

# Modular system in the development of pre-school buildings

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**Abstract.** The present work is devoted to the study of the possibility of applying an integrated modular approach in the development of buildings for children's educational institutions. Three aspects of the problem are considered. Firstly - the need to comply with the requirements for the device, content and organization of the mode of operation of children's preschool organizations. Secondly - ensuring urban planning maneuverability of structures. Parameters of the premises of a children's institution allow using a single module for any functional area. Thus, it is possible to arrange individual function blocks in different ways, and, by changing the number of units, vary the filling number of a children. Thirdly, the integration of architectural design with the simultaneous design of developing territorial complexes - locales in children's educational institutions.

## 1 Introduction

Modular buildings are well established for the rapid erection of objects for various purposes. The most application modular constructions has received in the field of construction of public and individual buildings. Among the main advantages of modular buildings can be distinguished ease of installation and dismantling, the possibility of changing the installation site, compliance with sanitary, as well as fire regulations and requirements. In this regard, the main area of application of modular buildings are residential premises for temporary housing, warehouses, shopping pavilions, country cottages, household buildings in private houses. When creating such buildings, various materials can be used - these can be containers with a metal, wooden or reinforced concrete frame. The covering materials can also vary depending on the purpose of the building.

The building of a children's preschool institution is formed from several isolated groups of rooms: bedrooms, assembly halls, premises of groups, gyms, dining room premises. Parameters of the premises of a children's institution allow using a single module for any functional area. Thus, it is possible to arrange individual function blocks in different ways, and, by changing the number of units, vary the filling number of a children. Due to the possibility of variable arrangement of blocks, the building has fewer restrictions on the shape of the plot of land [4]. The system of modules will allow to react flexibly to town-

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planning conditions and to specific requirements for children's institutions in different regions. It will be especially important in the conditions of renovation.

The article proposes an advanced approach to solving the problem in question. His goal is the integration of architectural design with the simultaneous design of developing territorial complexes in children's educational institutions. For this, the structure is developing a territorial complex, which includes sets of locales for the individual intellectual development of children of preschool age.

The advantage of such a model is due to the ability to launch the manufacture of elements in mass production. This will increase the speed of building and increase the service life.

## 2 Space-planning solutions

In the decision under consideration, a group of children's institutions with a set of auxiliary premises was adopted for this module. This scheme has such advantages:

- Presence of simple modules from which the building is constructing;
- Urban planning maneuverability of the structure, which respond to almost any configuration of the proposed site;
- Variability of facade solutions without changing the design scheme;
- Compliance with regulatory requirements and special needs of the regions (for specialized childcare institutions);
- Industrial approach and quality of products, of which the building is going;
- Reduction of construction time.

The universal module has a simple constructive scheme. The minimum number of load-bearing structures provides flexible layout within the module. In total, in this building will be used 5 types of modules: a block of one children's group, common children's rooms, an outdoor playground, administrative and entrance groups, eating establishment and laundry room. Using these modules, you can create a pre-school establishment for the required number of places by attaching modules horizontally and vertically.

The layout of the modules makes it possible to place the children's educational institution on the site of any configuration, placing the functional modules in accordance with the requirements for illumination. The area of the light front of each module provides the necessary level of insulation of internal premises [5].

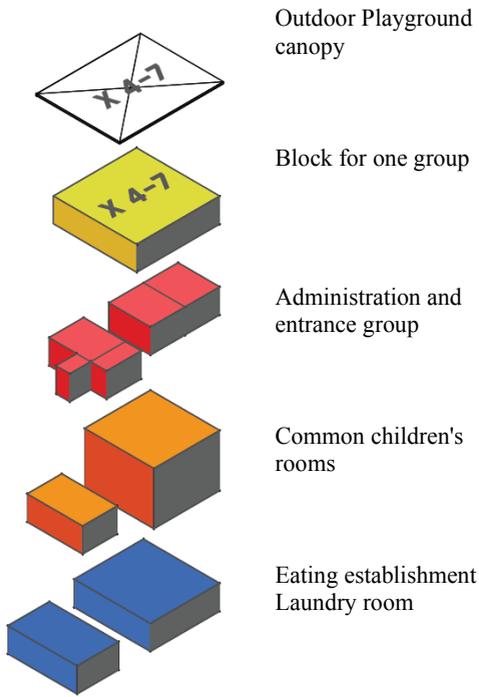
Based on the standards for the design of preschool institutions, depending on the number of group cells, the set of servicing facilities in the children's pre-school establishment is changing. By the number of area and their volume, there are three types of layout:

S (small) - small format includes 4 to 7 group cells (Fig.1). The block of one group includes: a wardrobe, a bathroom, a gaming room, a bedroom, a canteen and exhibition. Administration and entrance group include a medical unit, administrative offices, security, lobby, double vestibule. Common children's rooms include a music hall and gymnasium, a hobby-educational complex and ancillary facilities. M (medium) - medium format, consists of 8 - 13 group cells.

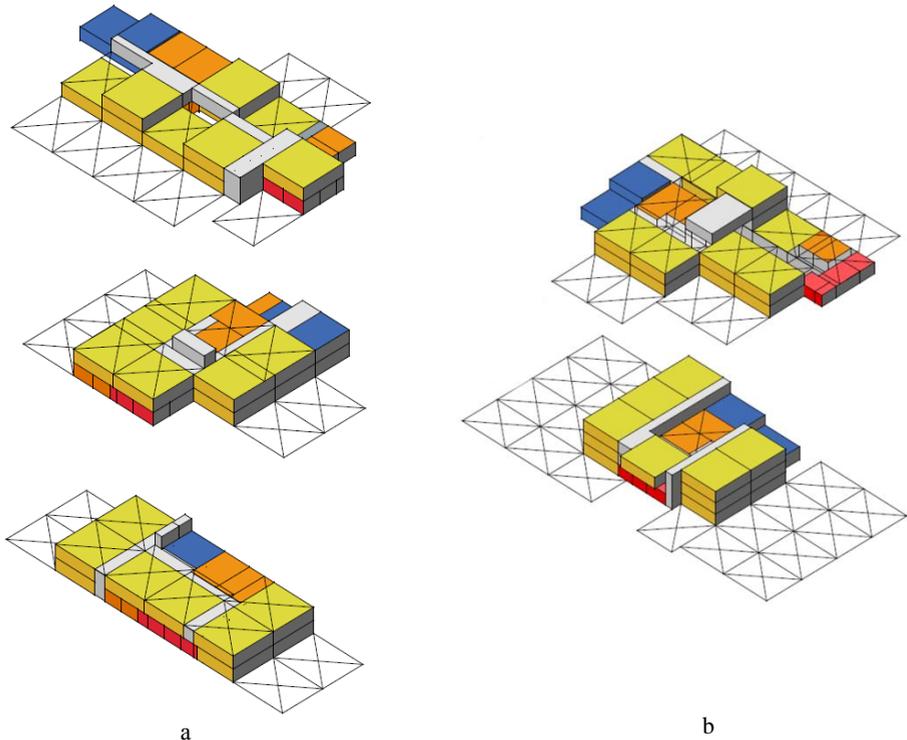
L (large) - a large format, includes from 14 to 19 group cells.

For medium and large format, there is a proportional increase in the number of modules. Examples of layouts are shown in Fig.2.

If necessary, it is possible to increase the number of public or group blocks. In the examples presented, the number of children's institutions is 3 floors, which makes it possible to implement high-density buildings. In the presence of extensive sites, it is possible to reduce the number of floors.



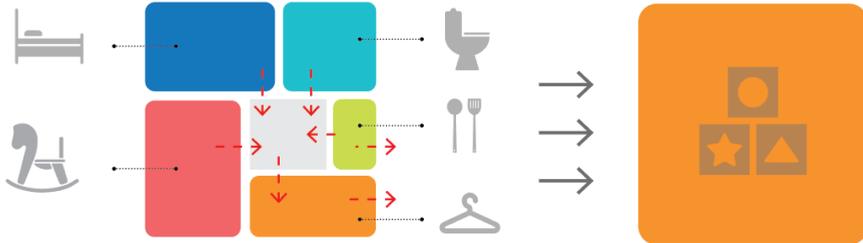
**Fig.1.** A set of modules and examples of layout of small format (S)



**Fig.2.** Examples of layout of medium (a) and large format (b)

### 3 Accommodation of space

The modular building in the plan consists of blocks of the same size, connected by hallways and vertical communications. An approximate scheme for forming a block module for one group is presented in Fig.3.

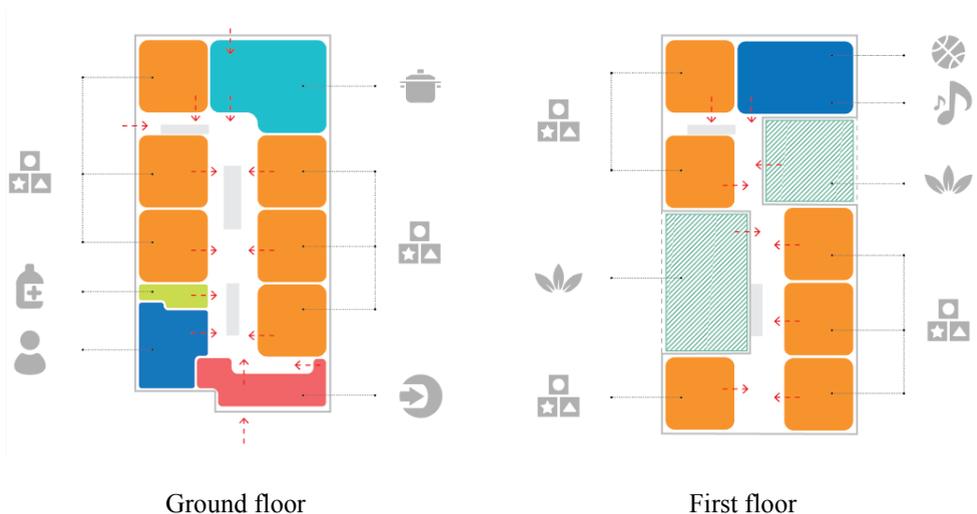


**Fig.3.** Block formation scheme for one group

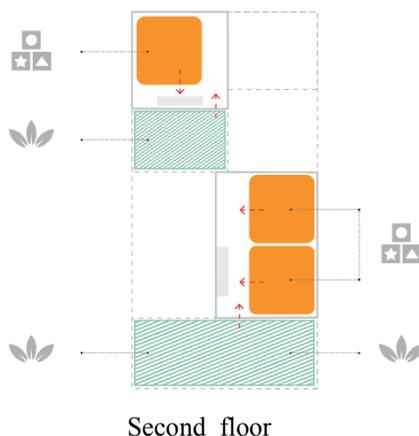
On the axis of the main entrance there are central wide halls on each floor, as well as an elevator for the movement of people with disabilities, which is also an elevator for fire departments. Staircases with natural light are located at the side facades and are used to evacuate people in case of fire.

The shape of the building allows to provide maximum illumination of the premises with the stay of children, playrooms, halls and study room for working with children. With this layout, short convenient connections are provided between the modules of each group, the servicing and auxiliary rooms. The location of the entrances and the planning structure of the building provides the principle of group isolation [6].

The zoning of children's pre-school institution is shown in Fig.4 and Fig.5. On the ground floor there are main servicing rooms, such as entrance hall, lobby, security room, cloakroom, bathroom for disabled people, eating establishment, medical unit, administrative section, manager's office, accountants, staff salons, laundry, 4 groupblocks for children early age from 1 to 3 years and 2 groupblocks of younger preschool age from 3 to 4 years. The entrance group includes a room for storage of wheelchairs and bicycles..



**Fig.4.** The zoning ground and first floor



**Fig.5.** The zoning the second floor

On the second floor are mainly blocks of children's group for 6 groups of younger preschool age from 4 to 6 years, as well as the premises of the music hall and gymnasiums, as well as the coach's office, the music director's office, and the personnel's bathroom.

On the third floor there are cells of 3 older children's groups, from 6 to 7 years old and 3 walking areas in the open air.

The underground technical floor includes a supply ventilation chamber, electrical switchboard, pump room, individual heat point, storage room for fluorescent lamps, garden equipment storage.

The pre-school preschool institution designed in this way can accommodate up to 270 children.

#### **4 Development locations for ensuring individual intellectual training for preschool children**

The speed of developing modern society require faster adaptation for a different aspect of real life. A wide range of different relevant tasks are carried out by preschool institutions.

In accordance with the Federal State Educational Standard for Preschool Education, approved by order of the Ministry of Education and Science of the Russian Federation of October 17, 2013, N 1155 [7], the Program for supporting childhood diversity, preserving the uniqueness and self-value of childhood as an important stage in general human development. The implementation of the Program is envisaged in the form of game, cognitive and research activities, in the form of creative activity that ensures the artistic and aesthetic development of the child, the individual needs of certain categories of children, including those with disabilities. The program focuses on ensuring the variability, diversity of content and organizational forms of preschool education, taking into account the educational needs, abilities and health status of children for communicative, social, educational, artistic, aesthetic, physical development.

In order to ensure proper conditions for the implementation of the tasks of the educational standard of preschool education, the concept of integration of traditional architectural design with simultaneous design of territorial complexes - development locations - for preschool children's educational institutions. The implementation of integration involves the need to solve the following main tasks:

- formation of the main directions included in the development locations;

- determination of the architectural requirement for development locations;
- development of the concept of operational adaptive integration of various areas in one development locations, depending on the combination of interests and hobbies of the real contingent of preschool institutions.

Integration unifies design processes, improves the quality and cost-effectiveness of the design itself. Additionally, integration creates a synergistic effect. It allows you to more deeply and meaningfully implement the tasks set for the development of children. Given the limited nature of the article, we will consider in the general concept the composition of the main areas included in the development localities and outlines of the architectural requirements for development locales.

Based on the basic directions of the formation of the modern personality, the requirements for the preschool preparation of the younger generation [7], it seems appropriate to identify as the main areas: general education, artistic, musical, choreographic, theater, sports, information technology, mathematical, etc.

When designing developmental locales to take into account the educational needs, abilities, and state of health of children, it is planned to make extensive use of various color schemes in accordance with the specific directions of intellectual development locales for interior design. This will provide an adequate impact on the psyche of children and will increase the effectiveness of development. In addition, the development of techniques for the use of ornaments, including three-dimensional. As patterns for ornaments, it is planned to use parametric software modeling [8]. It is possible to use non-standard sound-absorbing materials for wall partitioning structures, for example, music rooms, sports rooms.

In terms of architectural requirements a number of building standards and regulations are used. All development of locations take into account standards for future contain and work organization[9]. For site planning at the urban level, the relevant rules of planning and building are applied [10]. Whole complex is designed with a public purpose [11], provided with access for people with limited mobility [12]. Along with the above, the design includes energy efficiency accounting [13]. The buildings have a fire safety system [14].

## 5 Conclusions

The article describes the development of preschool institutions based on a modular approach. It is shown that the use of modular systems for the integration of architectural design with the simultaneous design of developing territorial complexes - development locales - in children's educational institutions allows developing various projects that can be easily adapted both to the specific needs of the region and to the existing building area. Modular systems are convenient for the formation in them of the provision of individual intellectual development of children of preschool age. The main tasks are formulated, the solution of which is necessary for the implementation of the integration concept.

Modular systems will allow you to quickly build buildings of preschool institutions in accordance with the needs of the population, its will fully complying with all regulatory requirements for modern construction projects.

The main developments outlined in the article are implemented in the renovation project of residential areas of the Golovinsky district of the city of Moscow. Designed with the use of these developments, a preschool institution can accommodate up to 270 children. The presentation of the project took place in the Central House of Artists in Moscow in May 2018 [15-17].

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