

Spatial organization of modern university campuses environment

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Abstract. The study reviews the regularities of the spatial organization of university campuses environment considering the functional needs of students, the spatial connections between functional areas, buildings and structures of the campus. Also a historical analysis of the development of complexes of higher education institutions in Russia is carried out. Thus, the general tendencies of creating the environment of university complexes have been reviewed. The concept and principles of the spatial organization of the environment of modern university campuses has been proposed. A conceptual architectural and spatial model is proposed taking into account the functional needs of residents.

1. Introduction

A student quarter is a form of environmental organization that has taken shape in the former Soviet Union, which is the territory on which student dormitories and, in some cases, household services are located. This form of organization took shape in the Soviet period, when higher education gained significant distribution and development in Russia (Figure 1) (Russian Federal State Statistics Service).

The first leap occurred after 1918-1921, during the process of economic recovery. After the civil war, famine and devastation, the need for a large number of qualified specialists for the restoration of the country and the development of industry and, as a result, the need for the creation of a powerful educational system and higher education institutions as part of it was clearly manifested. The number of universities increased rapidly, but the contingent of students in a particular university was limited and, as a rule, was in the range of 600-1000 people. During this period, most universities occupied only one or two buildings in cities downtown.

Since the late 1920s, there has been an intensive process of merging and consolidating of universities. All-Union, republican and regional educational centers are being created. The contingent of students in one university is increasing, and the university itself, as a result of the merger of smaller educational institutions usually looks like individual buildings dispersed throughout the city.



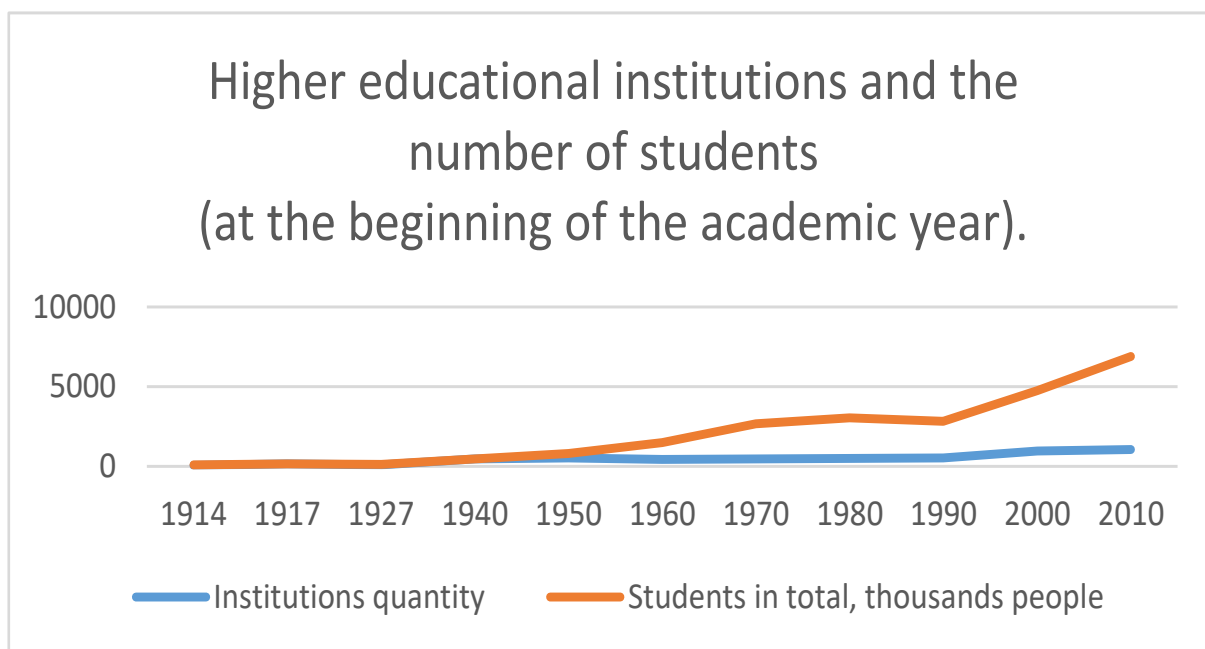


Figure 1. Higher educational institutions and the number of students (at the beginning of the academic year).

Difficult post-war social and economic situation made it impossible to build new complexes for combining the buildings of such educational institutions on the same student quarter - campus. During this period a significant number of students studied in extramural and part-time (evening) departments, combining study with work. In the 1940s and 1950s, during the period of the Great Patriotic War and the post-war period of restoration, there was no significant change in the architecture of the educational buildings of higher educational institutions and student dormitories.

In the 1960s, the construction of large centers of science and education began. University complexes such as, for example, Peoples' Friendship University of Russia in the south-west of Moscow, including educational buildings, dormitories, a student club, and sports facilities located on the same territory, have appeared. Krasnoyarsk State University (became a part of the first federal university in Russia - Siberian Federal University, in 2006), which has educational buildings, an administrative building, dormitories and sports facilities on the territory. In the 1980s, a new complex of Moscow State University of Civil Engineering was built, including educational and laboratory buildings, an administrative building, dormitories and a sports complex. An example of a university quarter in small and medium-sized cities is the IATE NIIU MEPhI complex located in Obninsk, Kaluga Region. Due to the fact that the territory of the city of Obninsk was chosen as a build place of the world's first nuclear power plant (1954) in 1951-1952, there was a need for a large number of qualified specialists in the field of nuclear physics, so it was decided to create a higher educational institution. Together with the educational and laboratory buildings, a sports complex was built, as well as three dormitory buildings. The territory of the university is remote from the city center and located in forest. The educational buildings and dormitories are separated by a dense forest belt through which one footpath goes (most of the campus is a dense forest). The territory of the educational institution has an extremely weak network of pedestrian paths, also there is no relative lighting system. Functional saturation is insufficient for a modern university campus. On the territory there are no grocery and household goods stores, hairdressers, places of leisure, parking lots, places for recreation are not equipped. In 2017, a dining room was opened in the building of the educational building.

During the period under review, a number of complexes of higher educational institutions were built. However, most universities were still located in individual buildings or groups of buildings

dispersed throughout the city.

A significant increase in number of higher education institutions in the 1990s and 2000s and in number of students enrolled in them occurred mainly due to the quantity increase of existing state universities (as a rule, without an increase in areas) and the emergence of many private small universities. During these difficult years for the country, the construction of multifunctional complexes of higher educational institutions was not carried out, and the existing ones often suffered from the inclusion of non-core buildings and their parts, a decrease in territory and poor-quality operation.

It is supposed that the greatest effectiveness of the scientific and educational process can be achieved with the thoughtful architectural organization of the local complex of educational, scientific, experimental production, residential, administrative, sports buildings on a common territory - the campus. General patterns and principles of organization of such a complex are reviewed in this article.

2. Spatial organization of the university campus

The analysis of the modern practice of building university complexes convinces us that the thoughtful spatial organization of the campus is perhaps even more important for the full and effective functioning of the campus than the architectural and functional qualities of its individual facilities. Particular importance is attached to public outdoor and indoor pedestrian spaces and connections which play the role of “indicative forming space”. It can be: platforms for social interactions, united by a single architectural and planning ideas; Recreational areas with a special comfortable atmosphere for relaxation and activities; communication spaces for walking access to all campus facilities. [1, 2]

Besides integral and thoughtful spatial organization, landscape features of the construction site should be used as well as the climate should be taken into account [3, 4]. For example, there is the Path of the Philosopher is laid around the campus of the University of Turin (Figure 2), erected on the banks of the Dora River in Italy (architect Norman Foster), — a walking route included in a developed network of walking paths connecting the university’s buildings with a well-equipped promenade and public transport. The internal space of the university complex is built around the main round square, around which educational and other buildings with independent entrances are located.



Figure 2. Turin university campus

An interesting example of a modern university campus is the campus of the Vienna University of Economics, illustrating the latest trends and ideas for creating an open social learning environment (the opening took place in 2013).

In addition to educational and scientific objects, the campus has shops - bookstores, grocery, cafe, bakery, restaurant, kindergarten, canteen, sports complexes.

The new campus of University of Vienna is a single space uniting academic, administrative and public buildings. The central space is a pedestrian axis connecting all buildings to each other (Figure 2).

The “Image Zone” is the square in front of the Library and the Training Center, and the building itself with the eye-catching avant-garde architecture. The campus was developed in accordance with global trends in the field of saving natural resources: geothermal energy of groundwater is used for own consumption. Also, the territory of the town is accessible and convenient for people with limited mobility.

The main buildings of the Vienna University of Economics campus are the Central building with a library and a training center, the main educational building, a student center, a teaching center, administration and management units, residential buildings (Figure 3). Famous architects such as Zaha Hadid, Peter Cook, Hitoshi Abe and Karim Pinos were involved in the design of individual objects.



Figure 3. Campus of Vienna University of Economics. Outline of the campus master plan.

There is a central pedestrian space along the longitudinal axis of the site. A large library and knowledge center building is situated on the transverse axis of the site; left part - educational buildings, administrative unit, management academy; right part - educational buildings, student and teaching centers

The university campus provides numerous service and leisure facilities.

The projects of modern campuses are united by a well-developed and integral spatial composition. The general principles for designing campuses are: clearly readable unified compositional structure of a scientific and educational complex with a compositional center - a public open space; expressive architectural and spatial appearance. Most university towns illustrate the trend of energy-saving technologies, significantly reducing operating costs of student complexes. [5, 6, 7]

3. Functional structure of the university campus

In order to determine the necessary functional saturation of a modern campus, it is necessary to analyze and structure the student's life process and time budget [8]. It is necessary to clearly identify the main activities of the hostel: this is educational activity, life and recreation.

Educational activity means the educational process in the classrooms of educational and laboratory buildings and self-study in dormitories. The transition from classrooms or between buildings should take a minimum of time, and therefore the complex of buildings should be compact. In addition to the areas occupied by classrooms and laboratories, it is necessary to provide a sufficient number of office premises, toilets, local recreation places, etc. Also, the educational complex will have a library, reading rooms, self-study classrooms, a canteen, assembly halls, conference and meeting rooms, groups of administrative and utility rooms. Such premises can be located in one of the buildings or located in a separate building in close proximity to the educational and laboratory buildings.

The average time spent on educational activities varies depending on the curriculum and is usually from 6 to 8 hours.

Functional needs of students living in campus dormitories are as follows:

- Daily - sleep, toilet, cooking, low hygiene, eating, general hygiene, changing clothes and personal care, passive rest;
- Periodic - washing of personal clothes, sports, drying and ironing of personal clothes, body and hair care, supply of food products, supply of household goods, cleaning of premises, occupations at home, communication (internal);
- Occasional - active recreation, parking, meetings, leisure (communication), storage of personal belongings, supply of medicines, reception of guests, medical assistance, environmental recreation, leisure (sight);
- Others - campus management, cleaning and maintenance, campus security.

The entire hierarchy of needs of living students should be considered when designing the campus and appropriate buildings and premises should be provided for them. Everyday needs are preferably realized within the framework of one building - a dormitory.

Cafes, bars, places of spectacular leisure are located in separate buildings or can be combined into one - student clubs. Student clubs can also carry out educational activities such as extra-curricular meetings and gatherings, personal self-study. [9]

Places for outdoor activities are platforms for practicing various sports. They are divided into two types - indoor and outdoor. Covered ones are located within the same building or complex of buildings or structures. Most often, both types of sports fields are located in campus, geographically located in one location and forming a single complex.

Sports complexes, student clubs or stand-alone cafes, bars, clubs, entertainment leisure buildings, etc. should be removed from dormitories and places of quiet recreation, otherwise noise reduction measures should be taken.

4. Results and discussion

The architectural organization of the university quarter - campus, regardless of the type and compositional solution, should be started with the allocation and justification of the following areas (Figure 4):

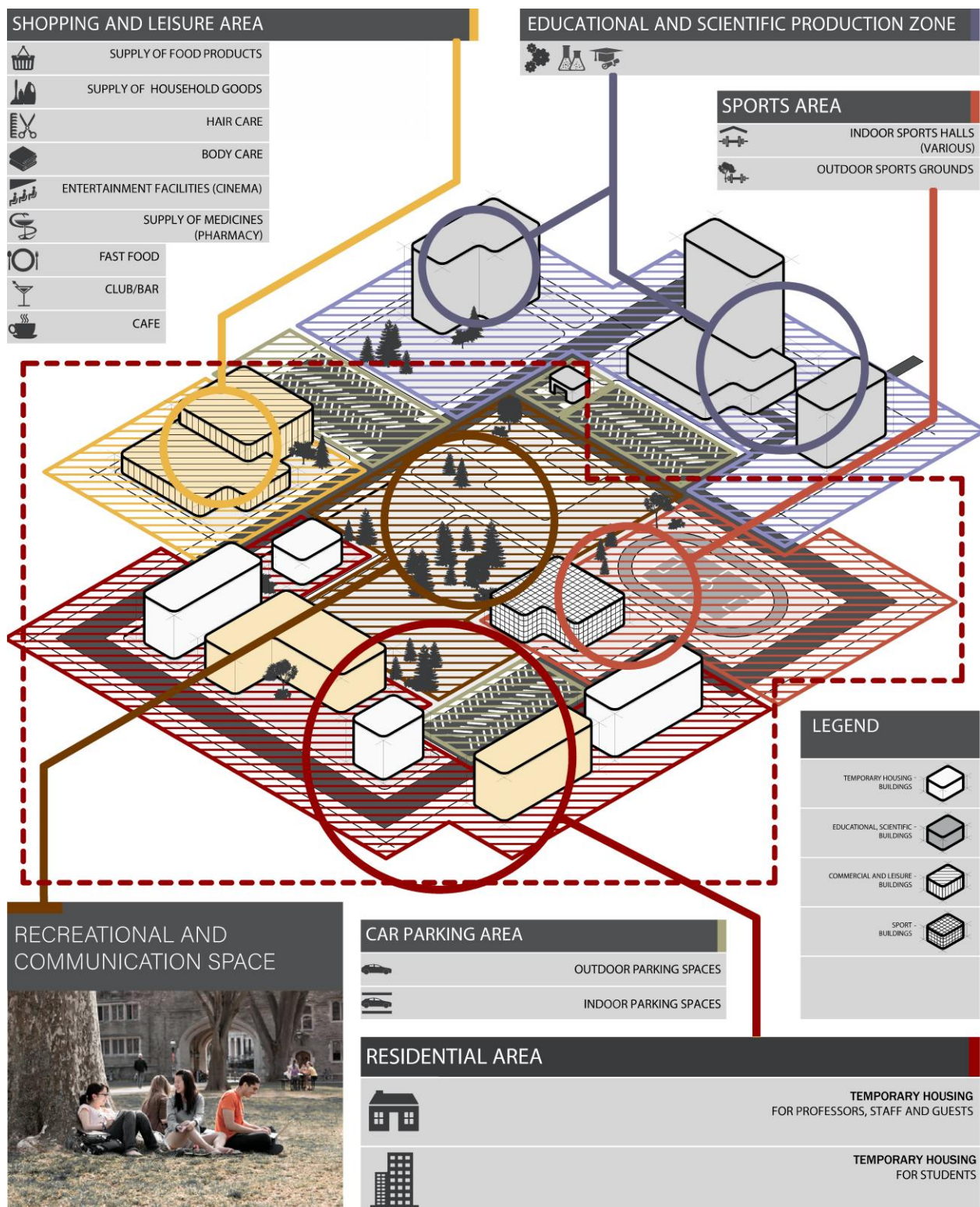


Figure 4. Functional model of an advanced student quarter - campus in a structure containing an environment for leisure and recreation, as well as a full range of service infrastructure.

- educational and scientific production zone, including educational, scientific research facilities and, sometimes, depending on the specifics of the university, specialized enterprises,

- residential area containing student dwelling facilities,
- shopping and leisure area, including enterprises providing food, essential household and office supplies, hairdressers and beauty salons, medical services and medicines, fast food enterprises, as well as leisure facilities (club, bar, cafe, etc.),
- sports area, including various relevant buildings and premises, as well as outdoor sports grounds,
- recreational and communication space, combining all of the above zones into a single educational environment,
- car parking area, including indoor and outdoor parking spaces.

Common campus design principles include:

- pronounced integral compositional structure of the university complex
- building of a complex on the basis of recreational and communication space as its core;
- expressive architectural and artistic appearance;
- openness, creation of a unified social environment.

In the circumstances of Russia, it seems promising to connect all campus buildings and structures with a complete pedestrian network, including off-street, bike paths network. Providing space without cars - only the necessary service entrances, entrances to parking lots, fire driveways. [10, 11]

Separately, it is necessary to mention a promising way for organizing pedestrian connections on university campuses, advanced for Russia and widespread abroad (mainly in Canada). It consists in organizing a developed network of underground pedestrian communications. So, in many universities in Canada, for example, at Carleton University in Ottawa (Figure 5), there is a network of tunnels that are isolated from the external environment and connect all university buildings. The underground tunnels of Carleton University allow extra-street movement of people and goods in special transport trolleys. This network of tunnels allows you to have reliable, weather-independent communications, save on heating and cleaning snow. Thus, paths to some buildings in the winter may not be cleared at all. In addition, this type of communication does not affect the architectural appearance of the campus.

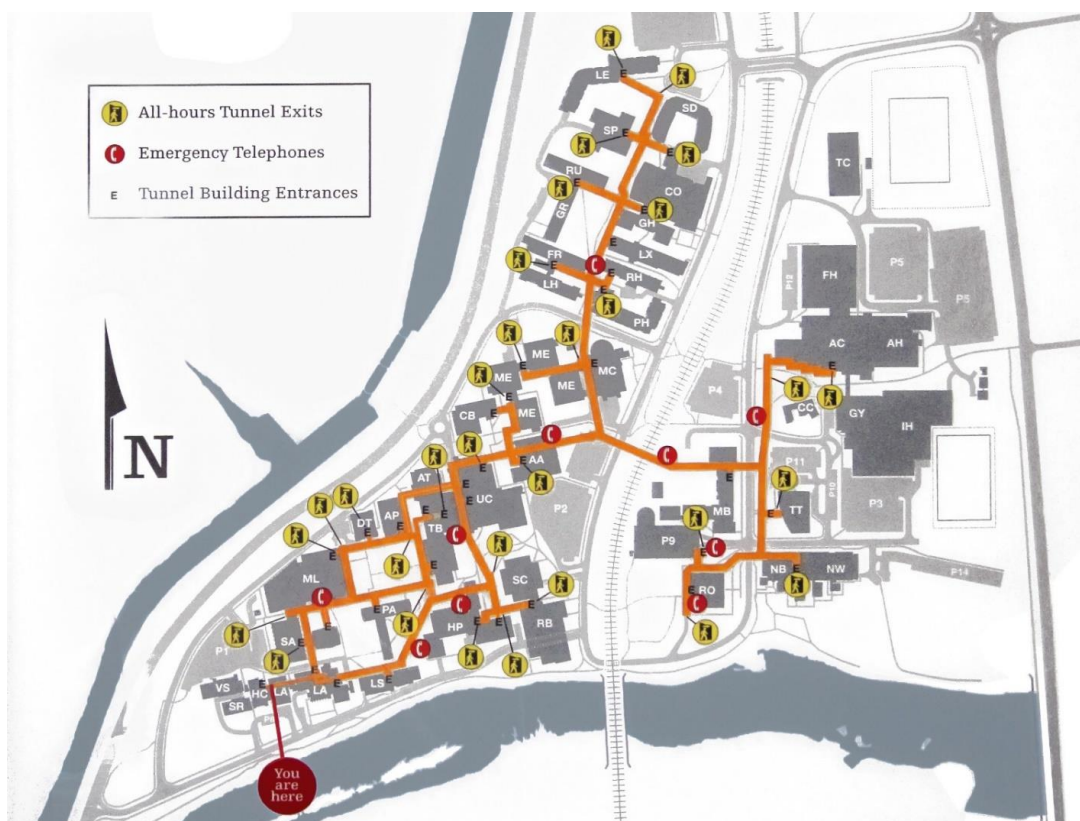


Figure 5. Carleton University Campus tunnel network. Ottawa, Canada.

5. Conclusion

Thus, the general tendencies of creating the environment of university complexes have been reviewed. The concept and principles of the spatial organization of the environment of modern university campuses has been proposed.

The general concept is to organize the campus as a local architectural and urban development object, multifunctional in structure, self-sufficient in its content, a single architectural ensemble with a clear functional and compositional structure. The architectural and planning composition of the complex is formed considering all the necessary life functions of the living students in the system of interaction between the home, the educational space, the complex of the serving infrastructure, the environment for recreation, recreation, leisure and communication.

References

- [1] Puchkov M V 2011 University campus. Principles of creation of space of modern University complexes *Bulletin of Tomsk state University of architecture and construction* **3** 79-88
- [2] Gelfond A L 2015 Public building and public space. The duality relations Academia. *Architecture and construction* **2** 18-31
- [3] Zhura S August 2019 Development of the subarctic territories: Technologies and socio-economic innovations *International Journal of Engineering and Advanced Technology (IJEAT)* **8 (6)**
- [4] Priemets O, Samoilov K, Zayats I, Kenessarina Z and Yssembayeva E August 2019 Innovations in Kazakhstan's Architecture *International Journal of Innovative Technology and Exploring Engineering (IJITEE)* **8 (10)**
- [5] Dorozhkina E 2017 Technical features of the formation of "green" architecture *International Multidisciplinary Scientific GeoConference Surveying Geology and Mining Ecology Management SGEM 17 Nano, Bio and Green - Technologies for a Sustainable Future* 787-792
- [6] Slavin A, Sinenko S and Yoshin N 2018 The evolutionary development of the methodology of operational planning of construction production *XXIst International Scientific Conference on Advanced in Civil Engineering: Construction - The Formation of Living Environment FORM 2018 "IOP Conference Series: Materials Science and Engineering"* 062040
- [7] Rodionovskaja I S and Dorozhkina E A 2018 Arkology approach to building multi-story "green" buildings suburbanities environment. *IOP Conference Series: Materials Science and Engineering electronic edition* 042006
- [8] Popov A V 2019 The impact of architectural and space-planning design of student accommodation (dormitories, campuses) on the time budget of the student youth *International Journal of Engineering and Advanced Technology* **8 3** 128-133
- [9] Kireeva T V 2016 New approaches in the formation of architectural and landscape environment of the university *International research journal* **2-4 (44)** 101-102
- [10] Danilina N 2016 Intermodal system for mobility demand in the realities of the russian federation: reality and forecast *E3S Web of Conferences "International Conference on Sustainable Cities, ICSC 2016"* 02001
- [11] Privezentseva S V 2017 Questions of the organization of the universal environment of public buildings *Construction - formation of the environment of life Electronic resource: proceedings of the XX International interuniversity scientific and practical conference of students, undergraduates, postgraduates and young scientists* 164-166
- [12] Shimko V T 2006 *Architecture and design of the urban environment* (Moscow: Architectura-S)