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SINGLE APARTMENT RESIDENTIAL HOUSE

Учебное пособие



Нижний Новгород
2024

Министерство науки и высшего образования Российской Федерации
Федеральное государственное бюджетное образовательное учреждение высшего образования
«Нижегородский государственный архитектурно-строительный университет»

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Утверждено редакционно-издательским советом университета
в качестве учебного пособия

Нижегород
ННГАСУ
2024

УДК 728.2
О 43
ББК 38.711

Печатается в авторской редакции

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Цветков, А.В. Одноквартирный жилой дом : учебное пособие / А.В. Цветков, А.А. Зайцев, Д.А. Лошкарева ; Министерство образования и науки Российской Федерации, Нижегородский государственный архитектурно-строительный университет. – Нижний Новгород : ННГАСУ, 2024. – 45 с.: ил. – ISBN 978-5-528-00578-2. – Текст : непосредственный.

The basic provisions for the design of single apartment residential buildings are presented. Their functional, structural, technical, architectural and artistic solutions are considered.

Intended for students at Nizhny Novgorod State University of Architecture and Civil Engineering to complete course projects in the subject “Architectural Design” in the training direction 07.03.01 Architecture and 07.03.03 Design of the Architectural Environment

ISBN 978-5-528-00578-2

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1. Introduction

The quality of the living environment is determined by functional planning, hygienic, technical and aesthetic parameters. When designing a single apartment residential building, you need to have a clear idea of the residents' lifestyle, demographic structure, people's needs in everyday life and leisure, you should not forget that the living environment formed by a man influences a person and determines his/her lifestyle. The modern typology of residential buildings is distinguished by significant diversity and has deep historical roots. The concept of "single apartment residential building type" has received a broad interpretation and is reflected in various classifications. Single apartment residential buildings can be classified: by type, by number of floors, by size.

By type: estate type (with a large plot of land and developed subsidiary farming); cottage type (with a small plot of land without subsidiary farming in the city);

By number of floors: one-storey with or without an attic; two-storey;

By size: with a minimum set of premises (4-6 residential rooms), economy class with a total area of up to 150 m²; with developed premises (additional premises: guest room, library, office, utility rooms) with a total area of up to 200 m²; mansions with a total area of more than 250 m².

According to the above classification, the designed single apartment residential building belongs to the cottage type, one-storey with an attic or two-storey, with a minimum set of premises.

The construction of single apartment residential buildings is spreading rapidly in our country and is becoming quite a widespread phenomenon. A significant positive factor characterizing low-rise buildings is the direct connection with the natural environment, the possibility to organize recreation for adults and children in the fresh air, the possibility have a healthy microclimate in your home. In the close vicinity of the house there may be a garden, a vegetable garden, a garage with a workshop, and household buildings.

An important property specific only to a single apartment residential building is relative freedom to choose the most appropriate space-planning scheme of the apartment, to give the necessary proportions to living rooms, to place light openings rationally and to orient the rooms according to the cardinal points.

2. Goals, objectives and composition of the project.

The goal of this project is to provide students with a practical introduction to the basics of architectural design of a single apartment residential building and to make them aware of the latest achievements in this field.

In the process of course project performing it is necessary to solve the following **tasks**:

- study the factors that influence the functional structure of a residential building;
- the basis for its internal space organization;

- to create an information base for solving creative design tasks on the training project of a single apartment residential building, which serve as the basis for a summary;

- on the basis of the analysis of the information obtained, to solve the space planning structure taking into account the principles of functional zoning of a single apartment residential building;

- find an artistically expressive image of a residential building, interconnected with its general volumetric-spatial solution;

- decide on the structural design of the building that best corresponds to the overall volumetric-spatial solution;

- reveal the author's intention and show the creative search for a design solution of a single apartment residential building;

Imagination is an important element of creativity, allowing the architect to solve difficult design tasks, which must be fostered in all periods of establishment and development of a creative personality.

Project composition:

Main facade – M 1:50;

Side facade – M 1:100;

Section – M 1:100;

Plans with furniture arrangement – M 1:100;

General plan of the site – M 1:500;

House layout – M 1:100.

The technique used for the main facade is watercolors wash drawing. Plans, sections, and general plans are drawn with ink outlines.

3. Factors influencing the design of a single apartment residential house.

When designing a single apartment residential building, the following main factors influencing the creation of comfortable living conditions should be taken into account: social, demographic, aesthetic, natural and climatic (temperature and humidity conditions, wind conditions, insolation and natural illumination, terrain), urban planning perception, structural systems, engineering equipment of buildings, building materials, economic characteristics.

3.1. Social requirements for housing.

Housing is not only an architectural, functional, technical, but also a social category. The housing system quite fully reflects the hierarchical structure of society:

1. individual - functional zone, individual space in the apartment;
2. intra-family group – premises for an intra-family group;
3. family – living unit (individual house);
4. neighborhood community - residential complex;
5. urban community - residential area, city, etc.

All types of housing have some common social functions:

- maintaining the health of people living in it (creating the necessary sanitary and hygienic conditions);
- strengthening the family and creating a healthy psychological climate in it;
- promoting family development (the number of children in a family, types of families, etc. depend on housing conditions);
- off-work time organization;
- professional development;
- children upbringing;
- creation of conditions for recreation;
- acting as a psychological “shelter”.

Each of these functions must receive one or another physical and spatial realization. The importance of these social functions is equally great for all people and nothing except housing can fulfill them. Many types of life activities that make up the domestic sphere are firmly preserved in a residential building. Each family strives to distribute and organize life processes in their home to make the most of their traditions, professional interests, values and habits.

3.2. Demographics and residential structure.

When designing a residential building as part of the living environment, it is necessary to understand the lifestyle of the population, its demographic structure, and the needs of people in the sphere of everyday life and leisure. The living environment formed by a man influences a person and determines his/her way of life. The demographic situation is characterized by a number of characteristics: the size and growth rate of the population, its gender and age, the number, size and structure of families.

When designing housing in each specific case, you should be guided by numbers that show the local demographic situation. The typology of residential buildings and apartments is related to the indicators of the gender and age structure of the population.

The fact of population aging is significant. As people get older, their lifestyles change, their psychology transforms, their time budgets rearrange, etc. The housing system must respond to these changes.

Among the factors influencing the design of housing is the level of education of the population, which is steadily increasing, and therefore there is an increasing need for such types of apartments in which it is possible to create a workplace for studying, scientific and creative work. The course project for a residential building should include 4–6 rooms, depending on the family size. There are five types of families: 1 – families with and without a family core (married couple); 2 – families with and without children; 3 – complete and single-parent families; 4 – nuclear (parents + children) and complex (married couple with children + one parent or relatives); 5 – families with one or more married couples.

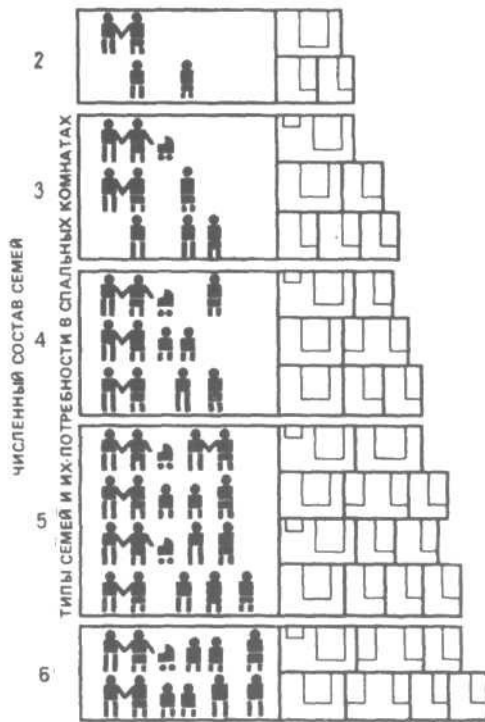


Fig. 1 Requirements of families with different size and structure to the set of bedrooms

3.3. Aesthetic requirements for housing.

The architecture of residential buildings reflects the aesthetic ideals, tastes and preferences of their time. The shaping of housing through professional creativity is linked to the history of architectural styles and its people. The subjective factor is also important when the architect demonstrates his creative style and individual approach to solving social, planning and artistic problems. The use of color has a rich tradition in shaping the living environment. With the help of color, you can reveal the plasticity of the facade, obtain a visual transformation of the plane or volume. The color scheme is a consequence of the certain building materials use that has a characteristic color (tiles, bricks, natural stone, etc.) The aesthetic qualities of a residential building are the result of an architectural understanding of some objective factors: natural and climatic conditions, urban planning situation, space-planning structure of the house, its structural design, construction technology and building materials.

The implementation of aesthetic ideals and traditions in the architecture of the dwelling is carried out in the course of its shaping at all levels: construction - house - large plastics of the house - detail. Each level has its own compositional tasks and each of them is important for creating an aesthetically complete living environment.

3.4. Natural and climatic factors.

The creation of a healthy and aesthetically pleasing living environment is impossible without taking into account natural and climatic conditions, which always have a significant impact on the architecture of buildings, on their spatial and functional organization, on the choice of building materials and structures, and many other factors.

Natural and climatic conditions include: temperature and humidity conditions, wind conditions, natural illumination, terrain, insolation of residential premises.

Temperature and humidity conditions, its impact can negatively affect the comfort of housing, therefore residential premises must be protected from sudden seasonal and daily changes in outside air temperature. The design of a single apartment residential building is carried out in the climatic conditions of Nizhny Novgorod city, which is located in the II B climatic subdistrict (SP 131.13330.2012 Updated version of SNiP 23-01-99 "Building climatology") with 2 outdoor air humidity zone (normal 75%), with the average month temperature in January is from 4°C to 14°C and the average month temperature in July from +12°C to +21°C.

In the climatic conditions of Nizhny Novgorod, a multilayer wall can have a 600-640 mm thickness. The construction of entrance lobbies with a depth of at least 1.2 m is obligatory. The depth of foundations is determined by the depth of soil freezing (1.5-1.8 m).

The wind regime is determined on the basis of long-term observations and is characterized by the direction and air speed in a given area. In Nizhny Novgorod the southwestern direction of winds is prevailing with an average annual air speed of 5 m/sec.

Natural lighting is important to achieve sanitary and hygienic comfort of premises. It depends on many factors: external illumination (brightness of the sky, the number of direct sunlight entering the room, taking into account the orientation of the windows to the cardinal directions and their overall dimensions), the number of light rays reflected by the ground and surrounding buildings, the depth of the premises, etc. All living rooms and kitchens should have natural lighting. The ratio of window area to floor area of living premises and kitchen should be taken at least 1:8. For attic floors it is allowed to take this ratio of 1:10.

The topography of the terrain plays an active role in shaping residential buildings and selecting construction techniques. A slight slope does not affect the architecture of the house, and a slope angle up to 10-15° leads to transformations of the first floor. With a slope of 15-20°, it is advisable to switch to terraced types of buildings. Slopes facing north are considered unfavorable for housing construction, because in this case, insolation of premises and territories is difficult.

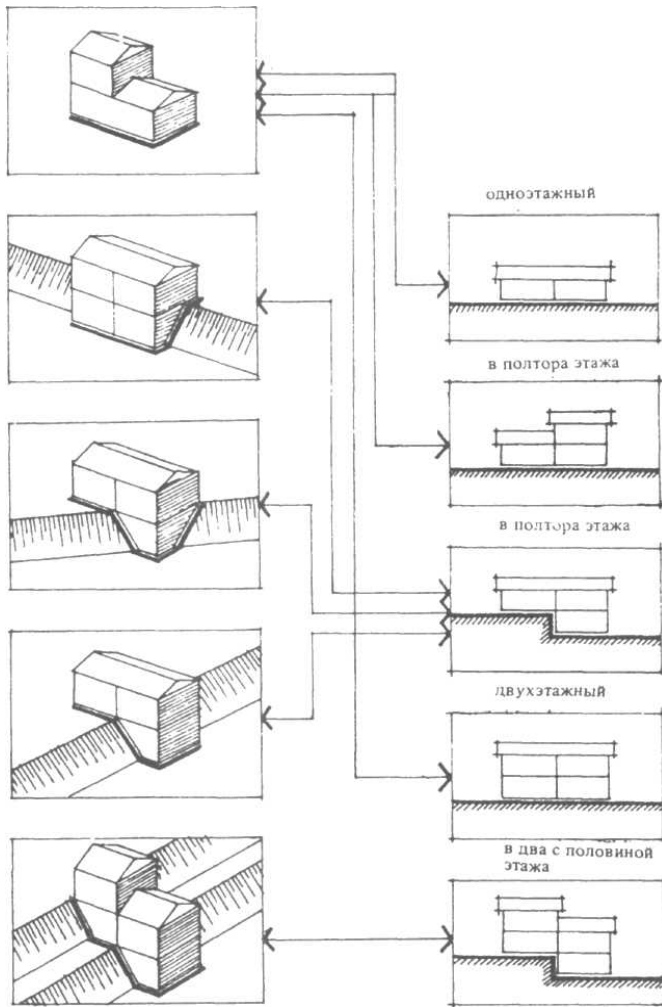


Fig. 2 Location of residential buildings of different storeys on the relief

Insolation - exposure of dwellings and neighbourhoods to direct sunlight. It helps maintain sanitary and hygienic comfort. For Nizhny Novgorod the recommended insolation rate is at least 2.0 hours per day for the period from March 22 to September 22. The duration of insolation largely depends on the residential premises orientation, the plans configuration, gaps between buildings and their height. In multi-room apartments, it is allowed to orient part of the premises to the northern part of the horizon (from NE to NW). In this case, at least one living room in 2-3 room apartments and at least 2 rooms in apartments with 4 or more rooms must be insolated.

Table 1. Living premises exposure (according to S.I. Vetoshkin and N.M. Danzig)

Living premises	South of 50 N latitude		North of 50 N latitude	
	recommended	allowed	recommended	allowed
Bedrooms, children and common rooms	S	S-E	S, S-E	S-W
Dining rooms, living rooms and halls	S, S-E	E, N-E, S-W	S, S-E, E	N-E, E

3.5. Urban planning factors

The most important of them are: location and size of the construction site; conditions of residential building visual perception; morphological, architectural and artistic features of the surrounding buildings.

Location and size of the construction site. The design assignment provides for the location of a residential building on the outskirts of one of the Nizhny Novgorod city districts.

When designing a residential building, it is necessary to pay attention to the choice of a construction site (row or corner at the intersection of two streets), with the walls of the main facade of the building set back 5 meters from the frontage line. The distance between the walls of residential buildings located on adjacent land plots must be at least 6 meters. Household buildings should be placed at least 1 meter away from the boundaries of the plot. The general plan diagram must show the designed residential building with pedestrian access road and driveway to a built-in or detached garage measuring 4x6 m or a carport (top view), as well as determine the location of the recreation area, the area of household buildings and the garden area with convenient access. The area of the construction site is taken to be 600 - 900 m². (Fig. 18).

Conditions of visual perception of a residential building. Taking into account the visual perception conditions means giving the architecture of the building such qualities that express its belonging to the particular construction site, and to the surrounding spatial environment. The visual diversity of a residential building activates all characteristics: from the overall form to the decorative details, to the design of balcony railings and sash window frames. Morphological, architectural and artistic features of the surrounding buildings are the geometry of its plans, the proportionality of buildings and the spaces formed by them, number of storeys, stylistic features, systems of proportions and scale, drawing of details, material and texture of enclosing structures, color, etc.

3.6. Structural systems of buildings.

An important task is the focus on new and advanced house-building technologies, which requires not only compositional ideas but also engineering knowledge from the architect.

A single apartment residential building can be built with a wall frame using walls made of artificial materials (brick, small and large blocks), from monolithic reinforced concrete in combination with brick cladding, from wood (logs and timber). A combined scheme is possible in the planning solution using brick in the ground floor and wood in the first floor and the frame.

External walls perform two functions - load-bearing and enclosing. Internal walls are only load-bearing; if necessary, they can be replaced with pillars that will support the floors through purlins. In Nizhny Novgorod, the thickness of load-bearing enclosing walls made of artificial materials is accepted as 640 mm. In low-rise buildings, the outer walls can be solid from homogeneous materials (bricks, blocks) or

layered, in which the load-bearing inner layer is made of a more durable material. The cladding is made with lightweight, perforated bricks.

The minimum thickness of a monolithic reinforced concrete layer in the structures of low-rise buildings is 120 mm for walls, 150-160 mm for floors.

The thickness of the internal load-bearing walls is assumed to be 250-380 mm. Ventilation and smoke ducts from kitchens, bathrooms, and basements with a cross-section of 140x140 mm are installed in the internal walls 380 mm thick.

Prefabricated reinforced concrete lintels are used to construct openings in the walls of low-rise buildings.

Low-rise residential buildings with walls made of logs are a traditional type of Russian national dwelling. When constructing them, the same design principle is used: a log cabin. The structural basis of a log house is a log cabin (klet'), assembled from timber sets laid on top each other. A timber set is one row of logs laid along the perimeter of a polygon and connected to each other at the corners by notches with half-tree height difference. The diameter of the logs is 200 – 220 mm. The structural height of the beams ranges from 180 to 240 mm. Such beams can be used to cover spans from 3.5 to 6.0 m. Prefabricated wooden elements from timber and wooden frames are also widely used.

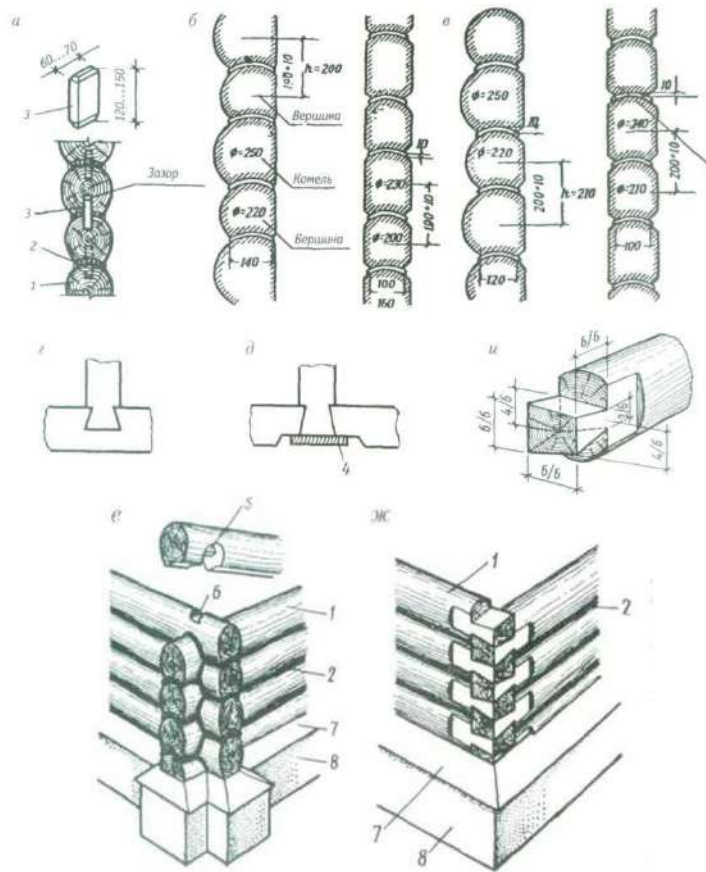


Fig. 3 Details of log walls: *a* - a log cabin; *б, в* - height of timber sets and logs $d=200-220$ mm in butt; *г* - secret mitred dovetail joint of logs “potaynym skovorodnem”; *д* - through dovetail joint of logs “skvoznym skovorodnem”; *е* - saddle notching “v chashu” with logs extending past the corner; *ж* - dovetail notch “v lapu” when logs’ ends are cut; *и* - processing of cut logs’ ends; *1* - frame crowns; *2* - caulking or “konopatki”; *3* - plug tenon; *4* - protective board; *5* - secret dovetail/plug tenon; *6* - mortise for a secret dovetail/plug tenon; *7* - flashing; *8* - base plinth.

The **outer wall** consists of: the base plinth, the wall, which may have window and door openings, a cornice or parapet.

The **base/plinth** is installed in the lower part of the wall with a height of at least 0.5 m. There are two structural solutions for masonry wall plinths - thickening the masonry at the bottom of the wall or making it thinner at this point (so-called undercut).

To protect the exterior walls from the direct impact of rain and melt water, a 0.5 to 1 meter wide **perimeter pavement** is built around the building.

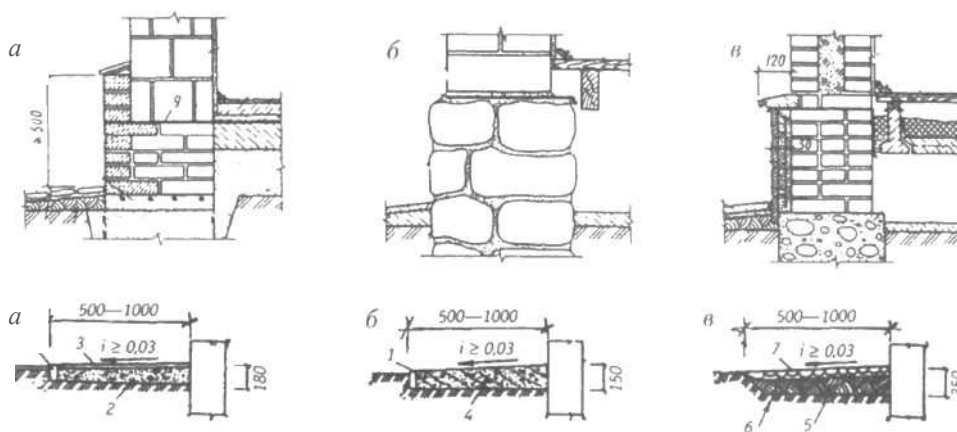


Fig. 4 A. plinth options: *a* – made of red brick under a wall made of lightweight concrete blocks; *б* – made of natural frost-resistant stone; *в* – made of solid masonry with facing tiles.

B. perimeter pavement options: *a* – made of asphalt concrete; *б* – made of cement concrete; *в* - made of cobblestone.

Cornices can be of three types - extensions of masonry rows, overhangs of a special reinforced concrete slab and special rafter system extension ('kobilka'). The cornice overhang must be at least 0.6 m.

Parapets (a section of the wall above the roof level) are designed of two types - with rainwater drainage devices from the parapet to the internal drain or with water removal from its exterior side through special openings.

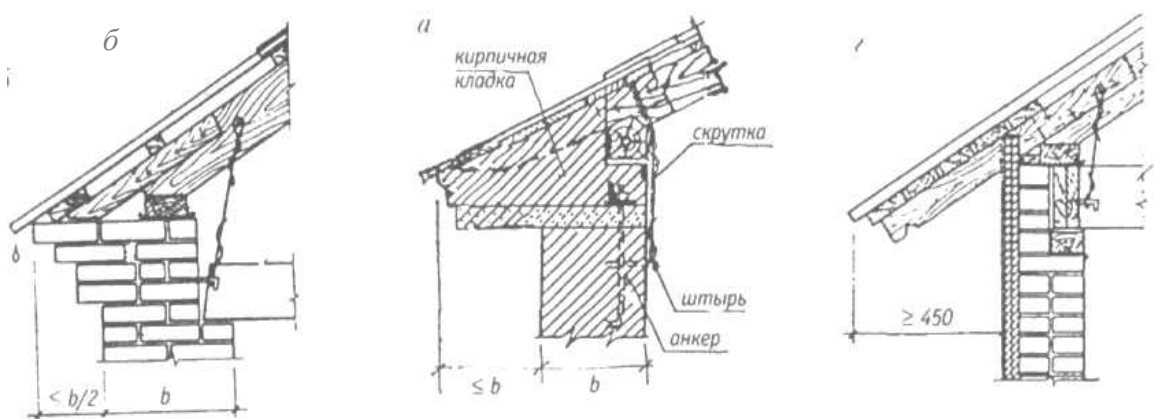


Fig. 5 Cornices of stone walls: *a* – formed by extensions of masonry rows; *б* – special reinforced concrete slab loaded with masonry; *з* – special rafter system extension.

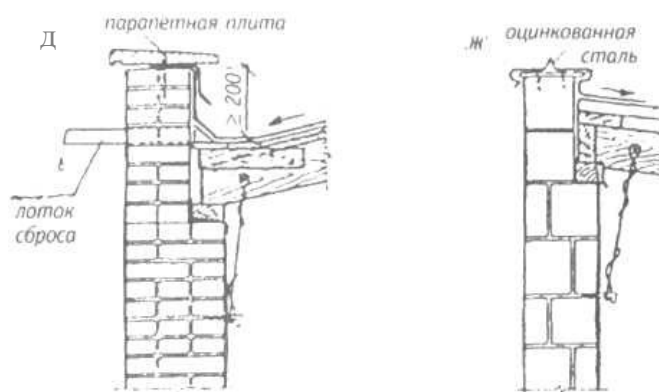


Fig. 6 Parapets of stone walls: д – parapet with rainwater drainage devices; ж – parapet with backwater drain.

Partitions are installed to the entire height of the room to completely isolate the internal spaces from each other. The thickness of brick partitions is assumed to be 120 mm. For "second light" illumination, as well as for providing visual connection between the separated rooms, sheet glass, glass blocks and glass profile are used in the construction of partitions. According to the operating conditions, there is a distinction between stationary and transformable partitions.

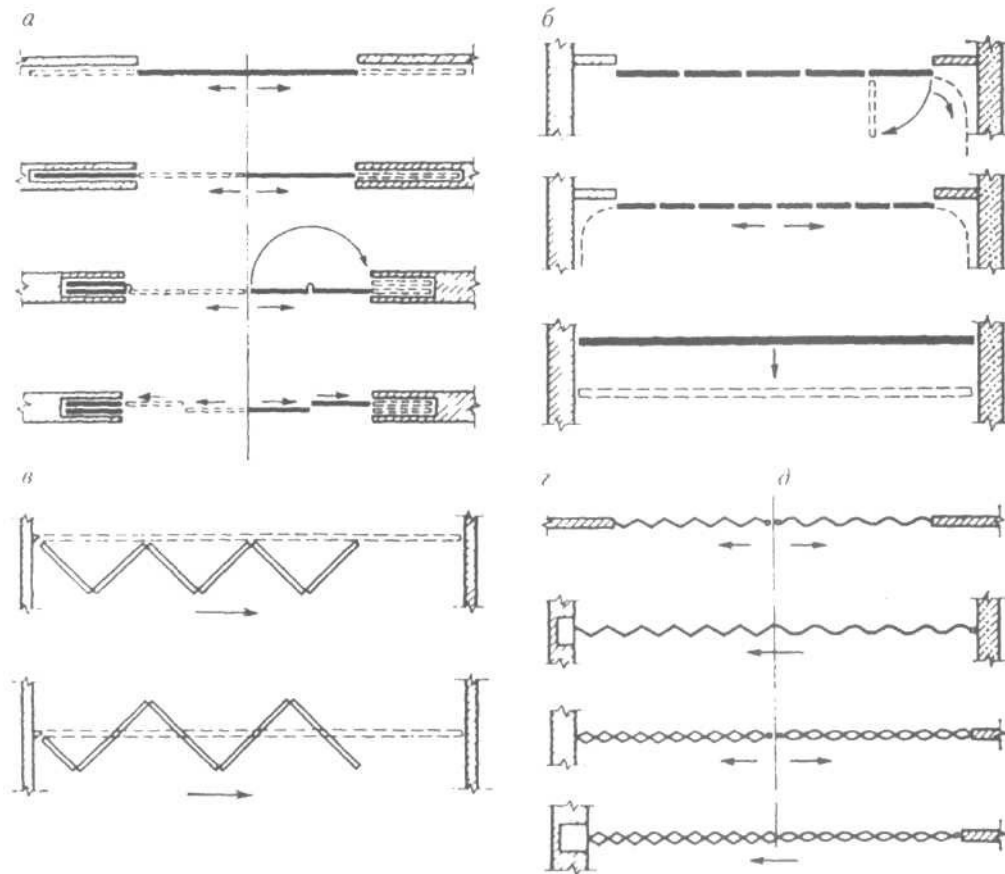


Fig. 7 Types of transformable partitions: *a* - straight sliding; *б* - rolling; *в* - hinged partitions; *г* - rigid folding partitions; *д* - soft folding partitions.

Floors - the enclosing structure that divides the interior space of the house into storeys. Horizontal load-bearing elements (crossbars, lintels, floor slabs, etc.) are made of materials that work well in bending. These include: reinforced concrete, metal, wood.

Floors can be classified according to the following criteria: by location in the building, by design, by material, by sound insulation, by installation method, by fire hazard. By location in the building - basement, interfloor, attic; by the design solution - beam floor (can be made of wood, reinforced concrete, metal), flat slab; by material - reinforced concrete (prefabricated and monolithic), with steel or wooden load-bearing beams; by sound insulation - acoustically homogeneous and heterogeneous (layered); by installation method - prefabricated, monolithic, prefabricated-

monolithic; by fire hazard - non-fire-hazardous, low-fire-hazardous and moderately fire-hazardous.

The roof (roof covering) is the upper enclosing structure of a building that protects the interior from external impact. Depending on the roofing, there are several types of houses: a mansard house, a house with an incomplete first floor, a house with an offset floor level, one part of which is one-storey.

Mansard - a storey in the attic space, the walls of which are partially formed by sloping roof without attic. The pitch of the roof must be at least 45° . The height of the walls at the cut-off parts must be at least 1.6m. In a house with an incomplete first floor, the roof can be single or double pitched. In case of combined roofing, the rooms in the ground floor, usually the common room, are higher.

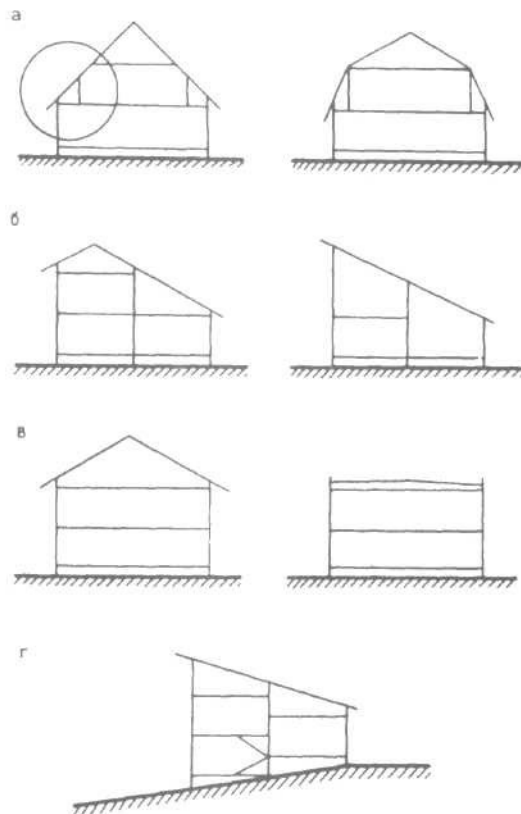


Fig. 8 Techniques for solving residential buildings on two levels: *a* - mansard without a roof break and with a roof break; *b* - part of the building is located in two levels (with attic or without attic); *B* - the whole building is located in two levels (with attic or without attic); *r* - house with a half storey difference in floor levels.

When designing a single apartment residential building, **verandas** can be installed. They are glazed, unheated rooms attached or built-in to the main building. Also there are **terraces** that differ from verandas in the absence of glazing.

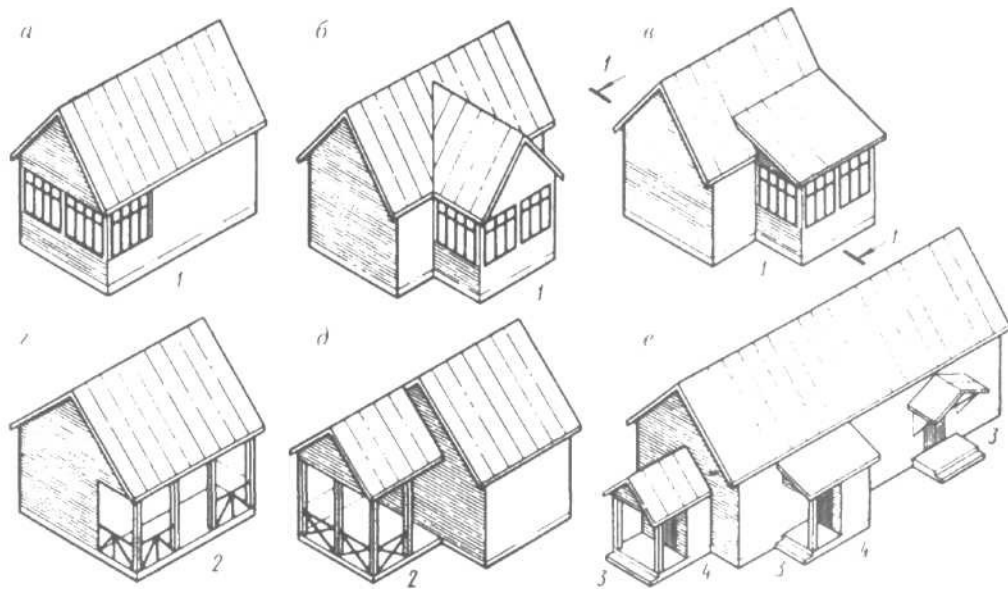


Fig. 9 Apartment premises of low-rise residential buildings: *a, б, в* – verandas; *г, д* – terraces; *е* – vestibules/lobbies and porches; 1 – verandas; 2 – terraces; 3 – porches, 4 – vestibules/lobbies.

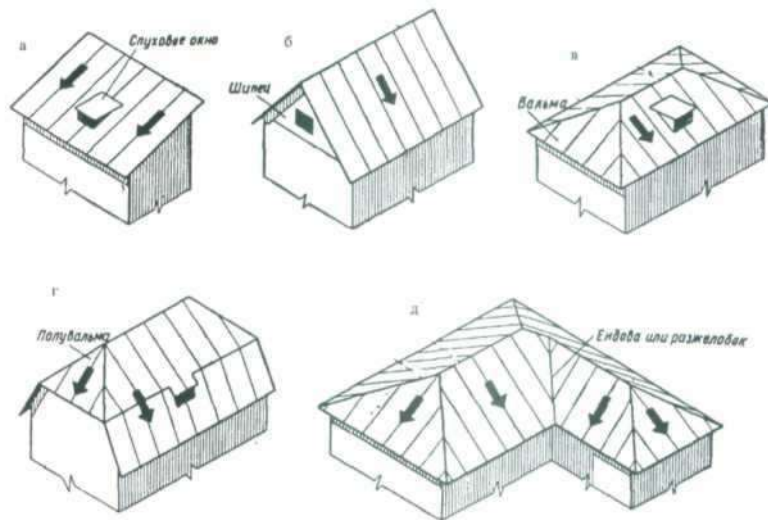


Fig. 10 Main types of pitched roofs and their elements: *а* – shed roof; *б* – gable/pitch roof; *в* – hip roof; *г* – mansard roof; *д* – cross-hipped roof.

With the help of overhangs and offsets (i.e. floor-by-floor rectilinear or curvilinear changes in the plan), it is possible to achieve any horizontal and vertical facade structure and to arrange loggias, balconies and bay windows in any arrangement.

Low-rise construction is characterized by easier methods of building construction. The small number of storeys and low loads allow using lightweight, cheaper structures.

3.7. Engineering equipment of residential buildings.

The course project must include modern engineering equipment designed to create comfortable living conditions.

Design of engineering equipment systems for a one-storey residential building - heating, ventilation, water supply, sewerage, electrical networks, gas pipelines, low-current networks (radio, telephone), television cables, etc. are carried out by relevant experts. Ventilation in the designed residential building is carried out naturally using exhaust ducts located in the kitchen and sanitary area. When designing sanitary facilities on different floors of the house, it is necessary to place them one below the other.

The architect should be familiar with the engineering of the residential building, and provide in the architectural, planning and structural design the necessary conditions for all types of networks and installation of equipment.

3.8. Construction Materials.

The selection of building materials for any structural elements of a residential building is carried out taking into account the main functions that they must perform.

Materials that can withstand heavy loads and that are characterized by durability and fire resistance should be used for the load-bearing structures of the building. These include various types of concrete and reinforced concrete, ceramic brick, natural stone, etc.

Enclosing structures require materials that have heat and sound insulation properties, they should be moisture resistant, durable and fire resistant and they should withstand temperature changes. Such qualities are typical for various types of light-weight concrete, ceramic hollow bricks, and many local materials.

To install a flat roof you need roofing felt, asphalt roofing paper, and bitumen-polymer based materials. Pitched roofs are an active architectural element. They require materials with improved decorative qualities (traditional and metal tiles, asbestos-cement sheets, various synthetic materials). Shape, size and color can vary, which is important for solving architectural issues. When finishing the external surfaces of residential buildings, the following are used: ceramic and glass tiles, facing bricks, natural stone, sheet materials made of asbestos cement, aluminum alloys, synthetic and other materials, and various types of plaster and paint are often used.

Depending on the purpose of the house premises (living rooms, kitchen, sanitary units, bathrooms, corridors, storage rooms, etc.), various natural and artificial decorative and finishing materials are used. Natural wood, wooden and various decorative panels are used for walls, floors, ceilings, and for the built-in furniture design, depending on the architectural design of the interior and the purpose of the premises.

The selection and quality of building materials determines the cost-effectiveness and durability of a building, as well as its aesthetic qualities.

3.9. Economic requirements.

To evaluate the project at intermediate stages, a system of indicators is used to select the optimal solution from an economic point of view.

Coefficient K1 is the ratio of residential and gross floor area in a residential building. $K1 = \text{living area in m}^2 / \text{gross total area in m}^2$.

An unreasonable increase in utility room space reduces the cost-effectiveness of the solution.

Coefficient K2 is a volumetric coefficient, the ratio of the cubic volume of a residential building to the total living area. $K2 = \text{cubic volume in m}^3 / \text{living area in m}^2$.

The value of the K2 coefficient depends on the value of the K1 coefficient, the number of vertical and horizontal communications (stairs, lobbies, corridors, etc.) in the house, floor height, design parameters (thickness of walls, ceilings, etc.).

Reducing the weight of structures is also essential. The technical and economic indicators of residential building projects are greatly influenced by space-planning solutions. Lack of compact building plan makes not only non-recurring construction costs worse, but also increases operating costs for heating and energy consumption.

4. Functional basis for designing a single apartment residential building.

4.1. Functional zoning of a residential building.

Comfortable living conditions in the house are ensured through its functional zoning, i.e. division into zones isolated from each other. Currently, the most common is two-part zoning into public and individual zones.

Public recreation, meals, reception of guests, etc. are organized in the public area. This zone includes the following rooms: entrance lobby, living room, summer rooms (veranda, terrace), toilet, kitchen-dining room. Based on its function, this group of rooms is close to the entrance of a residential building (in a two-storey building it is located on the ground floor).

Sleep, exercise, personal hygiene, relaxation, etc. are organized in an individual zone. It includes: bedrooms, a sanitary unit, storage rooms, dressing rooms. This zone requires maximum insulation and is located deep in the apartment. The bedroom area has independent access from the entrance lobby.

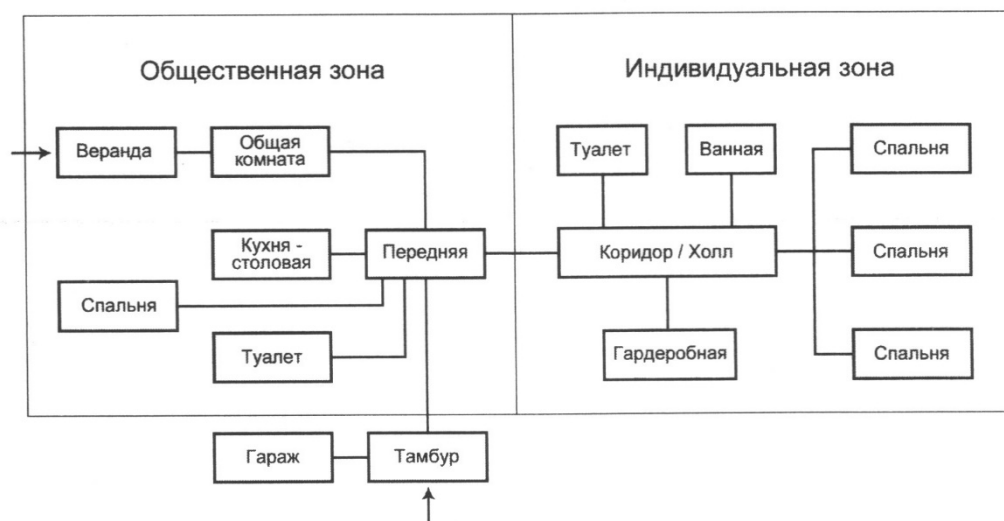


Fig. 11 Functional zoning scheme for a single apartment residential building

4.2. The main premises of a residential building.

The main element of the space arrangement of a residential building is the room. By nature of use all rooms are divided into two groups: living rooms (hall, bed-

rooms) and utility rooms (utility, communication, personal hygiene and storage rooms).

The hall is located near the main entrance, should be directly connected to the entrance lobby, have a link to the kitchen and veranda (terrace). The configuration of the hall should provide convenience: daytime and evening stay of the family, communication, relaxation, various activities, eating, family celebrations, receiving guests. It is possible to construct a double floor height area. Halls with the ratio of width and depth in the range of 1:1 - 1:1.5 are considered to be the most convenient. In the course project the area of the hall is accepted: 25-27 m² - in a four-room apartment house, 27-29 m² - in a five-room house, up to 30 m² - in a six-room house (Fig. 12).

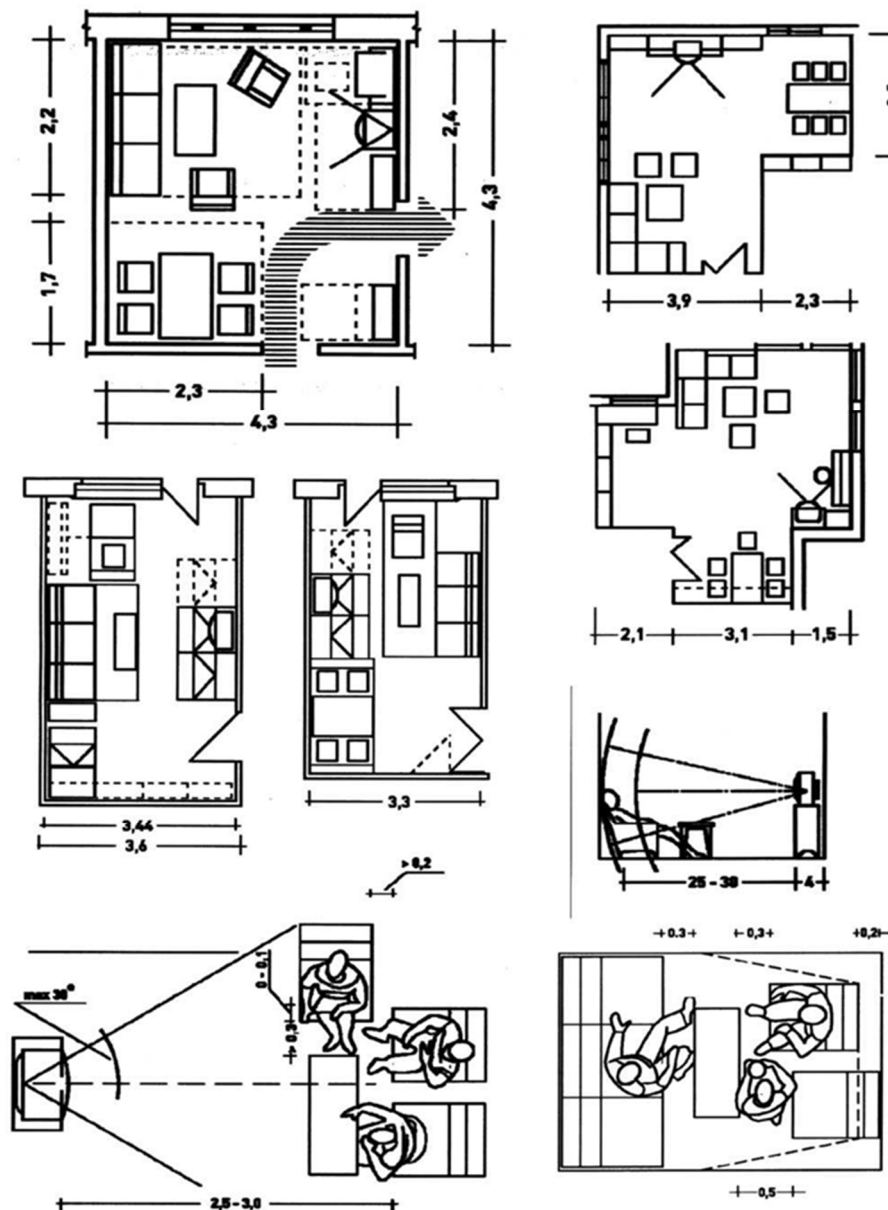


Fig. 12 Functional layout plan of the hall: a – functional layout plan examples; b – functional area for communicating and watching TV

Bedrooms should be grouped together and placed at the back of the apartment. In two levels houses, they are located on the top floor, and one bedroom for two people (elderly family members or guests) is preferably located on the ground floor. The

entrance to the bedrooms is organized from the corridor or hall. The windows of the bedrooms should preferably face the garden.

The bedrooms provide places for sleeping, storing clothes and linen. A bedroom for one person can also be used as a room for daytime use with space for individual study and relaxation. A children's bedroom, as a rule, also has a multifunctional character. It requires such placement of furniture and its transformation, which provide maximum free space for children to play.

All bedroom areas must be insulated. The ratio of their width and depth is allowed within 1:2. The recommended bedroom area is: 17-20 m² for parents, 13-16 m² for two people, 10-12 m² for one person (Fig. 13).

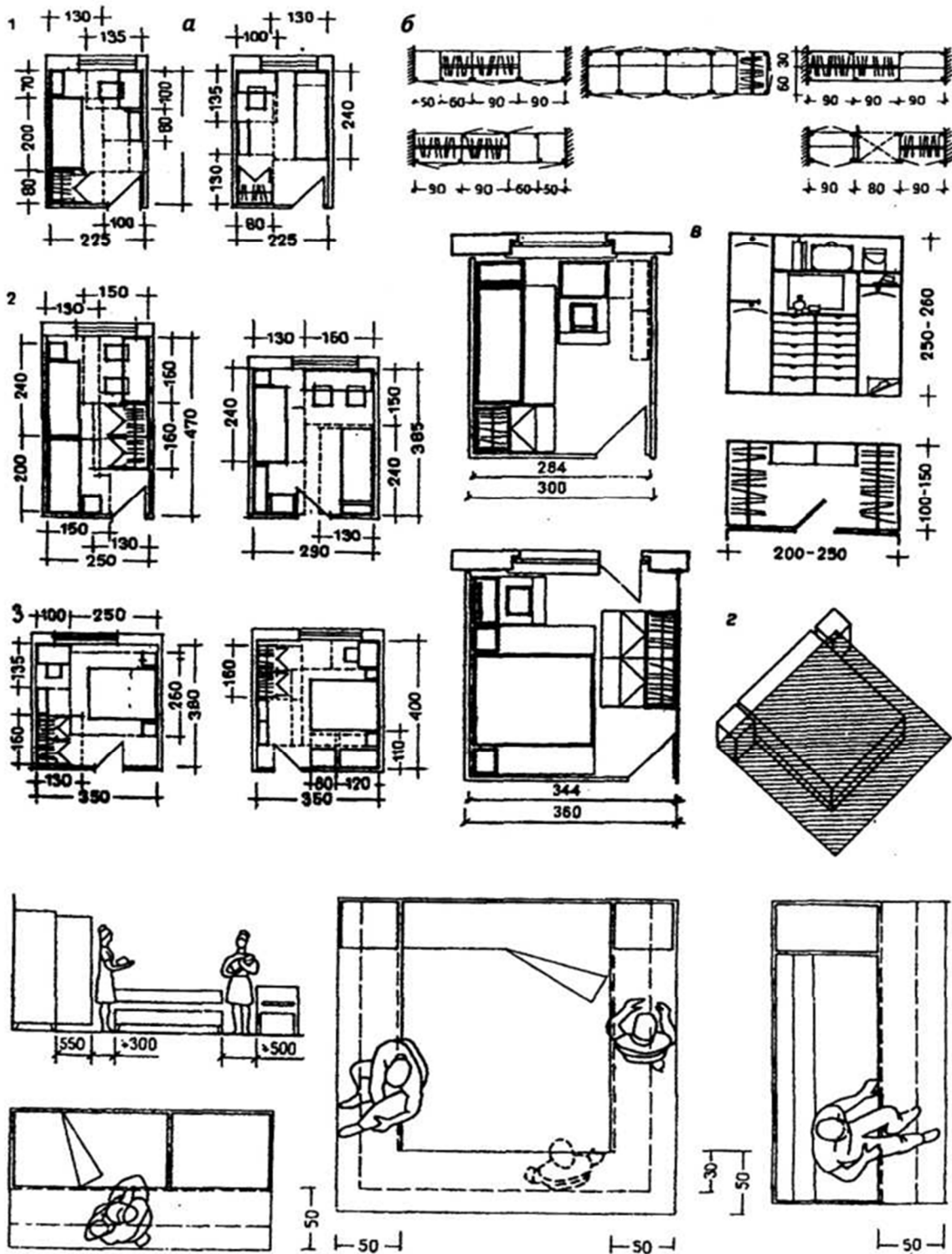


Fig. 13 Functional layout plan of bedrooms: *a* – bedrooms functional layout plan examples: 1 – for one person, 2 – for two people, 3 – for parents; *b* – built-in wardrobes; *v* – wardrobe; *z* – functional sleeping zone

The functional layout plan of a kitchen space depends primarily on its proportions, dimensions, location of door and window openings, as well as on the adopted layout of kitchen equipment. In an extended kitchen (at least 2 metres wide) with a window on the narrow side, a single-row arrangement of equipment is common. If the kitchen width is at least 2.3 m, a corner or double-row arrangement is

possible. These two layouts are compact and help to create space to organise the eating area (Fig. 14).

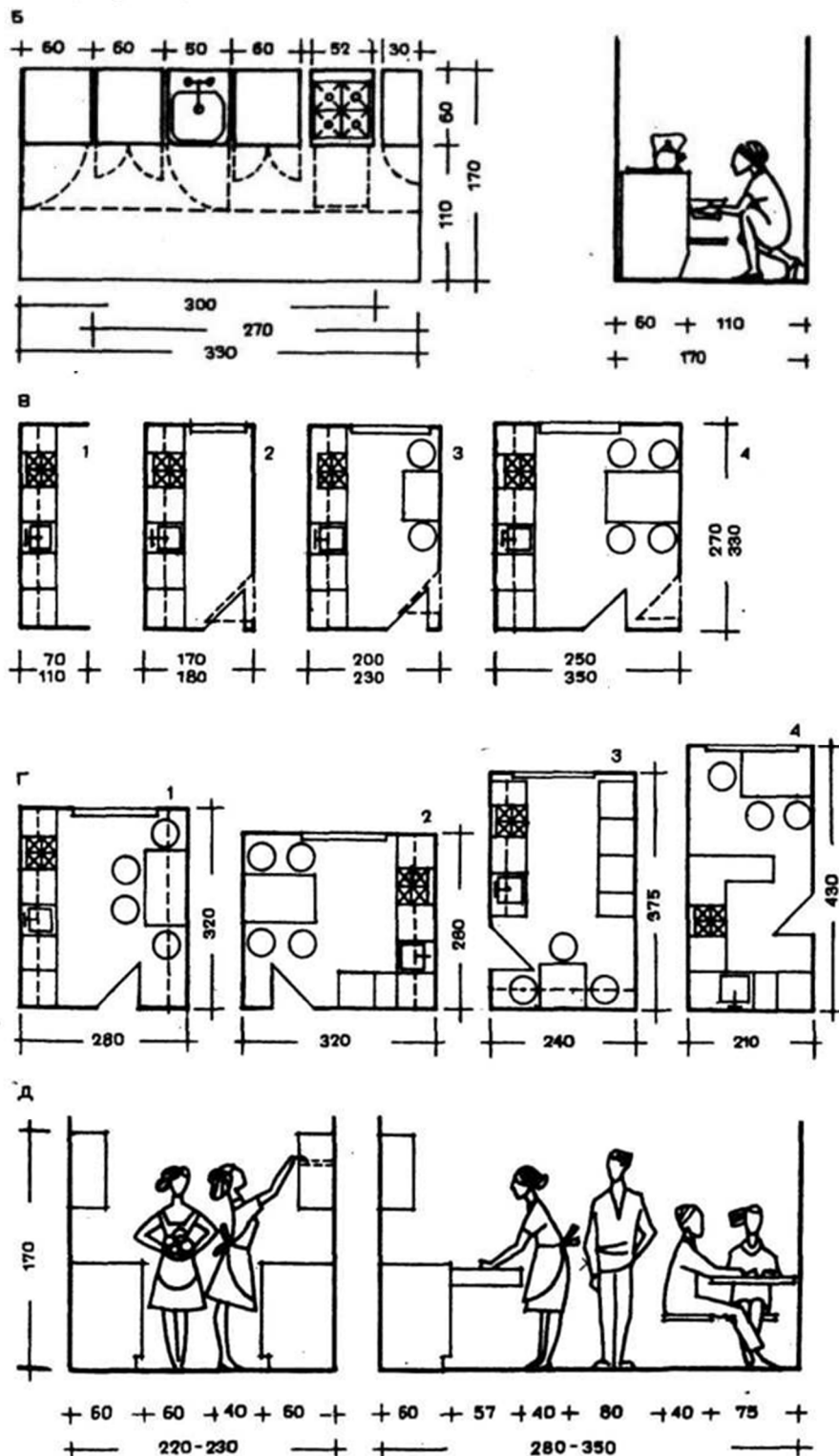


Fig. 14 Functional and planning organization of the kitchen: б, в – planning parameters of the food preparation area; г – layout of equipment in kitchen-dining rooms: 1 – single-row, 2 – angular, 3 – double-row, 4 – U-shaped; д – minimal passages in the kitchen-dining room

The kitchen-dining room includes a work area with kitchen equipment and a dining area for all family members. It is advisable to place it next to the hall. The area

of the kitchen-dining room should be: 16 m² - in a four-room house, 18 m² - in a five-room and six-room house.

Working equipment in the kitchen is installed in the following sequence: refrigerator – sink – work table – stove. The total length of the equipment front shall not be less than 2.7 m, with a width of at least 0.6 m. Kitchen equipment also includes a set of cabinets, a dining table, stools or chairs for which comfortable seats should be provided.

Sanitary and hygienic premises. They organize personal hygiene areas that are of a purely individual nature, so they require conditions of strict isolation. In single apartment residential buildings design, three types of sanitary and hygienic premises are used: a bathroom, a toilet and a combined sanitary unit. Each has a number of planning solutions. The main units that make up their equipment are a bathtub, a shower tray (shower stall), a washbasin, a toilet, and in some cases a bidet (Fig. 15).

The dimensions of the premises are assigned depending on the equipment. The bathroom is equipped with a bathtub and washbasin, and there is also space for a washing machine. Toilets are designed in two types: only with a toilet, if it is located directly next to the bathroom, and additionally with a washbasin in cases of significant distance from the bathroom. The width of the toilets must be at least 0.8 m, the depth - at least 1.2 m. The combined sanitary unit is equipped with a bathtub or shower tray (shower stall), toilet and washbasin. All sanitary facilities must have exhaust ventilation. Their doors should open outwards.

In a one-storey residential building it is necessary to provide a toilet and a bathroom. In a house with several levels, a sanitary unit with a toilet and washbasin should be designed on the ground floor; it is also possible to provide a shower tray (shower stall), and on the top floor there should be a combined sanitary unit with a bathtub, toilet and washbasin. Sanitary units must be placed one above the other. In exceptional cases, it is possible to place a sanitary unit on the top floor above the entrance lobby. In sanitary facilities it is not allowed to attach devices directly to the partitions enclosing living rooms.

It is necessary to design utility rooms in the house: wardrobes, storage rooms for storing things and household equipment. Their composition and placement on floors is determined individually, taking into account the general concept of house design. The total area of all utility rooms should be 10-15 m². The house also needs to provide summer premises. These include various types of balconies, loggias, verandas, terraces. A balcony is a platform projecting from the wall of the house facade, serving for relaxation in the summer. The balcony should have railings 1-1.2 m high. Since balconies are not protected from the wind, it is therefore advisable to design them with special screens on one or two sides. The loggia is a room covered and fenced on three sides, open to the outside space.

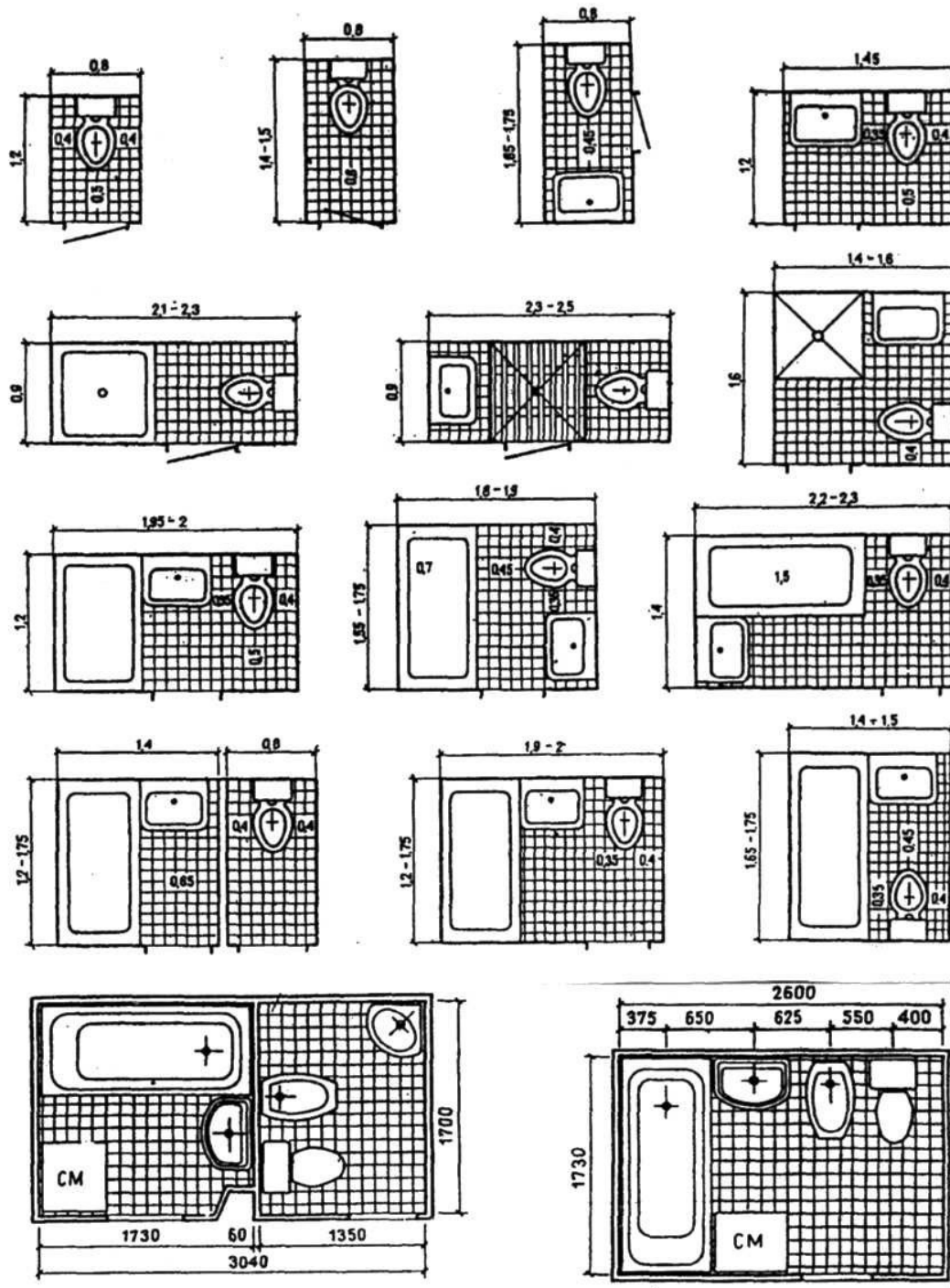


Fig. 15 Sanitary and hygienic premises.

A terrace is usually an open extension to a house in the form of a recreation area, which may have a roof. Terraces can be placed not only on the ground at the ground floor level, but also at levels above the located floors.

As a rule veranda is fully glazed, unheated room attached to or built into the house.

In a residential building, it is possible to install various types of summer rooms. On the ground floor they may have access to the land plot. Their total area should be no more than 25 m².

The link between the individual zones of the apartment is carried out through communication space and elements, which include entrances, the lobby, the hall, the corridors, and the stairs. In a single apartment house, it is possible to design both one and two entrances - the main and auxiliary (from the side of the plot adjacent to the house). The entrance to the house must be organized through a lobby with a depth of at least 1.2 m. The entrance doors to the lobby open outward.

The lobby is the center of communication, the main distribution center in a residential building and is located at the entrance to it. The most rational planning solution for the lobby would be to divide its area into two zones: the entrance zone itself (for changing clothes, cleaning clothes) and the rest, where there is a mirror, a table, and a chair. In the lobby it is necessary to install a built-in wardrobe measuring at least 1.2 x 0.6 m. The front area must be 8 m² in a four-room house, 10-12 m² in a five-room and six-room house. In all cases, the width of the lobby should be at least 1.5 m.

Corridors are used for communication between the rooms of the house. They should have a simple configuration, minimal area and length. The width of corridors leading to living rooms is at least 1.2 m; in other rooms - at least 0.85 m.

By redistributing the areas of the corridors, it is possible to create a hall in front of the bedrooms. There are interesting examples of solutions for the hall in the form of a mezzanine, open to the double floor height area of the hall. The apartment staircase serves to connect rooms located at different levels of the house (Fig. 16). As a rule, the staircase is located in the lobby, further from the entrance to the house. On the top floor it opens into a corridor or hall. The staircase should have natural light. Flights of stairs must be designed with a width of 0.9-1.2 m, with a pitch of the stairs of at least 1:1.5; the number of steps in a flight should be not more than 19 and not less than 3, with the landing width not less than the flight width.

The design of a residential building must include a built-in or attached garage with dimensions of 4x6 m.

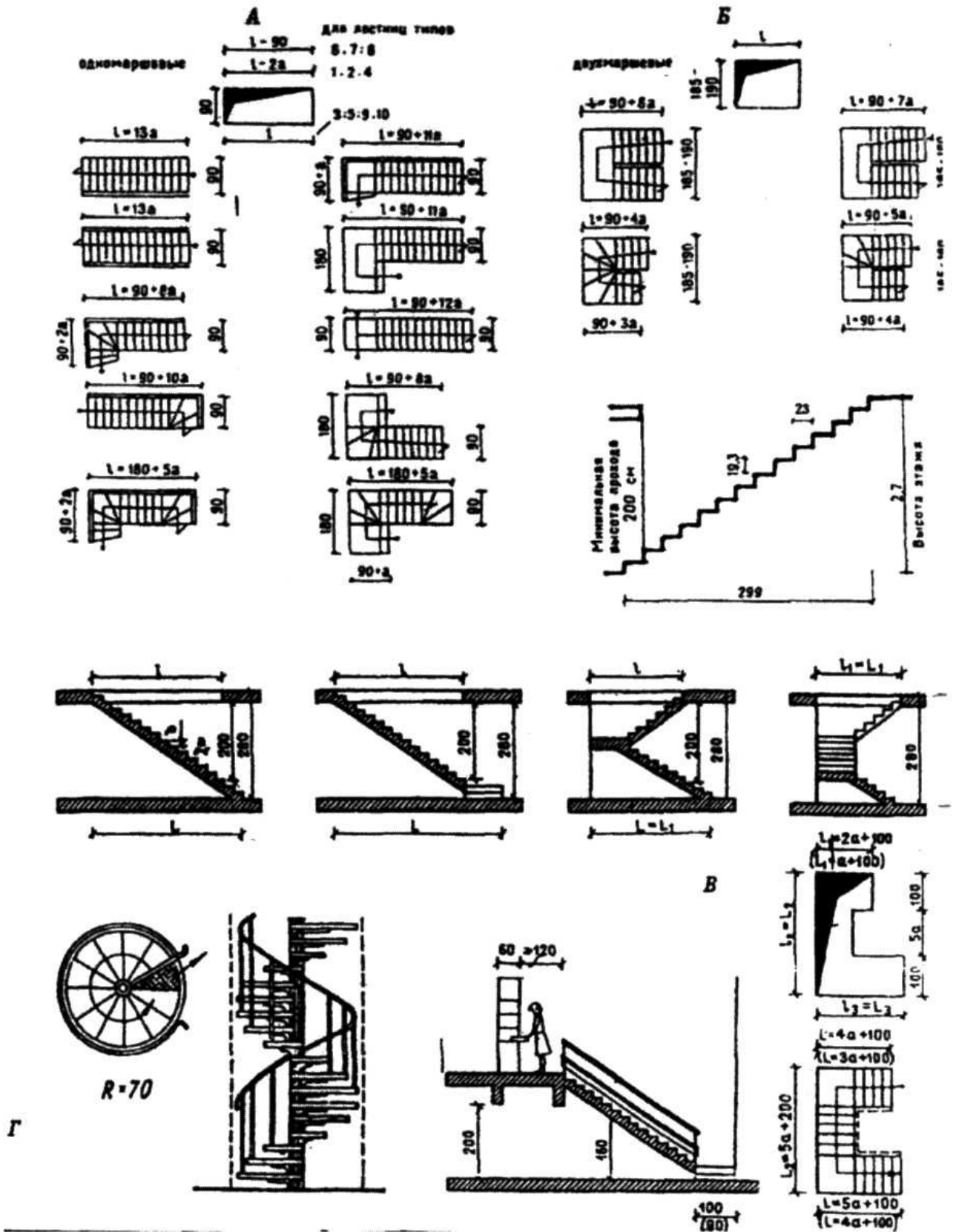


Fig. 16 Indoor staircases: A – single-flight staircases; Б – two-flight stairs; В – three-flight stairs; Г – spiral staircase.

5. Main stages of design and its requirements.

5.1. Work flow diagram of the project

Training design includes classroom and independent student work and is carried out in a certain sequence of several stages. The table shows a work flow diagram of the single apartment residential building project.

Table 2. Work flow diagram of the project

Week	Classes	Execution (%)	Classes content	
			Classroom work	Independent work
I	1 2	10	Introductory lecture. Task assignment.	Literature study. Writing a summary of the project.
II	3 4	20	Clausura: space-planning solution for a residential building.	Literature study. Writing a summary of the project.
III	5 6	30	Discussion of clausura. Submission of summary.	Search for ideas.
IV	7 8	40	Development of sketch-idea options.	Development of sketch-idea.
V	9 10	50	Choosing the optimal version of the sketch-idea. Approval of the sketch-idea.	Development of plans, facades, sections.
VI	11 12	60	Development of a preliminary design (specification of planning structure, structural system and architectural composition).	Graphic execution of the project sketch
VII	13 14	80	Approval of the project sketch.	Graphic execution of the project.
VIII	15 16	90	Submission of the graphic part of the project.	Making a layout of a residential building.
IX		100	Checking and assessment of the project by the commission.	

5.2. Clausura

Clausura is held after the introductory lecture. Its goal is to obtain a primary figurative idea of the designed object, to determine in general terms its architectural and compositional concept. Clausura does not always determine the further course of project development; however, it retains its certain creative and educational value as a subjective image of the whole topic.

The clausura is completed during four academic hours on a A-2 format sheet using various graphic design techniques (pencil, felt-tip pen, ink, watercolor). The clause must contain the following drawings of a residential building: facade (M 1:100), floor plans (M 1:100), section (M 1:100), perspective.

5.3. Summary

The summary is carried out to study independently the existing experience in the design of single family residential buildings. The summary, 10 sheets of A-4 format, contains 10-15 examples of facades, houses floor plans, as well as 1-3 examples of separate premises plans with furniture arrangement and general site plans in the form of drawings. Drawings can be made using various techniques: pencil, felt-tip pen, pen (ink). Under each drawing, you must indicate the name of the object, the surname of the author, and also provide the reference to the source from which this illustration is presented. References are given in square brackets indicating their number according to the references list attached at the end of the summary.

5.4. Sketch-idea

The sketch-idea stage gives a new level of the topic disclosure - an attempt to formulate the idea of a design solution. The purpose of this stage is to restrict the search area and turn the design into a challenge situation. Analysis of initial data and structure-forming factors serve to generate a primary hypothesis. With the help of creative imagination, the disconnected factors, through comprehension of the target setting, are transformed into different variants of volumetric and spatial models of the designed residential building. The sketch idea is carried out in graphic sketches of facades, perspectives, plans, sections, as well as working layouts, which are subject to logical analysis. The sketch-idea stage is completed by the teachers' evaluating the space-planning solutions of the house in order to identify the author's idea - a challenge that can form the basis for further sketching. The value of the sketch-idea is in the prediction of the creative development of the issue, in the individual interpretation of the topic.

5.5. Project sketch.

Development of a project sketch is a complex creative process of developing a working hypothesis expressed in a sketch idea. At this stage, one idea gives way to another. The variants are compared and selected on the basis of re-analyzing the initial information. Project sketch is aimed at studying: the links between the object and the environment; the functional organization of life processes and other factors that determine the choice of the volumetric-spatial structure of the house, the parameters and relationships of its individual premises and their groups.

During the sketching process, the concept of the idea is gradually clarified. By assessing the current state of the object, some unlikely solutions are rejected, some elements are excluded, and others that are suitable for further work are included in the new sketch.

The result of this stage is the development of a preliminary design consisting of a work layout (M 1:100) and a graphic part made on a 55x75 cm canvas stretcher. The preliminary design is approved and assessed at the department examination. It must correspond to the final project in terms of the drawings composition and their layout on the sheet.

5.6. Project

The residential building project includes:

- main facade (M 1:50);
- side facade (M 1:100);
- general plan (M 1:500);
- section (M 1:100);
- floor plans with furniture arrangement (M 1:100);
- model (M 1:100).

The facade views should reflect the adopted volumetric-spatial solution of the building. The facades should have detailed architectural, structural and decorative elements of the external wall surfaces; the shapes of balconies, bay windows, loggias, etc., details of door and window openings. The plasticity of the facades must be revealed using falling and attached shadow, taking into account the aerial perspective. The main facade technique is color graphics (watercolor wash), the side façade technique is lined graphics.

Drawings of building facades must be supplemented with entourage (surroundings) and staffage - stylized images of the natural environment of the architectural object.

The initial criterion for choosing the style of the entourage and staffage is the drawing style of the building façades (Fig. 17). It is necessary to fix the visual relation of entourage and staffage details with facades: to make them in the scale of the drawing of the image view, to place them on the horizon line, to intersect their contours with the outline of the building, etc. Entourage graphics should complement the architecture and must not be perceived independently.

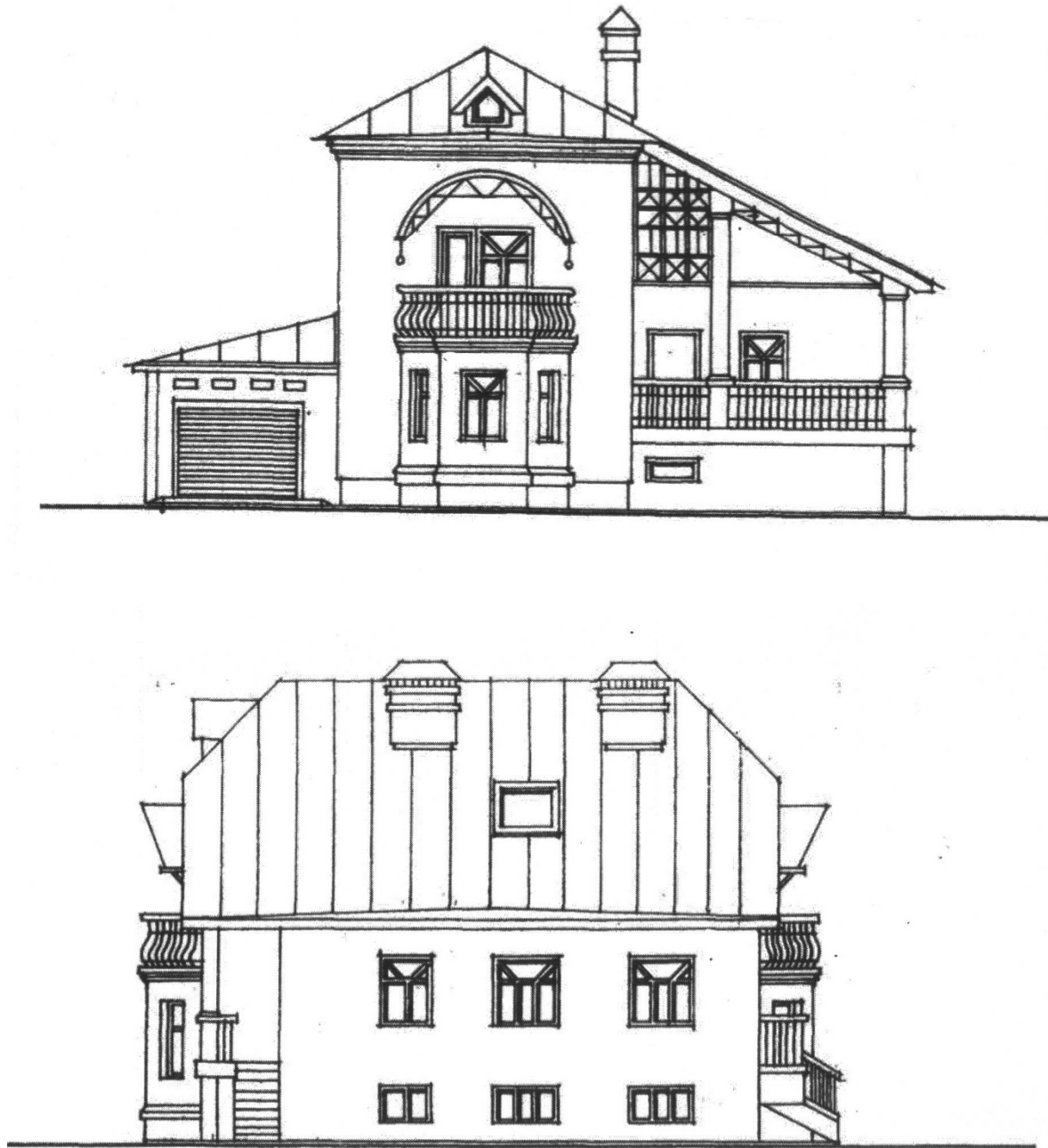


Fig. 17 Examples of the residential building facades drawings.

The general plan is a summary document of the planned territory development. It is necessary to reflect the boundaries of the site being built, its planning structure, and the main functional areas: the front (usually the entrance) area in front of the porch, a garage for a car, a front garden with flowerbeds; residential area - the house itself; a recreation area with playgrounds and a garden area. In addition, it is necessary to show the location of existing structures and structures to be demolished, roads, sidewalks, landscaping facilities.

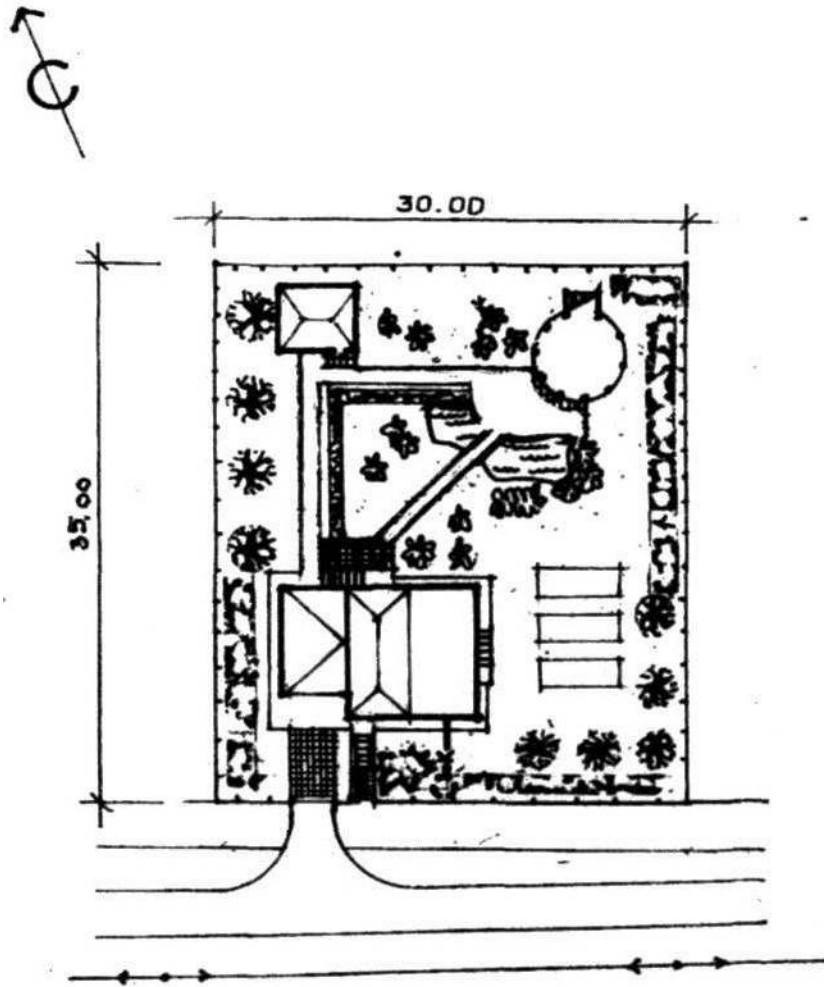
Dimensions and marks on general plans shall be given in meters with two decimals. The contours of the designed buildings are made with a solid main line. The top part of the general plan drawing should correspond to the northern part of the site area. Deviation from the north orientation to the left or right by 45° is allowed. The direction of orientation, i.e., the south-north line, should be shown. The general plan drawing is done in line drawing. (Fig. 18).

The floor plans must reflect the functional and constructive decisions made. Draw all structural elements (walls, pillars, partitions, window and door openings, etc.), as well as furniture, kitchen and sanitary equipment. (The outlines of furniture and equipment are drawn to scale and outlined with thin lines). It is recommended that the side of the plan corresponding to the main facade of the building (entrance side) should face the bottom edge of the sheet. Building plans are arranged on the sheet in the order of floor numbers from bottom to top or from left to right.

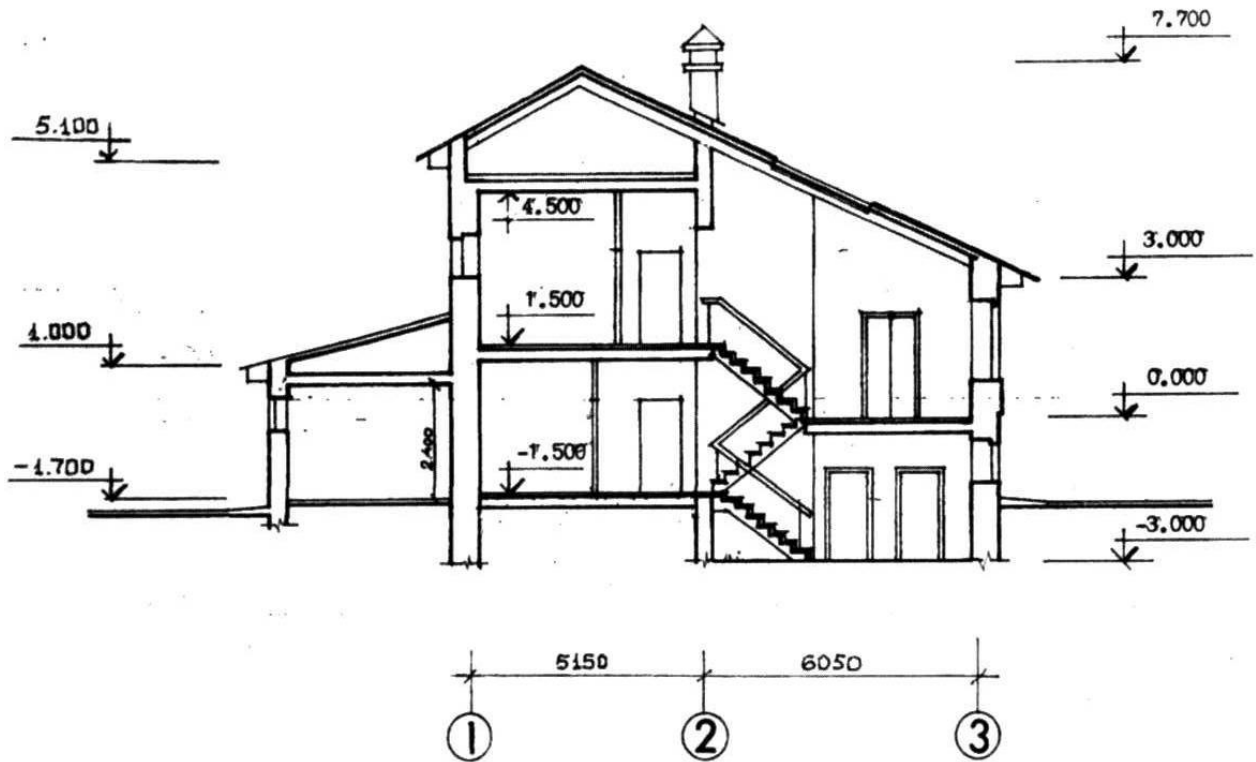
On floor plans it is also necessary to show all coordination axes, their markings, and main dimensions. Coordination axes are conventional geometric lines. They serve to link the building to the construction coordination grid and reference points of the general plan, as well as to determine the position of load-bearing structures, since these axes are drawn only along the main walls and columns. The coordination axes of the building are drawn with dash-dot lines. On the plans they are taken outside the outline of the walls and marked. Arabic numerals are used to mark horizontal axes, and letters of the Russian alphabet are used vertically (except for the letters з, й, о, х, ы, ь, ъ). Marking begins from left to right and from bottom to top. Gaps in serial numbering and alphabet when using letter designations are not allowed. Typically, marking circles (their diameter is 6-12 mm) are located on the left and bottom sides of the building plan. The dimensions of the plans indicate the dimensions of the premises, the thickness of the walls, partitions, the connection of internal walls to the coordination axes, partitions to internal and external walls. In addition, the plans must show the area of all premises (in square meters, in the lower right corner, with underlining). Floor plans must be signed indicating the floor number or its elevation (for example: 1st floor plan; Plan at level 3.00).

The section serves to identify the volumetric and structural design of the building, the relative position of individual structures, rooms, etc.

In the project of a residential building it is necessary to make a simple section (with one sectional plane) along the staircase. It should be taken into account that the secant plane, as a rule, is drawn along the flight located closer to the observer. In this case the staircase flight, included in the section, is drawn with a line of greater thickness (solid main line) than the contour of the flight, on which the secant plane does not pass. The contour of this flight of stairs is drawn with a solid thin line. The direction of the section is generally taken from bottom to top and from right to left. The sectional plane should not pass through columns, posts, along beams, walls and partitions. It should preferably be located between these elements.

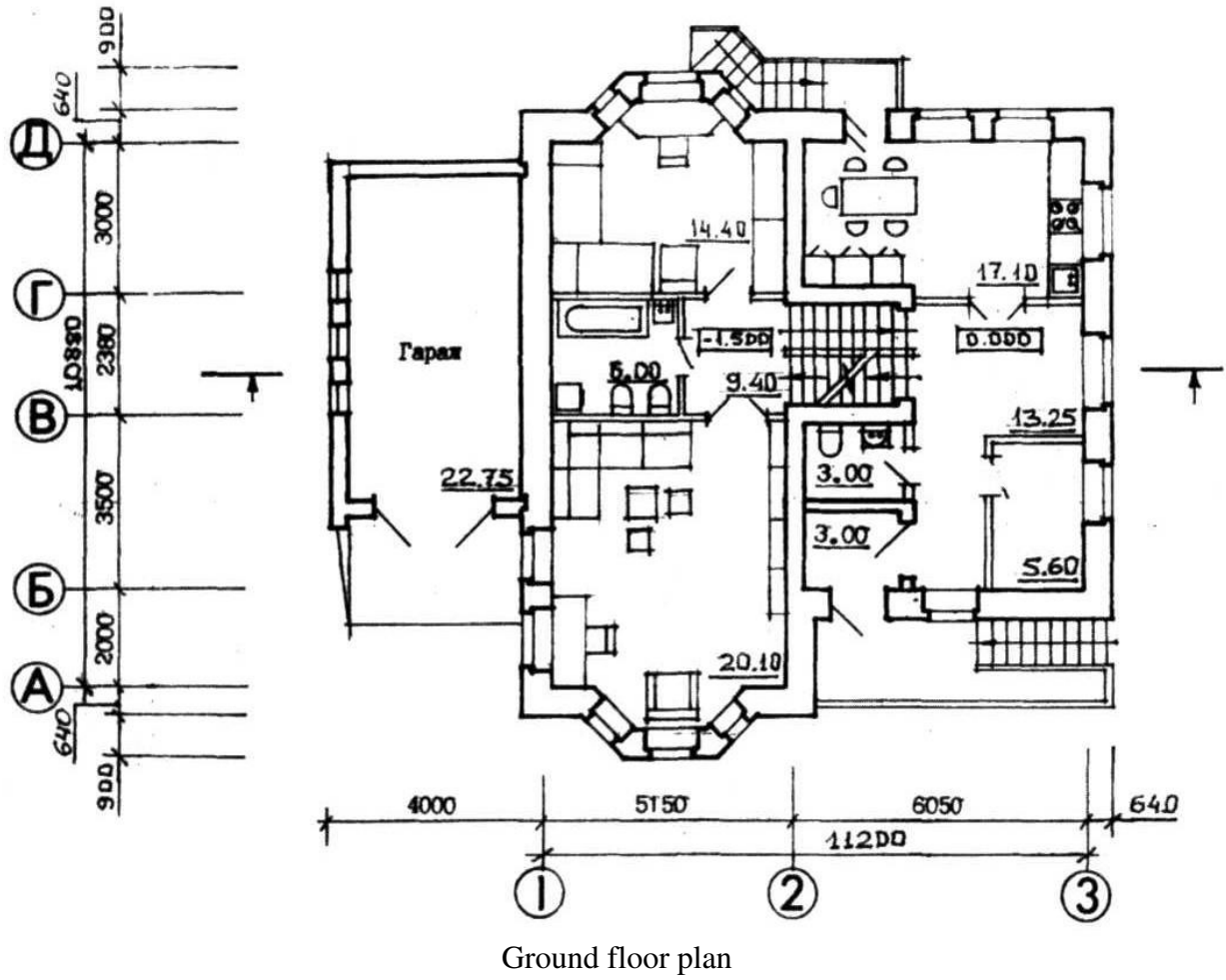


General plan of the site

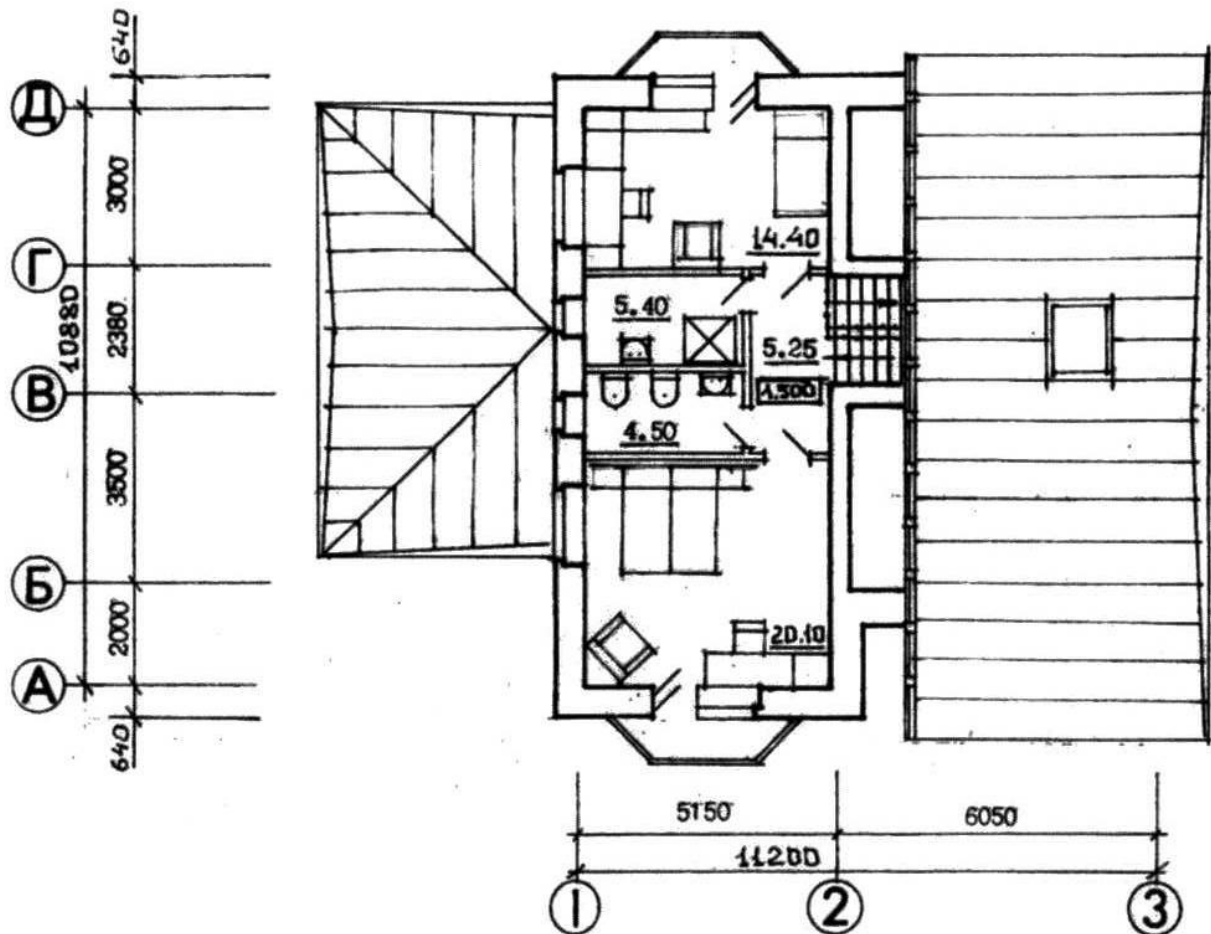


Section 1-1

Fig. 18 Examples of general plan drawings and residential building sectional drawings.



Ground floor plan



1st floor plan

Fig. 19 Examples of plans drawings for a residential building.

On the section drawing it is necessary to mark and indicate: the coordination axes of the building, the distances between these axes, the distances between the extreme coordination axes, as well as marks of the ground level, floor finish level of the ground floor and platforms, marks of the top of the walls, cornices, wall ledges, roof ridge.

When depicting openings with quarters on a section, their dimensions are indicated by the smallest size of the opening. The section dimensions should be marked at the outer contour of the section, then the dimension line should be drawn and the marks should be placed behind the dimension line. The marking stripe should be turned outwards (Fig. 18).

Drawings of floor plans and sections are made in linear graphics and ink. All dimensions are indicated in millimeters, marks - in meters (Fig. 19).

To get a complete idea of the spatial characteristics of the object, the project implies the **model** of the residential house made of white paper.

References

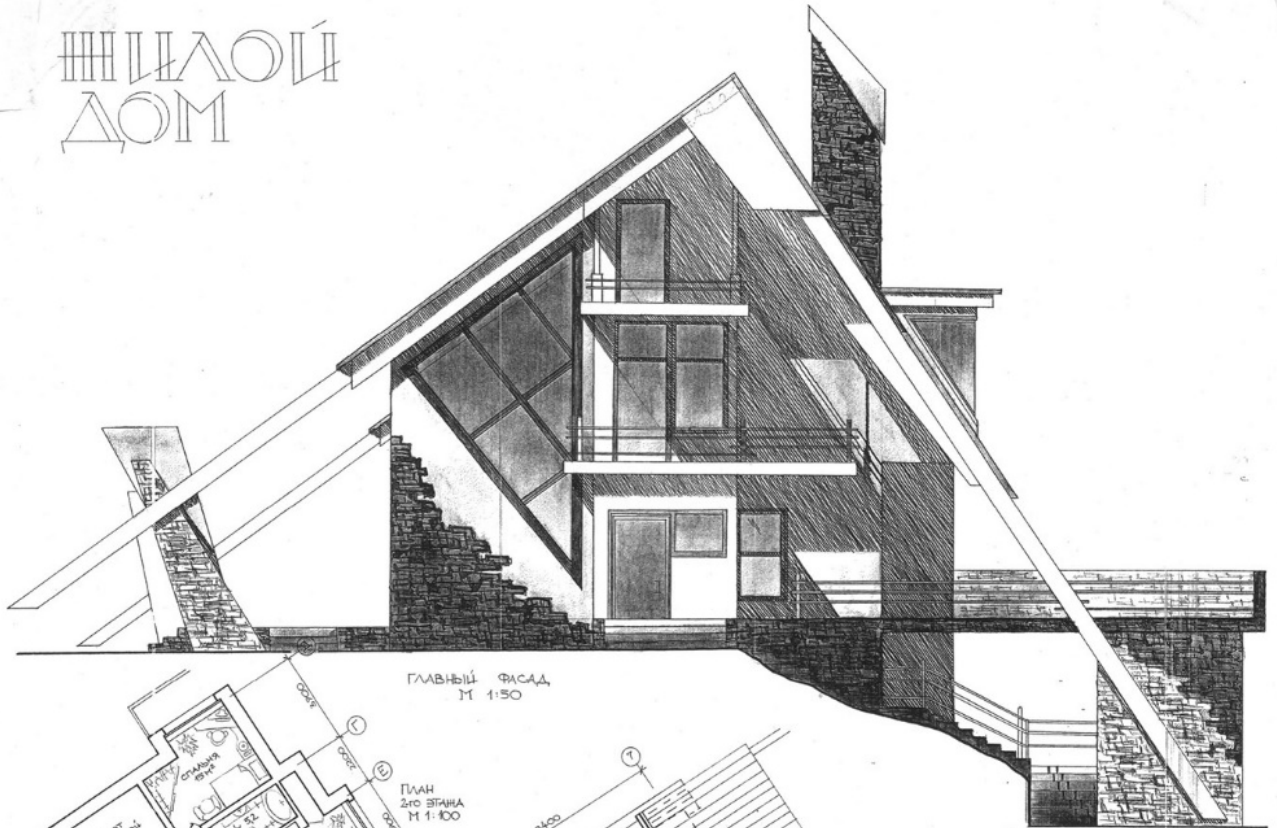
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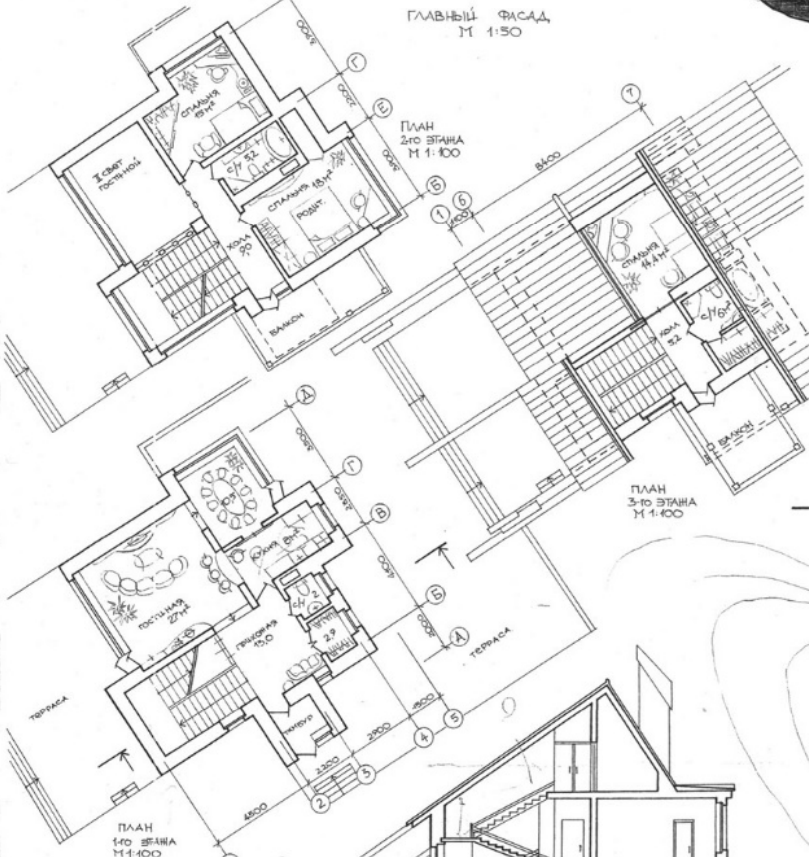
APPENDIX

Examples of course projects

НИЦЛОУ ДОМ



ГЛАВНЫЙ ФАСАД
М 1:50



ПЛАН
2-го ЭТАЖА
М 1:100

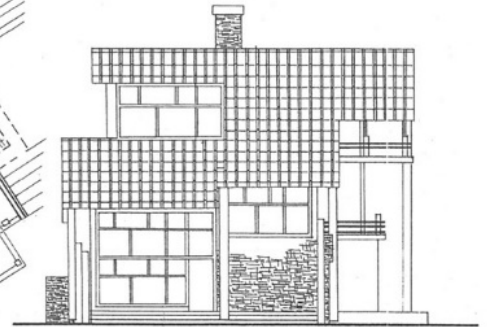
ПЛАН
3-го ЭТАЖА
М 1:100

ПЛАН
1-го ЭТАЖА
М 1:100

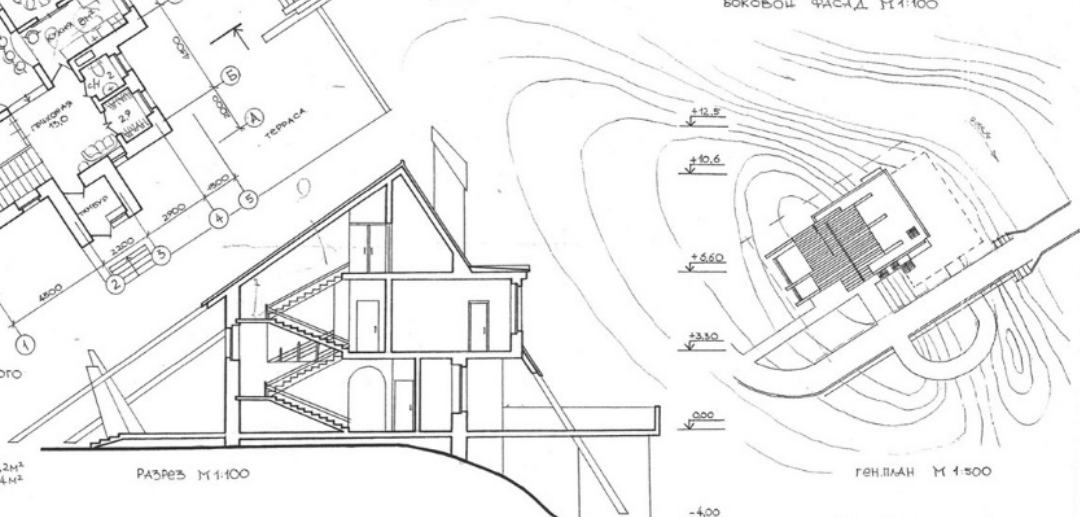
НИЦЛОУ ДОМ КСТЕДИННОГО
ТИПА НА 4 СЕМЬЮ
(ИЗ 4-5 ЧЕЛОВЕК)

ОБЩАЯ ПЛОЩАДЬ - 15,62 м²
ИЖАДР ПЛОЩАДЬ - 7,64 м²

РАЗРЕЗ М 1:100



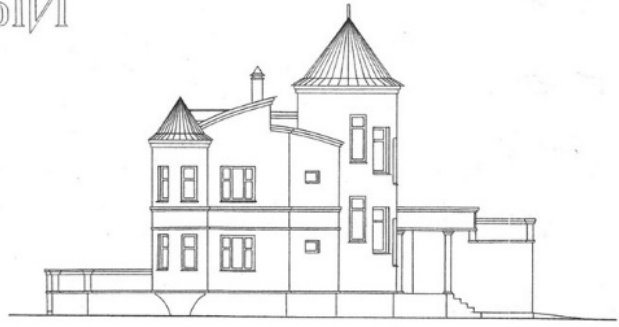
БОКОВОЙ ФАСАД М 1:100



ГЕН. ПЛАН М 1:500

НИПАСУ, ИАГ, ИКУРС, ИРСРС, 2003+
РУКОВОДИТЕЛЬ ГОГОЛЕВА Н.А.

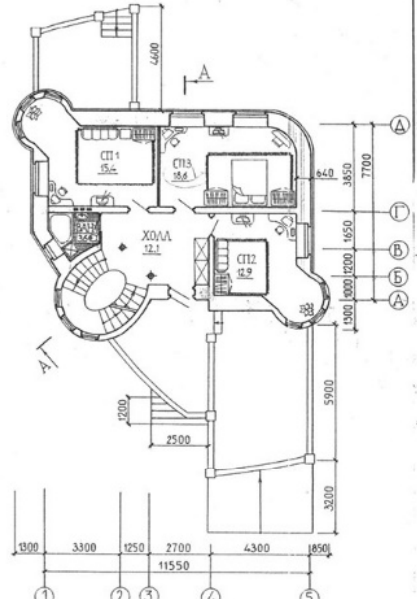
ИНДИВИДУАЛЬНЫЙ ЖИЛОЙ ДОМ



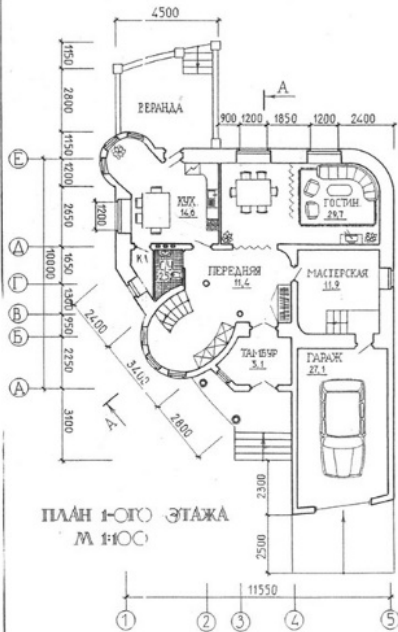
БОКОВОЙ ФАСАД М 1:100



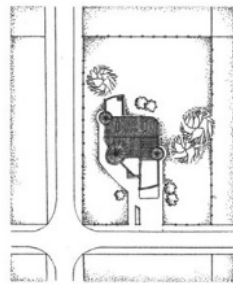
ГЛАВНЫЙ ФАСАД М 1:50



ПЛАН 2-ГО ЭТАЖА М 1:100



ПЛАН 1-ГО ЭТАЖА
М 1:100



ГЕНПЛАН М 1:500

ЖИЛАЯ ПЛОЩАДЬ - 73,6 М²
ПОЛЕЗНАЯ ПЛОЩАДЬ - 78,7 М²
ПЛОЩАДЬ УЧАСТКА - 119,0 М²

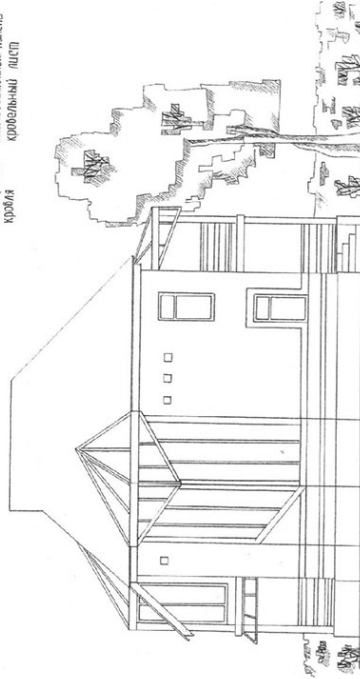
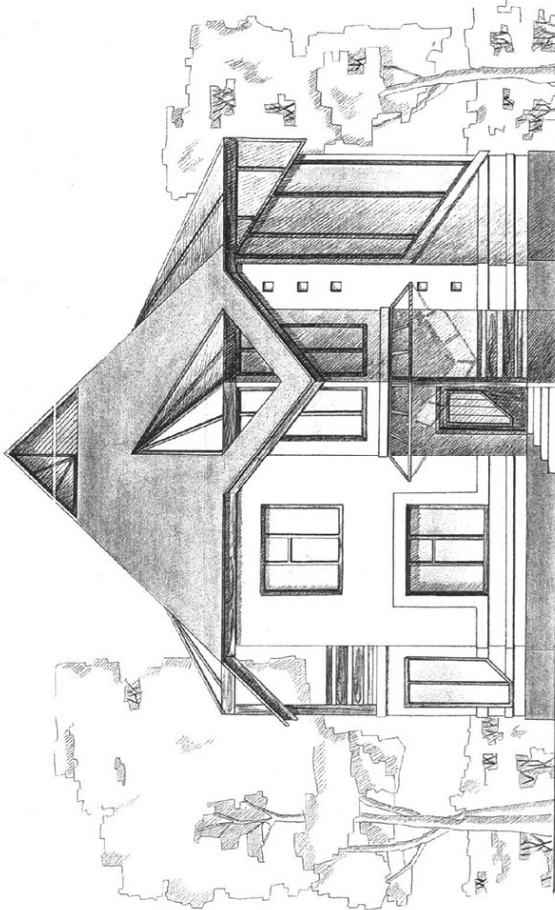


РАЗРЕЗ А-А М 1:100

НИГАСУ ИАГ ТР 097 КУРС II ГОД 2003
ВЫПОЛНИЛА РАФИЖ А.

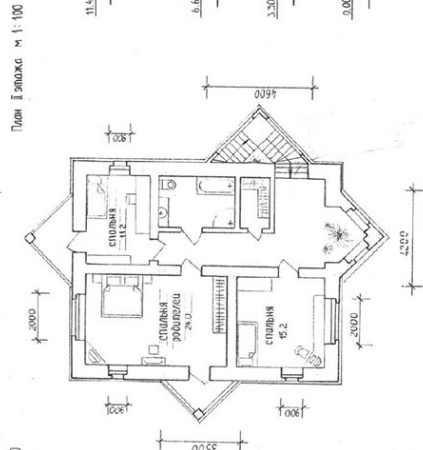
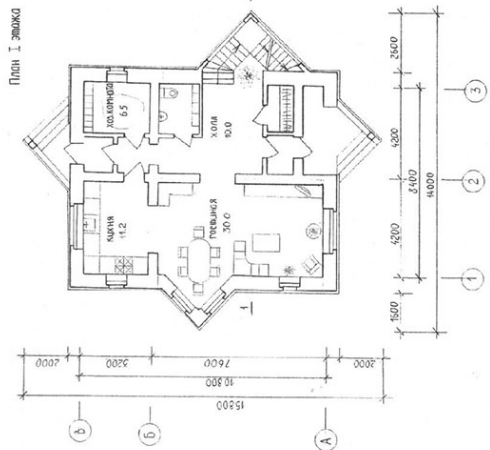
МАЛОЭТАЖНЫЙ ЖИЛОЙ ДОМ КОТТЕДЖНОГО ТИПА

общая площадь 176 кв. м
 жилая площадь 60,4 кв. м
 количество помещений 6
 железобетонные панели
 кровельный лист

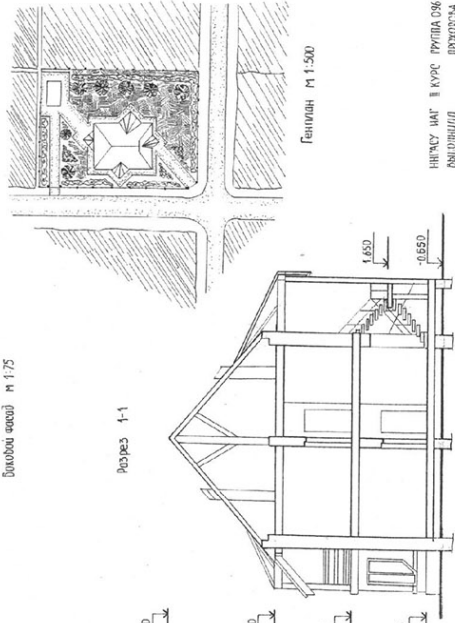


Глиняный фасад м 1:50

Битумный фасад м 1:75

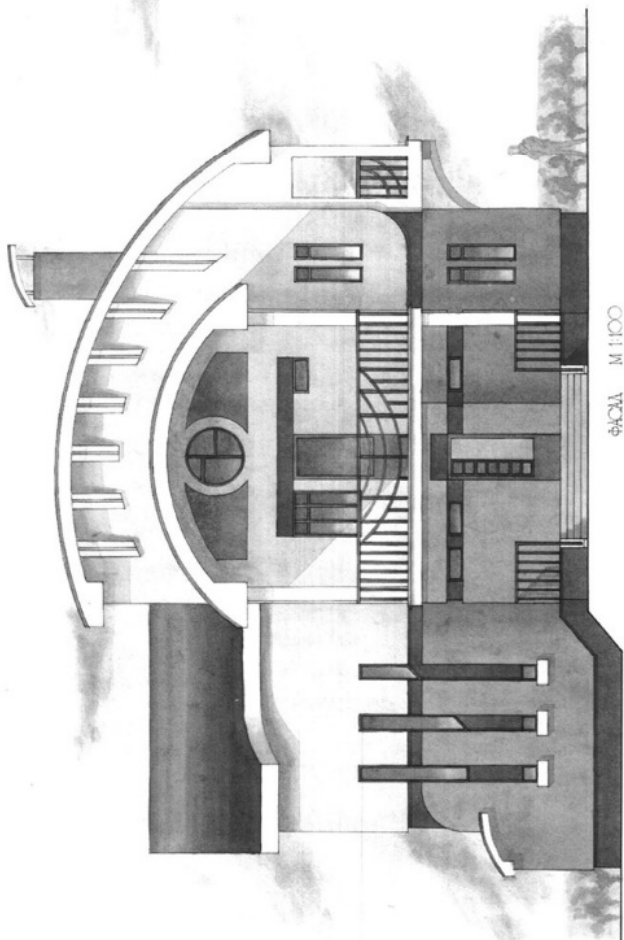


Разрез 1-1

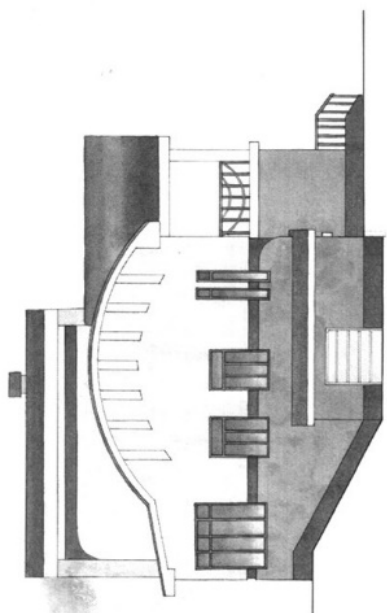


ИРИЧУ МАТ. В КУРС ГРУППА ОБК 2002-9
 ДИДИВИЛИО ДИДИВИЛИО М.Б.
 ПРОЕКТАНТЪЕЛЪЕ ЦВЕТКОВ А.Б.

ЖИЛОЙ ДОМ



ФАСАДА М 1:100



ФАСАДА

11500

6900

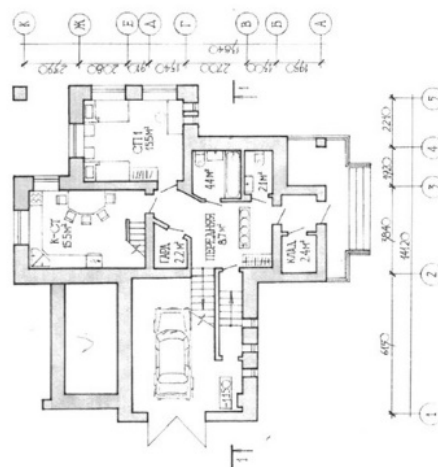
6400

3200

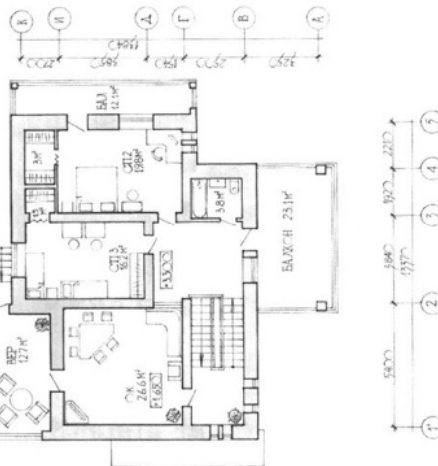
3000

4100

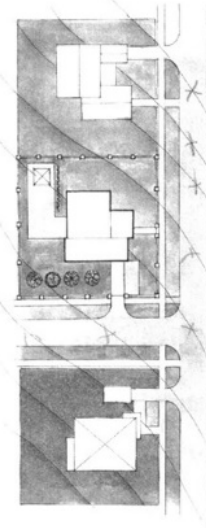
ПЛАН НА ОТМЕТЕЛЕ +0.000 М 1:100



ПЛАН НА ОТМЕТЕЛЕ +1.650 М 1:100



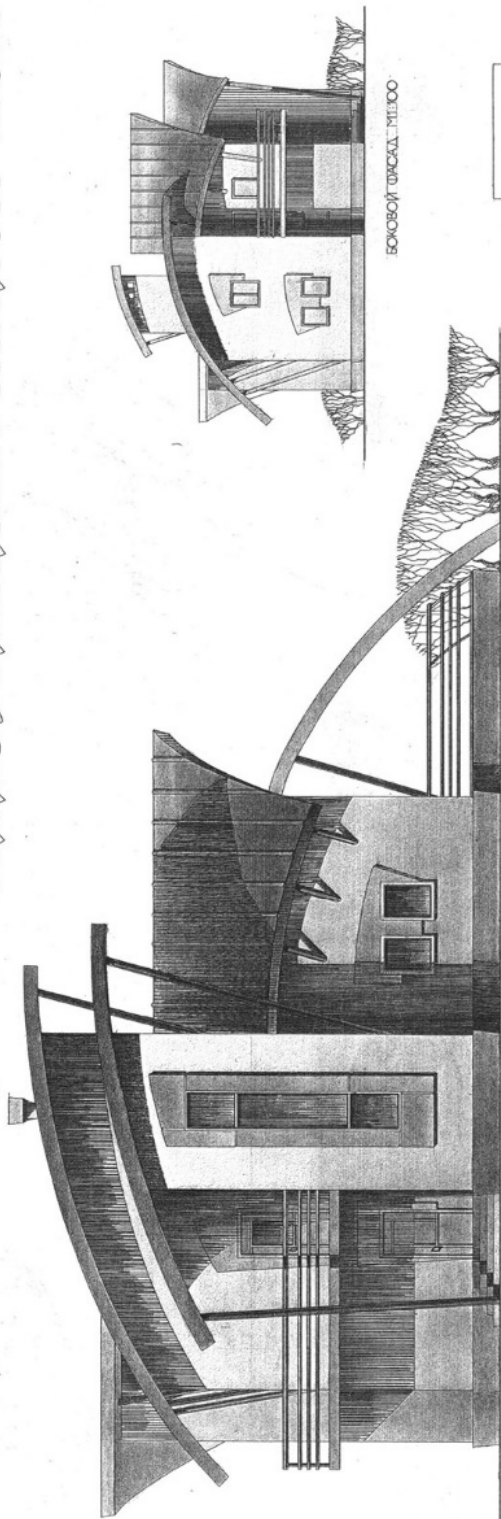
ПРЕЗЕНТ М 1:100



ТЕРИДИН М 1:100

НЕКЪ ДЕТ. ЗАПОС. ПЛОС. 23.07.07.
БЕЛОРУСА ИСХУДБА НА
ПРОЕКТАТА АНТОН БИ.

МАСЛОЭТАЖНЫЙ ЖИЛОЙ ДОМ



БОКОВОЙ ФАСАД М1:100

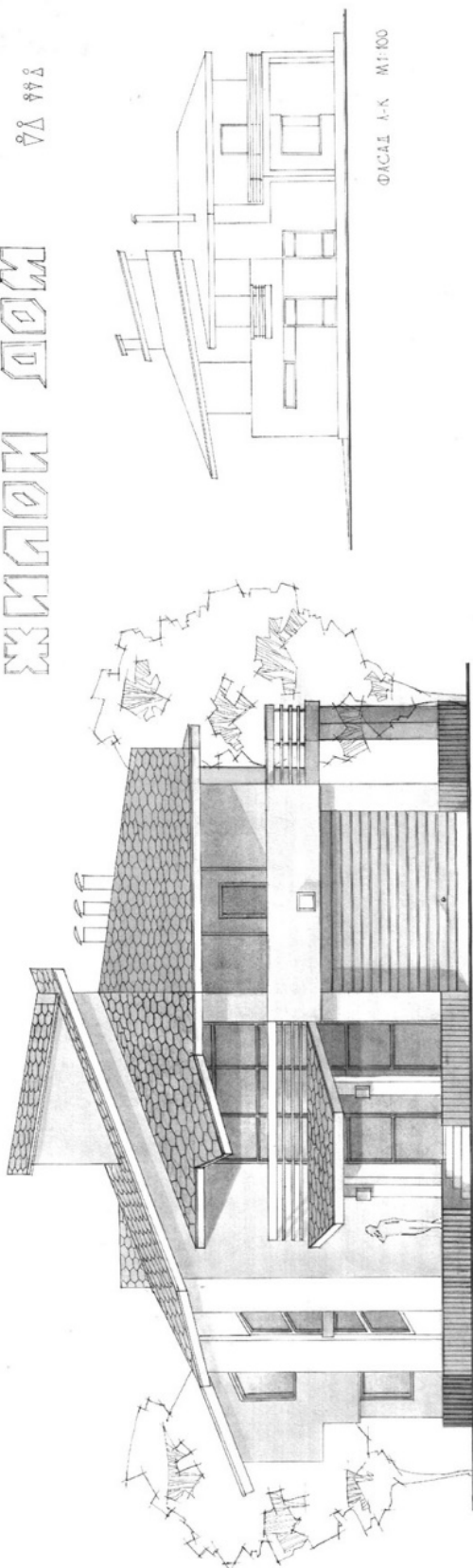
ГЛАВНЫЙ ФАСАД М1:50
 ПЛАН 1-ГО ЭТАЖА М1:100
 ПЛАН 2-ГО ЭТАЖА М1:100
 РАЗРЕЗ А-А М1:100
 ГЕОМЕТРИЯ М1:500

ОБЩАЯ ПЛОЩАДЬ 221 м²
 ЖИЛАЯ ПЛОЩАДЬ 99,21 м²
 КИ 0,45
 ПЛОЩАДЬ УЧАСТКА 1200 м²

ИЛЛЮСТРАЦИЯ
 ПРОЕКТА
 АРХИТЕКТОР
 В.И. ПЕТРОВ

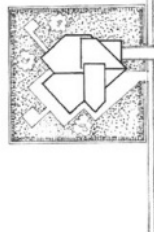
ЖИЛОЙ ДОМ

844

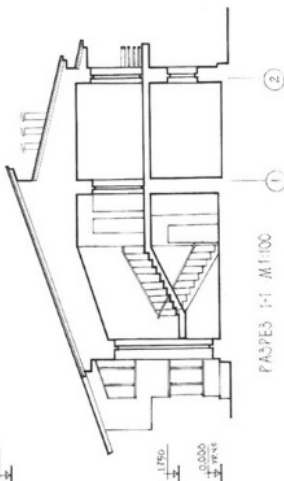


ФАСАД А-К М 1:100

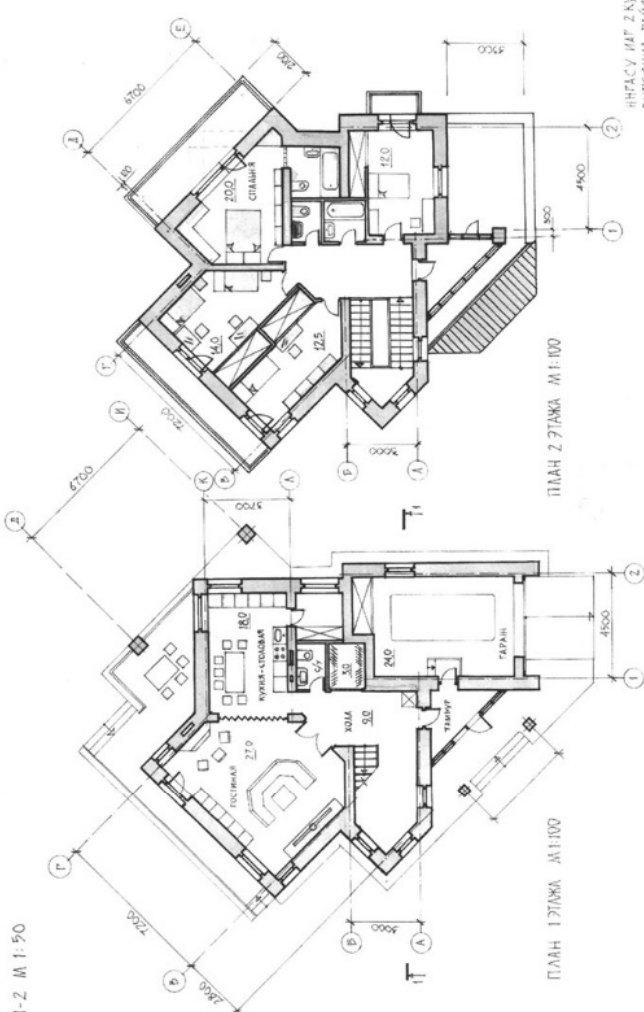
ФАСАД 1-2 М 1:50



ГЕНПЛАН М 1:500



РАЗРЕЗ 1-1 М 1:100



ПЛАН 2 ЭТАЖА М 1:100

ПЛАН 1 ЭТАЖА М 1:100

ИНСТИТУТ ЭКОНОМИЧЕСКОГО
ПРОЕКТИРОВАНИЯ И
ПРОЕКТИРОВАНИЯ
ПРОЕКТИРОВАНИЯ

Цветков Андрей Викторович
Зайцев Алексей Александрович
Лошкарева Дарья Александровна

SINGLE APARTMENT RESIDENTIAL HOUSE

Учебное пособие

Подписано в печать Формат 60x90 1/16 Бумага газетная. Печать трафаретная.
Уч. изд. л. 2,6. Усл. печ. л. 2,8 Тираж 70 экз. Заказ №

Федеральное государственное бюджетное образовательное учреждение высшего
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