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Space-Planning Modernization Methods for Educational Buildings of the Southern Federal University

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Abstract: Nowadays, the modernization of higher education in Russia is a comprehensive approach - from changing teaching methods and education informatization in its different aspects to the enhancement of material and technical basis and the development of social infrastructure. The difficulty of space planning modernization of a university is that there are many educational buildings in different architectural conditions. They have diverse teaching specificities, many problems and shortcomings. In order to solve these problems they consider a method of space planning modernization and reconstruction that can promote a brand new row of educational buildings for a university.

Key words: Modernization · Reconstruction · Educational buildings · University complex

INTRODUCTION

The questions of space planning modernization of university facilities are the most important for carrying-out priority state programs aimed to the development of higher education in Russia.

Various institutions of higher education united in Federal Universities form a complex functional and planning structure with all sorts of departments. Educational buildings, on their turn, differ in types, size and capacity of rooms. It is necessary to create appropriate conditions for the improvement of training efficiency. This is possible if a system and "flexible" approach will be used in architectural modernization of university buildings [1].

The analysis of existing material and technical basis of educational buildings belonging to the Southern Federal University allowed us to reveal its main drawbacks: work space shortage, lack of certain rooms (recreation rooms, universal areas, special-purpose rooms); space planning and functional structures of buildings do not create conditions required for a full-fledged educational process [2].

The modern foreign practice of design and construction gives us a large basis of examples of university development [3-5]. In spite of Russian experimental method foreign colleagues have development concepts that they are constantly working on. This allows them to change their directions in accordance with changing world course of higher education.

It should be noted that, in addition to new construction, material and technical basis of university buildings is being widened with the help of various reconstruction methods. These methods are especially useful for the existing universities that have an urban allocation scheme. The Southern Federal University can be referred to such institutions.

The article is aimed to studying possible methods of space planning modernization and reconstruction o f existing educational buildings of universities. Besides, the authors try to identify research parameters for the rational choice of modernization method and reconstruction measures.

The space planning modernization of educational buildings means the enhancement of objects with the help of different reconstruction methods and IT equipping.

The reconstruction of buildings and facilities includes a row of measures for the reorganization of their space-planning and constructive solutions: replanning; strengthening or substitution of structures; adding; heightening; insertion; front enhancement; creating modern interiors [6].

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MATERIALS AND METHODS

Existing reconstruction methods can be divided into two main groups: without changing the original dimensions of buildings and with broadening the space-planning dimensions of buildings [7].

Modernization methods in principle should be chosen sequentially. First of all, it is important to ground the necessity of broadening, to find out modernization opportunities in the existing dimensions of a building; secondly - to value its physical capacity; thirdly - to work out reconstruction proposals; fourthly - to estimate the economic efficiency of the proposal; fifthly - to check whether the expected result meets the demands. At the end of inspection, one should choose a rational method of modernization and a package of reconstruction measures.

In the course of investigations we found out the parameters that can be divided in two categories:

- The parameters determining the necessity of broadening;
- The parameters estimating the possibility to change the space planning dimensions of a building.

The first category of parameters include: the scale of area deficit, the quantity and the functional purpose of deficit rooms.

The scale of area deficit is obtained by the percentage of missing areas to the existing ones. If there is no area deficit, or if there is an excess of them, or if there is a slight deficit (up to 10%), then the modernization in the dimensions of a building is possible. When the deficit value is average or high (30-50 %) it is necessary to carry out modernization with broadening of dimensions. If the deficit value is limiting (more than 50%) it is recommended to carry out modernization by new construction.

The quantity and the functional purpose of deficit rooms are obtained by quantitative indexes (from 1 to 10 and more than 11) in the following groups of rooms: specialized, general-faculty, educational, lecture rooms of different capacity and multifunctional zones.

If there is no room deficit or if there is a slight one then modernization can be carried out in the existing dimensions. If the values of deficit are maximum, it is recommended to start a new construction. By average values, one should determine possible reconstruction measures with space-planning changes.

The second group of parameters includes: the physical deterioration of a building, the scale planning structure and the functional interconnections.

The degree of physical deterioration of the whole building is obtained by the sum of physical deterioration values of its separate elements, structures and systems that have their own specific percentage ratio in the whole building. The estimation of physical deterioration is conducted in accordance with deterioration estimation rules for buildings (VSN 53-86(p). Within the bounds of this research, the values of physical deterioration of buildings are conventional. They are obtained in accordance with the percentage ratio: 0% - a new building; 30% - a building in want of a face-lift; 60% - a building requiring a general overhaul with the strengthening of structural members; 90% and more - house breaking and new construction are required. A building is estimated visually by external and internal inspections.

There are several types of space planning structure of functional units in educational buildings: large-block structure, small-block structure, hall-type structure and mixed structure. The type is identified by the comparison of the existing structure with the demand. It can be expressed in two indexes: correspondence or disparity with the required structure. In compliance with this, the possibility of correction with the help of replanning or the necessity to create external planning blocks (adding, insertion, heightening).

Functional interconnections between rooms are estimated by the degree of their necessity (necessary, desirable, possible, not necessary). They are expressed in two indexes: meeting the requirements or not meeting the requirements. This parameter let us estimate the necessity of functional redistribution of zones and rooms, replanning.

There are basic indexes for each of the modernization methods. They determine the usage of one or another reconstruction measure. If they do not meet the requirements of the educational building then one considers the interaction of all indexes that can influence the decision.

It should be noted that, in addition to space planning parameters, there is an architectural factor - the placement of facility in a town. This factor can influence crucially the possibility of building broadening. University educational buildings can be classified in the following way [8]:

- Facilities situated in densely built-up areas (in central part of towns). The modernization of such facilities is limited in effective reconstruction methods because there is no opportunity to absorb the surroundings;
- Facilities situated in the part of town structure that has reserved or free territories (in suburbs). These facilities have a great advantage in choosing effective methods of reconstruction.

Main Part: On the basis of experience in reconstructing public buildings and the analysis of studied university facilities, the author propose the following classification of modernization methods for educational buildings of the university:

- The adaptive method;
- The method of internal reconstruction;
- The method of external reconstruction;
- The revalorization method.

The adaptive method is based on getting the optimal values of functional and planning parameters without changing the internal layout of the existing building. This is carried out by functional redistribution of areas and room and also by technical and engineering re-equipment [9].

This method is suitable mainly for buildings situated in densely built-up areas of a town if: area deficit is absent or it is very slight; functional interconnections in a facility do not meet the requirements and it is necessary to redistribute rooms.

The method of internal reconstruction without changing the dimensions means the replanning of existing rooms, the development of the basement and the attic, the absorbing of excess areas and rooms [9].

The replanning of the buildings situated in densely built-up areas and in areas with reserved territory is carried out with a slight deficit of areas if the redistribution of rooms is necessary.

When the deficit indexes of areas and rooms are high, the replanning is possible together with other reconstruction measures.

It is possible to develop basement and attic if the building has reserved areas and the deficit values do not exceed them.

The method of external reconstruction with changing the dimensions and space-planning solution of a building consists in an insertion (of a room or a section), an adding of functional planning units to the existing buildings, or a heightening (the expansion in the number of stores). Besides, it can be applied by housebreaking a new construction [9].

The insertion of new rooms is conducted in the blanks between the existing buildings. In educational buildings, it is rational to use new areas and rooms as zones for recreation and communication, or as rooms for general faculty needs.

This method is possible to apply in a densely built-up area of a town if a building has a U-shape or a closed shape.

Additions, depending on the type of connection, can be:

- The structures adjoining on all sides;
- The structures connected to the existing buildings by passages;
- The structures uniting two or more existing educational buildings.

The first type of addition is used in densely built-up areas with slight deficit of areas and rooms if the existing space planning structure meets the requirements and physical deterioration does not exceed 60%.

The second type of addition is the priority one because new rooms are designed and constructed as separate buildings. This makes it possible to apply the necessary space-planning and structural concept. It is used in areas with reserved territory when a faculty has a quite large deficit in work space.

Universal functional and planning units are necessary for efficient modernization according to the method of adding [10].

The third type of addition is the uniting one. It is useful for the modernization of the existing comprehensive development of university educational buildings. The functional purpose of such type of addition includes recreation and communication.

Heightening of the existing buildings is one of the most effective architectural and planning methods as it does not require additional areas. This is a rational method for the densely built-in areas of a town. It is possible when there is a positive technical conformance of load-carrying ability of the existing structures of a building when physical deterioration is not more than 60%. All these facts determine the necessity of additional measures for strengthening the existing elements or the need for new construction.

A heightening can include one or two stores both above the whole building and above its part depending on the actual area and the demand.

Housebreaking with new construction is a cardinal method of modernization. It is carried out only in the case when physical deterioration of a building is 90% or more. Other space planning parameters do not influence the application of this method.

The revalorization method is changing of functional purpose of a building. His method can be complete or partial. Partial revalorization is used if an educational building has two or more functions. In this case, broadening is carried out by transferring the excess functions to new specialized buildings and re-equipment of cleared rooms according to the main function. Complete revalorization is conducted when function are redistributed between buildings in order to optimize the connections between them.

In the course of complete valorization, the existing cleared building is used for the educational purpose of some other faculty or department of a university.

On the basis of worked out methods of space planning modernization of educational university buildings and the analysis of facilities belonging to the Southern Federal University, the authors studied educational buildings and made a proposals for their reconstruction.

Bearing in mind the sequence of modernization method, the educational buildings of the Southern Federal University were analyzed by the parameters of the first category. As a result, the authors found out the facilities that do not require or require space planning modernization.

It is recommended to conduct the modernization of the first facilities using the adaptive method (Figure 1) and the method of internal reconstruction (Figure 2).

On their turn, facilities that require space-planning broadening were considered according to their place in the city. Educational buildings in the historic central part of Rostov-on-Don and Taganrog as a rule are situated in densely built-up areas. They were built in the end of 19 - the beginning of the 20 centuries. They have some architectural and planning peculiarities: corner buildings on the crossing of central streets, two main facades are on the frontage line and one of them has an entrance. On the plan view, buildings have a U-shape or a closed shape with a courtyard. The height of such buildings is from 3 to 6 stores.

Such facilities have several possible ways of modernization. We propose the following measures of the method of external reconstruction: an insertion of a functional unit and heightening (Figure 3). If using them one should broaden a facility to the max with minimum

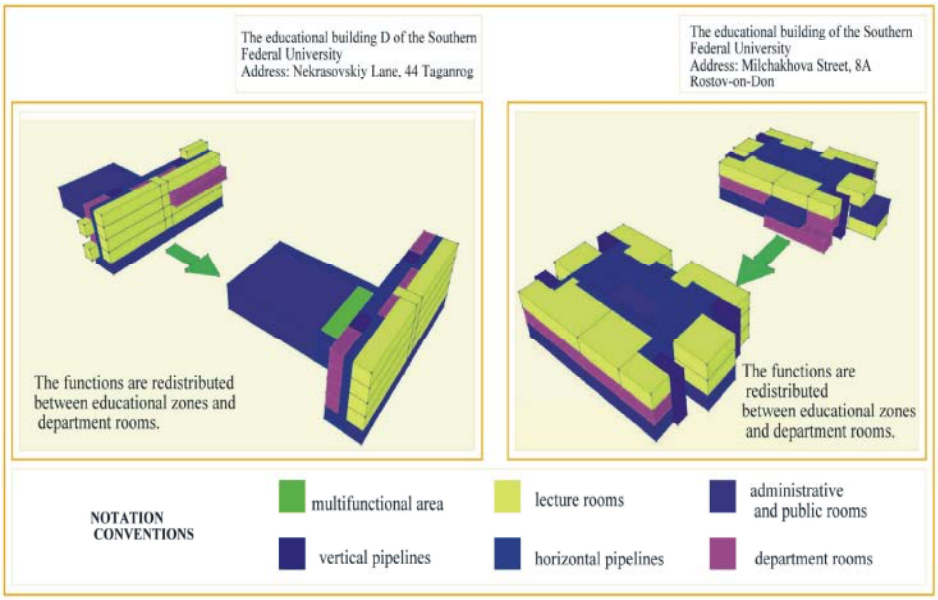

Fig. 1: The modernization proposals for educational buildings of the Southern Federal University using the adaptive method.

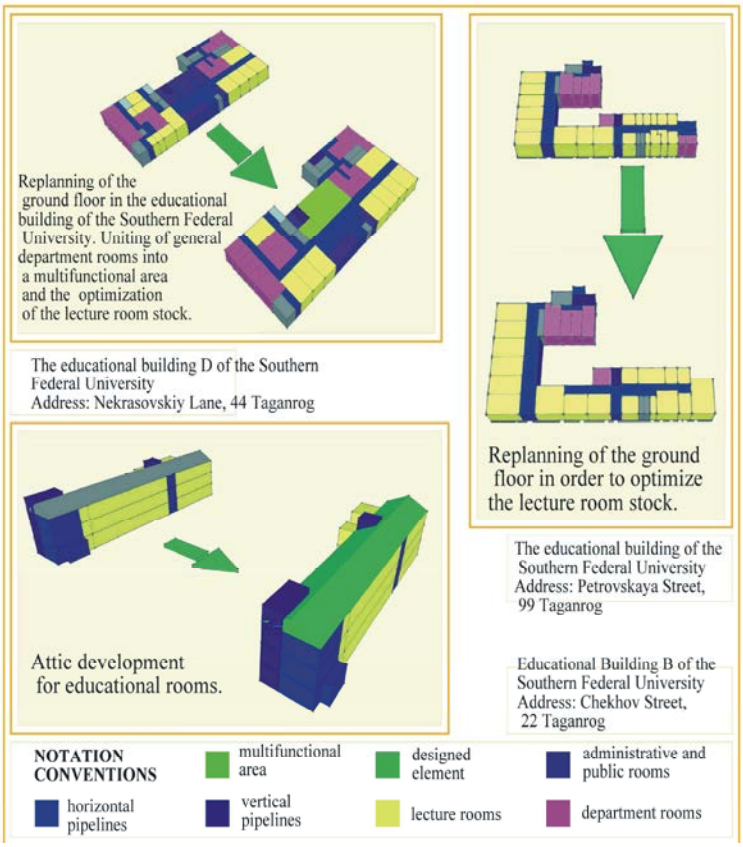

Fig. 2: The modernization proposals for educational buildings of the Southern Federal University using the method of internal reconstruction.

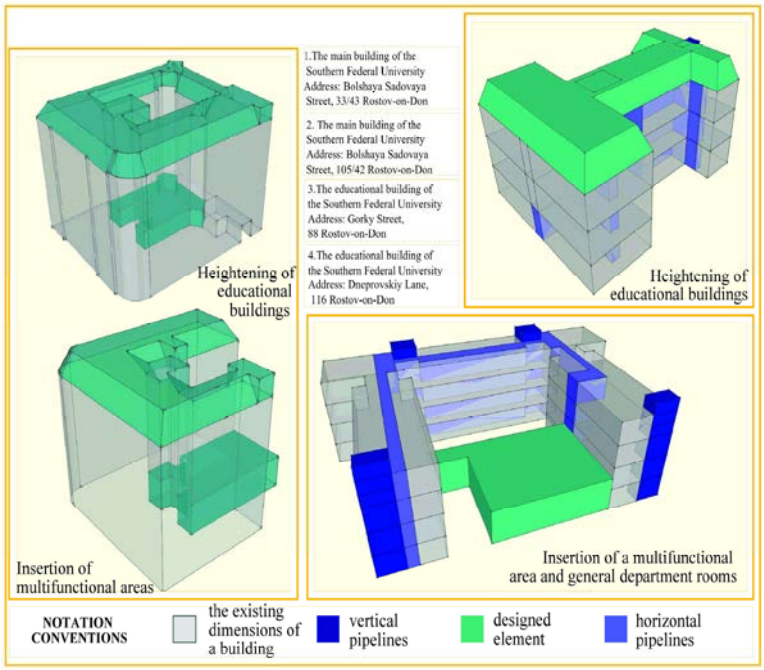

Fig. 3: The modernization proposals for educational buildings of the Southern Federal University using the method of insertion and heightening.

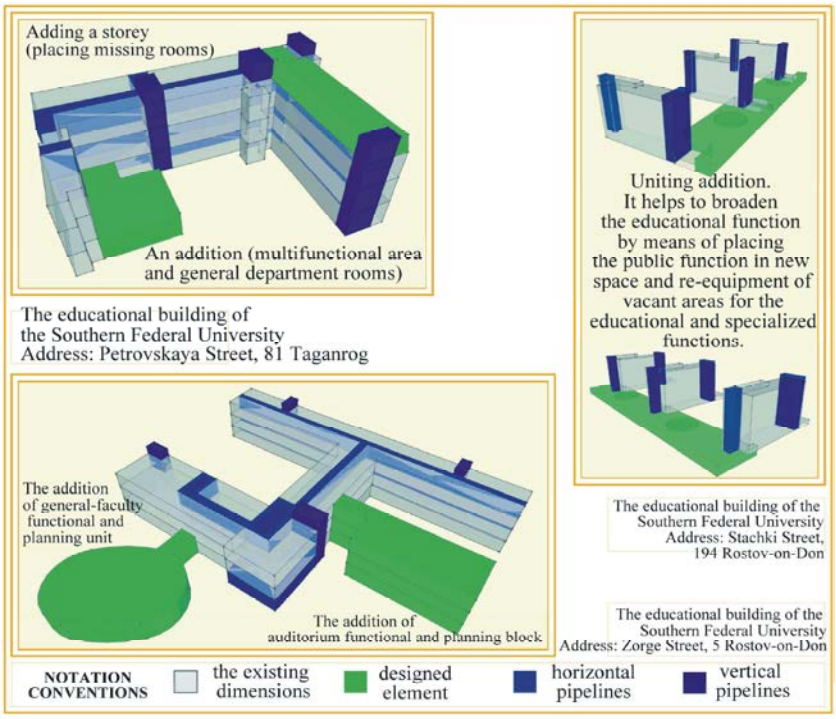

Fig. 4: The modernization proposals for educational buildings of the Southern Federal University using different additions.

interference in architectural the image of the building. It is necessary to apply these measures along with the adaptive method and internal reconstruction.

Concerning buildings situated in the historic part of the city, it should be noted that these buildings usually combine both educational and administrative functions. This is a forced combination of different functions. That is why it is necessary to use the method of partial revalorization in modernization.

For the educational buildings situated in the area with reserved space, we propose to use the most effective measure of external reconstruction - the addition of a functional planning unit. One should choose the type of addition depending on the functional purpose of deficit rooms. It is recommended to add a planning unit in accordance with the existing structure of the building and the type of the unit (Figure 4).

CONCLUSIONS

As a result, we can state a fact that the article proposes the classification of modernization methods for the educational buildings of universities. Besides, the article describes reconstruction measures for each of them. The authors formulated an algorithm and found out the investigation parameters of facilities for choosing an effective modernization method and reconstruction measures. The implementation of these actions will give the opportunity to create an optimal functional and planning structure of educational university buildings for educational process that will meet the up-to-date requirements.

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