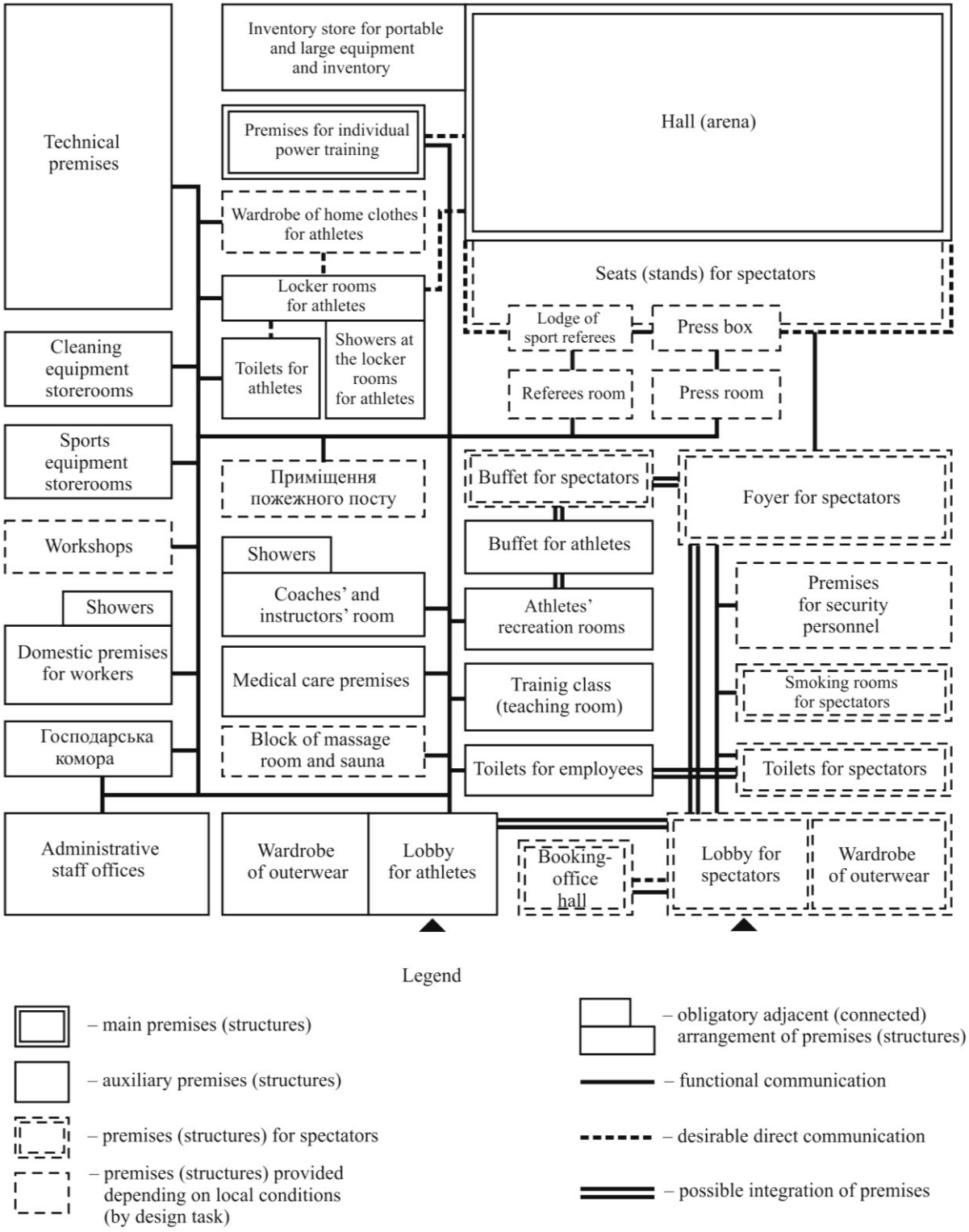


Fig. 4.24. Composition and interconnection of the sports building main and auxiliary premises

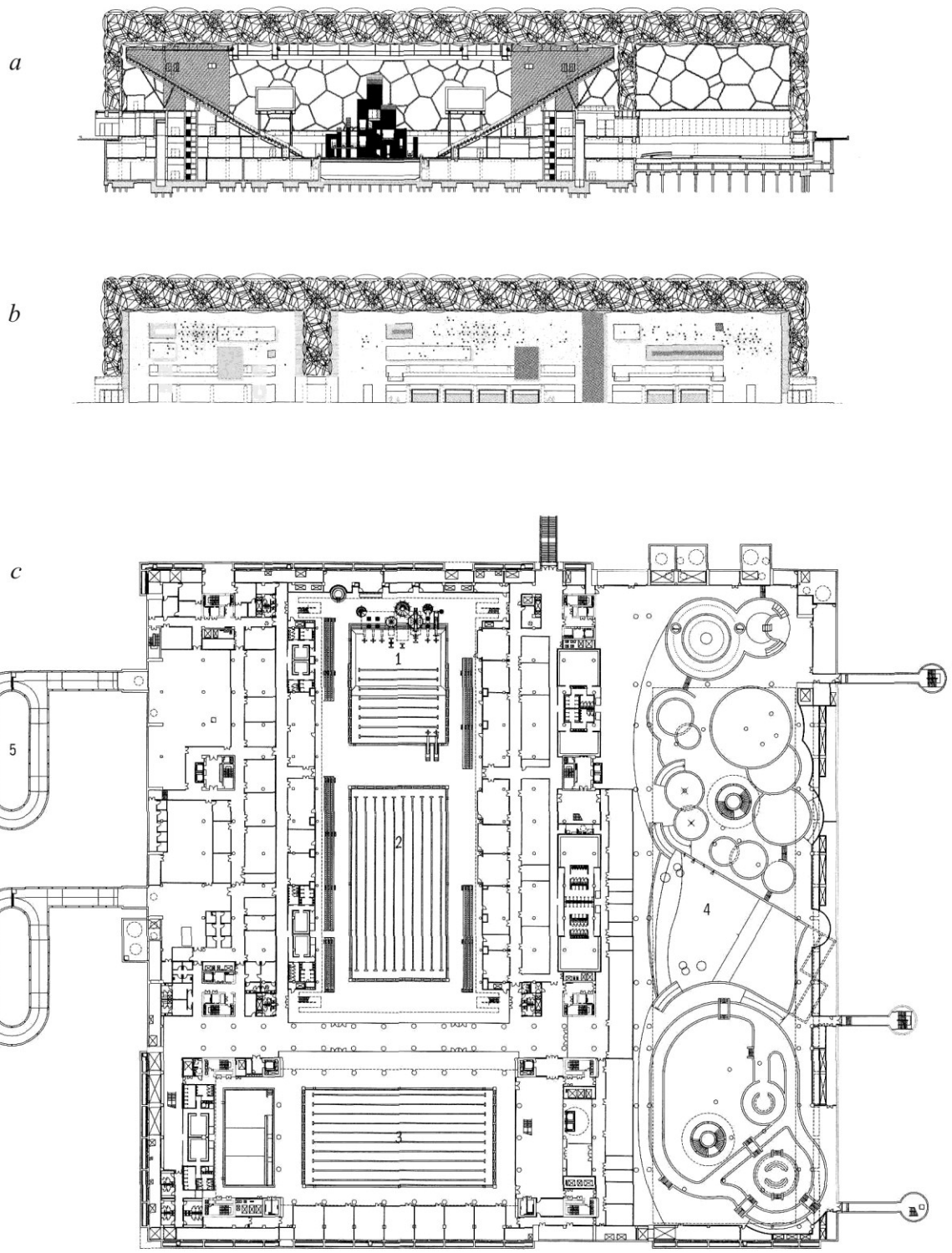


Fig. 4.25 National Water Sports Center (Water Cube), Beijing, China. Designed by: PTW Architects (Australia), Consultants: PTW Architects, CCDI, Arup: a – cross section; b – longitudinal section (in the baths of the main pools); c – ground floor plan: 1 – 25 m high jump tower; 2 – 50-metre swimming pool; 3 – training 50-metre pool; 4 – water and entertainment complex; 5 – entrance ramps for persons with disability

Auxiliary facilities are divided into the following main groups: for spectators and athletes, for judges and coaches, for radio and television commentators and press bureaus, administrative and business premises.

Spectator rooms include lobbies, dressing rooms, lobbies, corridors, buffets, bathrooms, ticket offices and venues for honoured visitors.

The lobby area with wardrobes is provided not less than 0.24 m^2 per visitor (including the wardrobe area 0.08 m^2), the length of the barrier is calculated at the rate of 40 – 50 spectators per 1 m. Sides, lobbies and buffets are calculated from the standard rate of 0.5 – 0.6 m^2 per spectator, the number of ticket offices – based on the sales rate of 400 – 500 tickets per hour. The ratio of the number of men and women for the calculation of toilets is taken 5:3, for men – 1 device for every 100 people, women – for 50. Toilets should be placed evenly on all floors, avoiding counter flows; their planning solution should provide separate entrances and exits from them.

Facilities for athletes include lobbies with wardrobe, dressing rooms, showers, dressing rooms, massages, baths, medical centres, methodological office, buffets, facilities for recreation of athletes and for their collection before entering the arena. It is desirable to design all of these premises in one place, isolated from other premises, with convenient links to the sports arena.

The dressing area for one person in the arrangement of cabins for re-dressing with the distribution of streams of bare and foot athletes – 3 m^2, without distribution – 2 m^2. For swimming pools, the dimensions of the foot shower are 0.85 x 1 m, the minimum size of the shower cubicle is 0.9 x 0.9 m, the width of the passage between rows of cabins is 1.5 m, between the row of cabins and the wall is 0.9 m. from the calculation: in sports halls – 1 shower for 10 people, in swimming pools – 1 shower for 3 people engaged simultaneously.

The number of sanitary appliances in the toilets is: for men – 1 device for 25 people, for women – 1 device for 15 people simultaneously working in the pool. Massages should have 12 m^2 per table, with more – 6 m^2 per table. The area of a dry steam bath is determined at the rate of 1 m2 per 1 place, but not less than 10 m^2; buffet – 1.2 – 2 m^2 for every 6 people with the necessary utility rooms; sports recreation room – 1.5 m^2 per person engaged in the gym or swimming pool.

The medical centre consists of a waiting room, a dressing room and a doctor's office, and in advanced sports facilities it is supplemented by appropriate procedural ones. This one is located near the entrance for athletes with convenient communication with the arena or pool.

The premises of the judges in the courtroom, the chief judge’s office, the secretariat, the darkroom, and the changing rooms with showers and toilets should be conveniently connected to the venue as well as the finish area and the judge's lodge.

A group of radio and TV commentator rooms is usually located behind the last row of stands or in a gap between rows of seats or floors in bunk stands. In addition to the cabins, from which the entire arena or bath pool should be clearly

visible, this group of premises includes press rooms with an operating room, a telecommunication centre, sound recorders with staff rooms, a press bar and a conference room.

When designing sports facilities with stands for spectators, it is necessary to clearly distinguish the movements of spectators and athletes, providing separate entrances and exits for them.

Control questions and tasks

1. What are the main types of sports complexes?
2. What are the main functional areas of the sports building?
3. Describe the main requirements for the solution of gyms. and swimming pools.
4. How swimming pools are divided by their purpose?
5. Describe the main requirements for the solution of swimming pools.

4.5. Multifunctional museum complexes

There is a steady trend towards increasing the size of museum buildings and complicating their functional and planning structure, which in turn inevitably leads to the gradual transformation of the museum into ***a multifunctional museum complex***.

Among multifunctional museum complexes, in turn, by the size of the total area, large ones are distinguished – up to 10 thousand m^2, large ones – from 10 thousand m^2 to 100 thousand m^2, and the largest ones – more than 100 thousand m^2 [36].

As a part of multifunctional museum complexes the following functional groups of premises are distinguished: educational, research, depository, display, recreational, administrative, utility, service and communications (Fig.4.26).

The nature of the links between the institutions integrated into the complexes, taking into account their composition and capacity, determines the use of one or another method of forming a three-dimensional structure of a multifunctional building, among which are:

– ***locally focal*** when the basic connections between premises are intersected in one planning node;

– ***discrete-centre*** (dispersed) when there are several nodes;

– ***combined*** that combines the features of the previous two.

Depending on the degree of development of multifunctional museum complexes vertically, the following spatial planning schemes are distinguished:

– ***planar*** – does not have significant vertical development, is used when building a large free area; as a rule, functional blocks are placed in one (one and a half) levels;

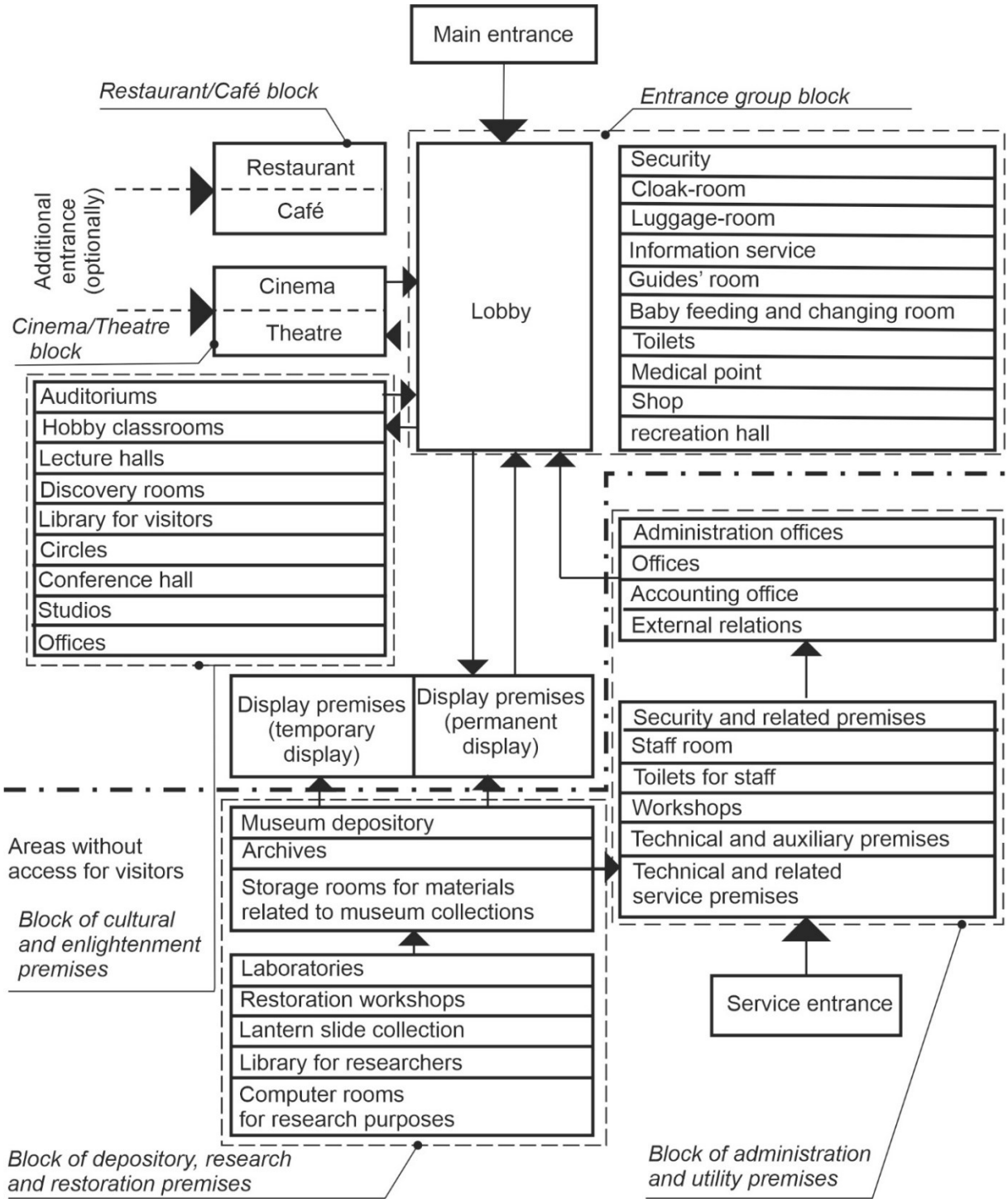


Fig. 4.26. Functional planning scheme of the composition and interconnections of premises of multifunctional museum complexes (according to K. Trehubov [36])

– ***volumetric*** – has a certain vertical development due to the use of vertical functional zoning;

– ***vertically developed*** – has two main volumes – vertical (main) and horizontal (underlying); while the horizontal is connected with the transport infrastructure and includes a developed parking lot, on the first floors of the vertical volume there are

fund and exhibition zones, on the middle floors – educational, on the upper floors – recreational.

According to the form of complexes in the plan the following planning schemes are distinguished: ***linear, L-shaped, U-shaped, twice-ring-shaped, annular, mixed.***

The nature of visitors' movement inside multifunctional museum complexes is largely determined by the number and location of so-called ***"magnets"*** that have the most meaningful and attractive features to the consumer.

Accordingly, the following schemes of functional and structural organization are distinguished:

– two-magnetic – the internal movement of visitors is mainly between two magnet objects; of particular importance is the formation of well-organized developed recreational areas (covered areas) and associated admission groups;

– multimagnetic – similar to the first scheme, but with a large number of magnetic objects and, consequently, recreation areas in them.

The size of the total area per visitor of the multifunctional museum complex (while staying) is: for large – 9.4 m² / person, very large – 25.6 m² / person, the largest – 36.7 m² / person.

Control questions and tasks

1. What functional groups of premises are distinguished in multifunctional museum complexes?

2. What methods of forming a three-dimensional structure of a multifunctional museum complex do you know?

3. What spatial planning schemes are distinguished depending on the degree of vertical development of multifunctional museum complexes?

4. What is a "magnet" in the structure of a multifunctional museum complex? Accordingly, what schemes of functional and structural organization are distinguished?

5. What planning schemes according to the form of complexes in the plan are distinguished?

4.6. Theatrical and entertainment complexes

Two- or three-auditoriums theatrical and entertainment facilities are becoming more and more widespread, which allows for providing a significant variety of repertoire, increasing the capacity and, consequently, the profitability of such a building with the same stage equipment. At the same time, one of the auditoriums is designed to be smaller in capacity, with a different type of stage or platform (Fig. 4.27). For example, in a large auditorium, there may be a deep portal stage, and in a small one, there may be an open stage. Auditoriums are designed one above the other with stages in one direction (larger over smaller), on the same level with parallel longitudinal axes and a common stage part or on opposite sides of the stage complex.

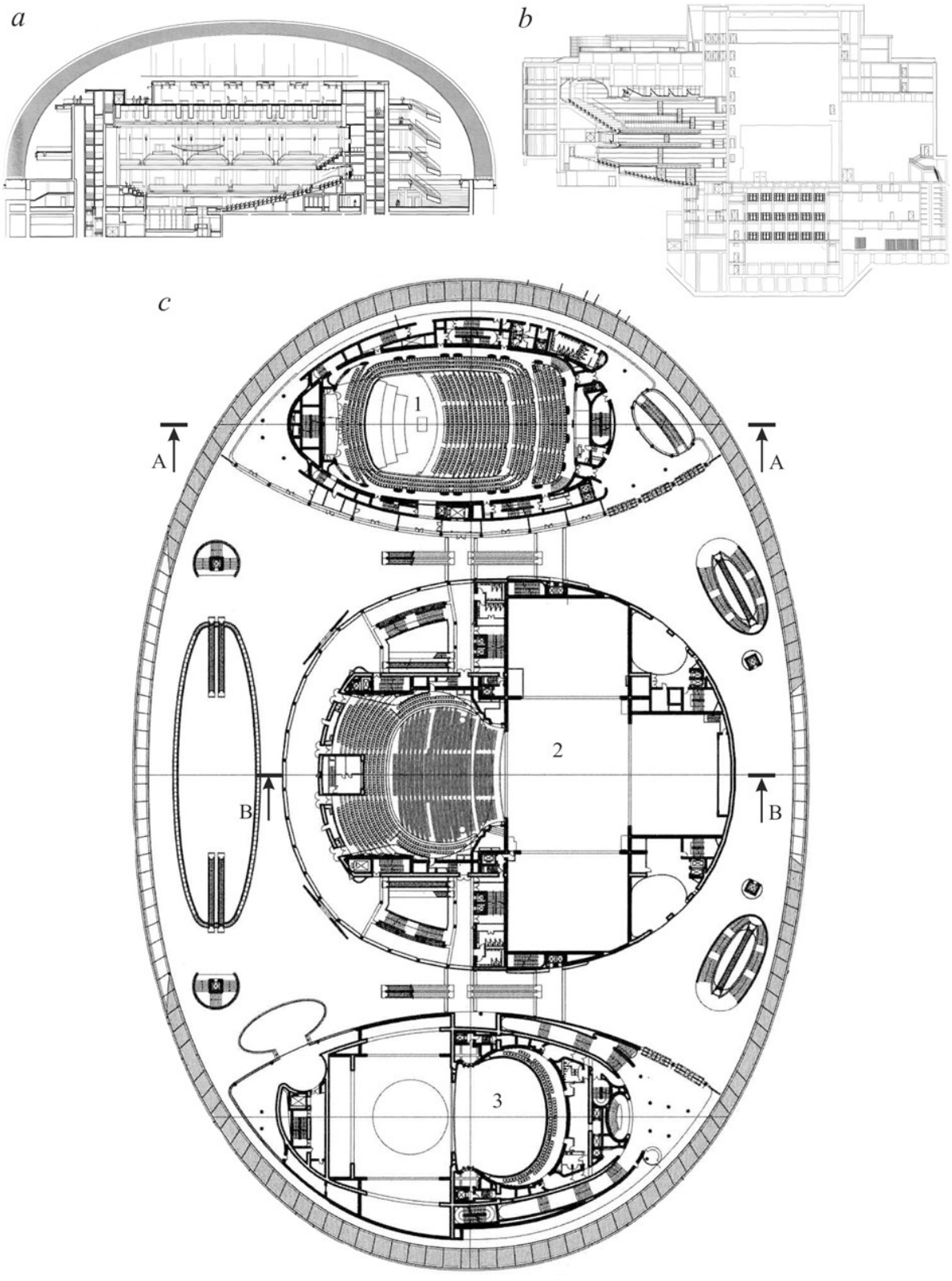


Fig. 4.27. National Big Theater of China. Beijing, China. Project 1999, implementation in 2007. Architects: P. Andre, F. Tamizier, E. Langle, etc.:
a – section A-A (along the longitudinal axis of the concert hall); b – section B-B (along the longitudinal axis of the opera and ballet hall); c – plan of the ground floor: 1 – concert auditorium; 2 – opera and ballet auditorium; 3 – drama auditorium

When designing several auditoriums, it is necessary to provide convenient connections of each of them with the general stage working, production premises – artistic rooms, workshops, storerooms, etc.

Spectator rooms – lobbies, foyers, buffets, etc. can be both independent and combined. In theaters with large and small auditorium (auditoriums) to determine the number of visitors to the spectator complex (foyer, cafeteria, smoking rooms, museums, toilets, as well as in the cloak-room) should take into account the capacity of the small auditorium.

Control questions and tasks

1. What are the main prerequisites for the formation of theatre and entertainment complexes?

2. What are the differences between different auditoriums in multi-auditorium theatre and entertainment complexes?

3. How can spectators' rooms be distributed between several auditoriums in multi-hall theater and entertainment complexes?

4.7. Features of architectural design of high-rise multifunctional complexes

When designing multi-storey and high-rise (over 40 floors) buildings, interrelated problems arise that significantly affect the composition, ease of operation, and cost of construction. These are: choosing the optimal plan form; rational organization of vertical mechanical transport (possibly with its zoning by height); ensuring the safety of people, property, and the building itself in the event of a fire or other emergencies; choosing a structural system that will ensure the stability of the building under conditions of high wind loads that increase with the height of the structure. The optimal plan form is related to the layout of the transport node and the adopted structural system. Considering that vertical communications become the main ones in a multi-storey volume, and horizontal paths are secondary, it is desirable that the elevator node be single and located in the geometric centre of the plan or the middle part of the building, and stairwells are more often located near the elevator node. The dispersed placement of these elements may be due to the specifics of the compositional or constructive design. In buildings higher than 16 floors, it is advisable to provide for zoning of vertical transport depending on the height with the division of lifts into groups with separate halls serving the lower and upper floors (regular and high-speed lifts, respectively).

A compact, geometrically balanced plan with a central core of rigidity is optimal for high-rise buildings from a structural point of view. Layout schemes for multi-storey and high-rise buildings can be classified according to the shape of the plan and the position of the vertical communications node. Compact and elongated compositions in plan are often found in buildings up to 20 – 30 floors high, while in high-rise buildings, mainly only compact ones. The relatively small width (30 – 36 m)

of buildings with a compact layout (up to 20 floors high) and an even smaller width (15 – 24 m) with an elongated corridor layout system (up to 9 – 16 floors) are due to the requirement of mandatory natural lighting of all working spaces. Common rooms of considerable depth are often provided in the basements of buildings so that natural lighting is from three sides. The most important problem in the construction and operation of multi-storey and high-rise buildings is ensuring the safety of workers. To this end, smoke-free stairwells and lift shafts, special smoke exhaust systems, fire alarm and fire extinguishing systems, etc. are designed.

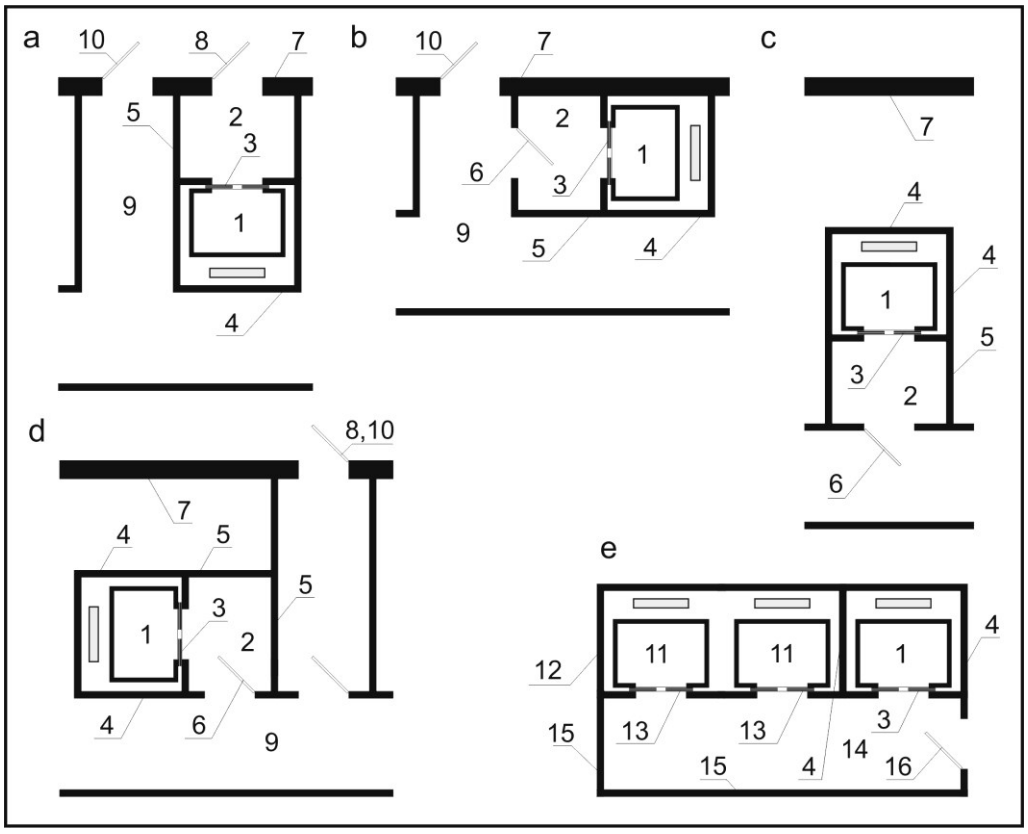


Fig. 4.28. Examples of the fire lift location [25]: a – d – in a separate shaft with an independent lift lobby (a, b – fire lift on the main landing floor near the outer wall of the building; c – fire lift inside the building on the main landing floor; *d* – fire lift on other floors inside the building); e – in a separate shaft with a common lift hall with other lifts; 1 – fire lift; 2 – lift lobby of the fire lift; 3 – fire doors of the 1st type of the lift shaft of the fire lift; 4 – enclosing structures of the lift shaft of the fire lift; 5 – enclosing structures of the lift lobby of the fire lift; 6 – fire doors of the 2nd type of the lift lobby of the fire lift; 7 – external wall of the building; 8 – entrance from the outside to the fire lift; 9 – section of the evacuation route (corridor, hall, foyer, lobby, etc.); 10 – entrance to the building; 11 – other lifts; 12 – enclosing structures of lift shafts of other lifts with fire resistance classes established by relevant regulatory documents; 13 – fire doors of the 2nd type of lift shafts of other lifts; 14 – common lift lobby; 15 – enclosing structures of the common lift lobby of the fire lift; 16 – fire doors of the 2nd type of the common lift lobby of the fire lift

In these buildings, a lift for transporting fire brigades (the so-called fire lift) should be provided in each fire compartment. The entrance to such a lift must be organized directly from outside the building. If the main entrance to the building is made from the above-ground floor, it is allowed to organize such an entrance through the lift lobby. The fire lift must have a separate lift shaft, and a separate power supply system. The doors to the lift cabin and to the lift lobby must be equipped with fire doors (Fig. 4.28).

Control questions and tasks

1. What problems affect the design of multi-storey and high-rise buildings?
2.What are the optimal layouts for high-rise buildings from a structural point of view?
3.What is a fire elevator and what are the features of its arrangement?

4.8. Multifunctional complexes in small settlements

Using the example of one of the smallest multifunctional buildings – the integrated building of the small town or village community centre, you can trace the process of integration of various institutions in one multifunctional building. There are 4 main options:

– only technical (auxiliary) premises are integrated, the main ones are only blocked;

– communication and auxiliary rooms are used together, the main ones are grouped around vestibules-lobbies, and halls and have exits in them;

– the main room is transformed with the help of furniture and equipment and has a multifunctional purpose;

– both main and auxiliary premises are jointly used and have a multifunctional purpose.

Multifunctional buildings differ from specialized ones by a more complex functional and volume-planning structure, which is determined by the composition of institutions and enterprises that merge, and most importantly – by the emergence of additional relationships between groups of premises, which determine a qualitatively new characteristic of the integrated object. The nature of the connections between the integrated institutions, taking into account their composition, capacity, determines the application of one or another forming method for the volume-planning structure of the building (Fig. 4.29):

– ***local-central,*** when the main connections between premises intersect in one planning node (premises or their groups);

– ***discrete-core (distributed),*** when there are several nodes;

– ***combined,*** combining the features of the previous two.

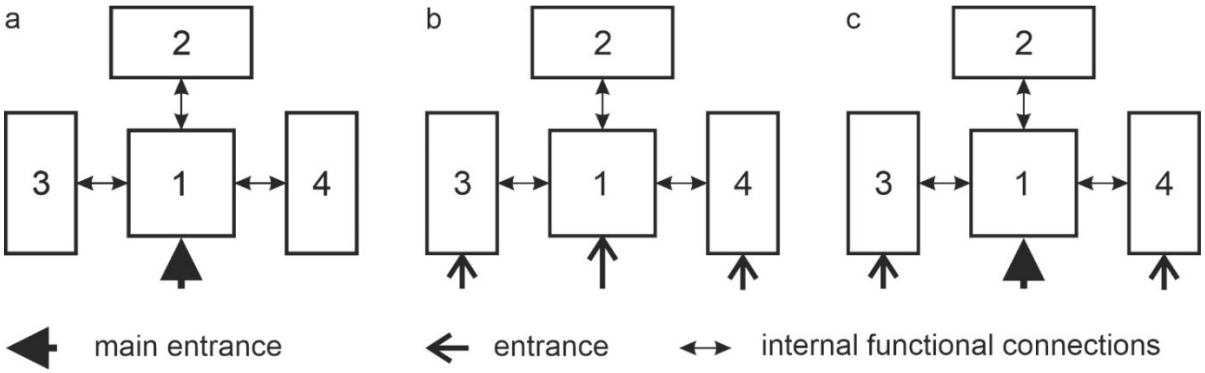


Fig. 4.29. Forming methods for the volume-planning structure of a small multifunctional building (according to T.P. Lytvynenko [32]):
a – local-central; b – discrete-core (dispersed); c – combined; 1, 2, 3, 4 – groups of premises or institutions of different functional purpose

Control questions and tasks

1. Name forming methods for the small multifunctional building's volume-planning structure.

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