



## Testing the Methods of Reconstruction of the Spatial Solution of the Pedestrian Street

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## Testing the methods of reconstruction of the spatial solution of the pedestrian street

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**Abstract** This chapter describes techniques for designing a pedestrian city street in an existing building. At the beginning, the methods and level of study of the modernization of a city street into a pedestrian are described. Also mentioned are publications on research into the problems of modern urban spaces. Then in the chapter the results of the analysis and the concept of the design solution are presented. At the end, an assessment of the developed design solution is given.

**Key words:** urban space, scenario design, pedestrian street, modern techniques, underground parking.

### 1 Introduction

The problem of effective architectural and functional organization of urban public spaces is quite relevant today. A feature of this problem in post-soviet cities is the already established street-road network of the industrial period of domestic urban planning. Thus, the problems of developing the underground space of modern cities are studied in sufficient detail in publications. [1]. The problems of planning post-soviet cities have been studied for a long time. For example, a review of the literature on the urban environment of the post-Soviet city of Krasnoyarsk was carried out by Smolin M.G. and Koptseva N. two years ago. In the same year, Reznikova K.V. published a review of studies of the urban environment of Russian cities. No less interesting are publications on spatial planning in European cities Chistobaeva A.I. and Fedulova S.I. Of interest is the study of changes in urban planning in Krasnoyarsk at the end of the last century by such authors as V. Lusan. , Pimenova N.N., Khrebtova M.Ya., Khudonogova E.A., Sertakova K.I., Shimanskaya. Some supporting methods have been restored based on the research of the architectural reconstruction of a quarter in German Mannheim by authors Petrichenko M., Rakova X., Vyatkina M., Musorina T., Kuznetsova D.[2; 3; 4; 5; 12] in the global architecture and urban planning, the need for modern universal techniques for reconstructing the spatial solution of a pedestrian street is also confirmed by a large number of other authors. [6; 7; 11] as the working material in the design, the working methods described in:

- an album of typical solutions for the comprehensive improvement of the embankments of the moscow river, moscow 2016
- recommendations on the use of paving in the construction of coatings for residential and public-business buildings, rmd 32-18-2016 st. Petersburg
- an album of standard solutions (standards) for comprehensive improvement of the territory of the “departure” highways of the city of moscow, moscow government committee for architecture and urban planning, moscow 2015
- “a comfortable city. Norms and rules ”, moscow arch council, moscow government committee on architecture and urban planning, moscow 2017
- book by K. Lynch “The image of the city”

### 2 Methods

The purpose of the study is to verify the effectiveness of modern techniques and design tools on the example of a street reconstruction project.

Research Objectives:

- to analyze the existing functional and spatial organization of the new pedestrian street
- script the existing use of urban space
- make a model of the existing planning organization of the city street
- identify conflict areas in the territory
- determine the condition of equipment and landscaping
- on the basis of theoretical design techniques and modern tools available to the designer to develop fundamental solutions to conflict areas
- create a possible scenario for the use of urban space
- make a model of the planned planning organization of the street
- determine the effectiveness of the proposed design solutions.

During the study, various working methods of analysis, reconnaissance survey, office processing of the collected field data, and correlation analysis were used. In the design, scenario and variational approaches to the organization of the material urban environment were used. The work carried out is focused on adapting the existing design methodology to modern technical capabilities and urban space planning tools. [8; 9]

At the first stages of the work, data collection and systematization techniques were used. The field survey was carried out by the method of conversion and inventory of plants on the project site. The collection of initial data on the territory was carried out using modern interactive resources (electronic cadastral map, map of urban planning regulations and others). All materials collected for analysis were uploaded to electronic resources in graphical, textual and numerical formats.

During the analysis of the existing state, the territory was conditionally divided into seven fragments. On all fragments of the territory, paving defects were revealed, damaged trees and shrubs, and emergency equipment. Among the paving defects, the following were distinguished: inhomogeneous surface of the coating, chips and cracks on the paving slabs, lack of tile fragments, dips in the surface of the coating, incorrect vertical layout of the surface. Of plant damage, particular attention was paid to places with roots that came to the surface. Broken swings, broken fences, reinforcement sticking out of the ground, and construction waste after demolition of the building were revealed from the emergency equipment. [10; 4]

Scheme of analysis of the state of planning elements

The diagram reflects the state of the road surface, types of paving, and the condition of equipment: lamps and navigation objects, urns, benches and other outdoor furniture, bicycle parking lots, shopping pavilions and equipment for children and sports grounds.

Criteria for assessing the condition of equipment:

Excellent - used constantly, as intended

Good - often used for its intended purpose

Satisfactory - it functions, but needs repair, is rarely used or for other purposes

Not satisfactory - not functioning, not used for its intended purpose

Emergency - does not function, is broken, or is dangerous when used.

In total, 308 objects were analyzed on the territory. Of these, 4 objects were identified in disrepair, 9 objects in unsatisfactory condition, 1 in satisfactory, 25 in good condition and 269 in excellent condition. The results of the analysis of elements of external improvement showed a rather good state of improvement. But there is emergency equipment that is unacceptable in public urban spaces.

Based on the analysis of the pavement, existing characteristics are used that will help in a reasonable solution of the road-path network in the project area. Namely, it will allow to qualitatively improve the material component of urban space.

**Table 1.** Information on the main characteristics of paving from stones / paving slabs [8; 12]

<b>№</b>	<b>Evaluation criterion</b>	<b>Description of Creteria</b>
1	2	3
1	Load bearing capacity	The bearing capacity of paving stones / paving slabs is independent of the ambient temperature
2	Device complexity	There is the possibility of mechanized laying of stones / slabs in the coating. Stacker productivity up to 800 m2 per shift.
3	Repair possibility	Paving stones are reused. The coating is disassembled and restored back when laying and repairing underground utilities. During repair, special machines are not required.
	Environmental friendliness of materials	Concrete, natural stone materials do not emit harmful substances into the atmosphere. It is possible to produce stones / paving slabs with a photocatalytic surface to clean the air of harmful substances.
	Appearance	The use of slabs and paving stones of various colors, shapes and various processing of the front surface allows visual zoning of the space, to form a specific visual image of the urban space.
	Water permeability	Coatings may be permeable or waterproof. Special permeable (draining) coatings reduce the load on the storm system.

Design solution. Techniques for creating an architectural and planning solution.

A universal walking script for st. Kayuma nasyri based on the work of the tatar scientist-writer, in whose honor the street is named. The motive of the ball from the fairy tale "stepdaughter" is taken as the main idea. So getting on the street kayuma nasyri from the street. Tatarstan, tourists and citizens follow the thread of the ball, the role of which is played by the colored strip of paving, like the heroine of a fairy tale. From the street safyan script works in the opposite direction, offering to trace the path of the tangle, which symbolizes the fountain organizing the entrance group.

Each intersection (the intersection of kayuma nasyri st. With zaini sultan and fatykh karim streets) is a public garden. In addition to solving the problem of lack of landscaping, such nodes also perform a number of other functions: a landmark, dispersal of pedestrian flows, creating a mental pause in the visitor's imagination for the convenience of remembering and forming the image of the street. The open space interrupting the linear street also makes you look at the historical buildings and take a walk along it, which contributes to the goal of attracting and increasing the length of stay in the territory of visitors.

Change profile st. Kayuma Nasyri from car to pedestrian, entails a complete replacement of existing paving. Coatings used in the pedestrian zone should ensure the comfort of pedestrians, including people with limited mobility, within the territory.

Arrangement of coatings, principle units and interfaces of pedestrian zone coating elements is carried out in accordance with the following requirements:

- created pedestrian sidewalks must ensure the continuity of links of pedestrian and transport routes, as well as free access to objects of mass attraction;
- pedestrian sidewalks should be laid along the shortest (most convenient) and safe routes of movement;
- if possible, walkways should be carried out without changing the level of the longitudinal profile;

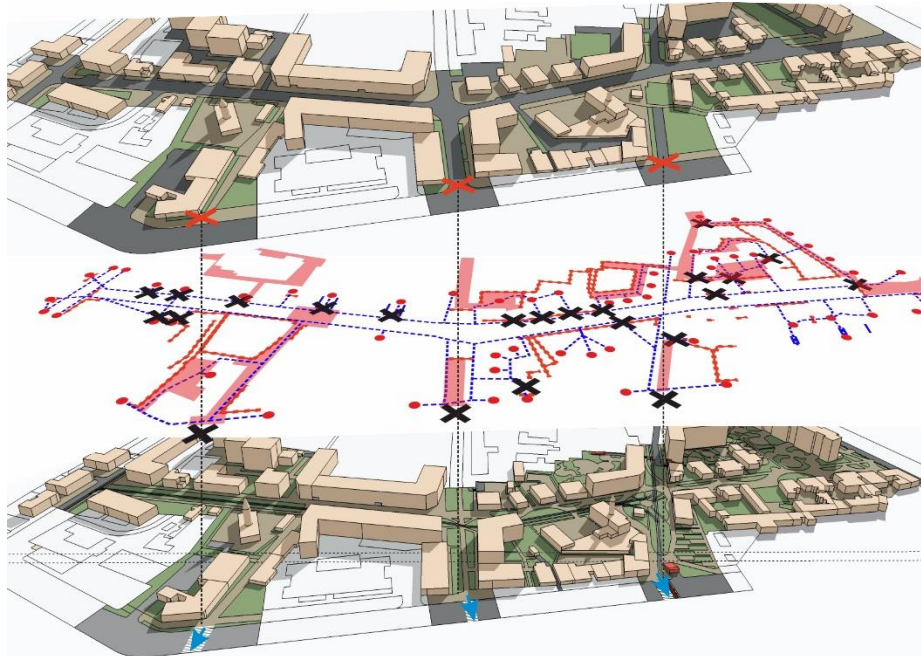
- the arrangement of pedestrian sidewalks should be carried out taking into account the need for partial or complete separation of the main oncoming and intersecting flows of pedestrians in areas of mass foot traffic.

Two new types of paving have been added: paving stones aesthetically completing the appearance of historical buildings and paving slabs along the street axis, with a guide strip that differs from the first type with a flat surface, for a more comfortable movement. The strip serves as a guide when passing the street through squares at intersections and is a symbol from the tales of Kayum Nasyri. The rationale for the choice of paving slabs as paving in section 2.1. The analysis of the state of planning elements in the table "Information on the main characteristics of paving stones / paving slabs".

Landscaping stripes and an asphalt bicycle path are also added to the street profile.

2650 m<sup>2</sup> of coverage along ul. Safyan and in the courtyards.

New wooden equipment fits well thanks to the selected material. Separate elements (awnings, bicycle parking) with their plastic help to support the idea of a "tangle of fairy tales". The luminaire in the territory of the contact zoo and information stands are subject to replacement.



**Fig. 1.** Scheme of conceptual solution of design problems

The figure shows the identified key conflict points in the territory and their solution in the developed project. On the diagram are highlighted the honor of driveways, which became dead ends at the entrance to the pedestrian street. Also on the diagram are marked routes according to the developed unified universal scenario for the use of this urban space. The models in the upper and lower parts reflect changes in urban space, taking into account the methods of spatial reconstruction of the city street.

The territory's landscaping scheme has been developed on the basis of its new planning organization and the results of the analysis of the state of settled forests. The results of the inventory of green spaces and an assessment of their condition made it possible to determine the decorative and sanitary-hygienic assessment of their content on the project site. Thus, it was revealed that over 433 trees and 49 shrubs will grow on the

territory. The assortment of plantations is represented by 33 species of plants 18 of which are trees. The main species involved in the landscaping were *Acer negundo* (112 units) *Tiliu cordata* (159 units). Among the bushes there are *Svida alba*, *Caragana arborescens*, *Dasiphora fruticosa*

On average, the sanitary condition of trees and shrubs in the project area was estimated at 3.6 points (max 5 points). More than half of the plants suffer from a lack of insolation, diseases, old age, mechanical damage and violations of urban landscaping care technology. Trees in emergency condition were found on the territory.

Criteria for assessing the condition of trees on a 5-point scale:

Excellent - a young, well-formed, healthy plant. Decorativeness is expressed in the most suitable place for placing the plant in the overall volumetric and spatial composition of the landscape of urban space and the absence of factors that can negatively affect the growth of the plant.

Good - a healthy plant at risk of damage and disease, or planted under conditions not favorable for growth. Elimination of mechanical damage. Decorativeness is not expressed can form any green volume. It is possible to carry out crown cutting events.

Satisfactory - the plant may be old age or be ill with treatable phytocenotic diseases. Usually requires careful treatment and care. Decorativeness is not expressed. Planting is usually required, which replaces the damaged plant without violating the spatial composition of the landscape.

Not satisfactory - an accidental plant capable of falling. Dead wood. Such a plant requires removal with the replacement of young long-lived plants.

In landscaping, the project proposes to exclude *Acer negundo* from the assortment. And also, increase the participation of more valuable and durable species of trees and shrubs. The main priority is placed on the formation of a city space free from the dense shadow. This is due to the hanging of a sense of security and the preservation of visual connections under the canopy of trees for the townspeople. [12; 13]

### 3 Results and Discussion

The following results are obtained. The qualitative characteristic of the territory is developed in the form of a table and shows the need for the following transformations and systematic work to repair and update the elements of external improvement of the city street. 10 key issues highlighted. For each of the identified problems, solutions of different scales and levels of action are formulated. The data are shown in table 1.

**Table 2.** Qualitative characteristics of the territory

№	The problem of low efficiency of using the space of the city	Possible solution to this problem
1	2	3
1	Spontaneous parking	Construction of municipal underground parking (with the function of hourly rental space for a car)
2	Kayuma Nasyri Street has a cross-sectional construction of the main street of regional significance [SP]	Street reconstruction in the boulevard
3	Hazardous equipment and green spaces	Compliance with the program of municipal measures for the maintenance and operation of elements of external improvement

4	The presence of unused fragments of the territory	Formation of a single spatial infrastructure with a single universal use case
5	Entrances to the spatial design area are not formed	
6	There is no expediency of the installed equipment in some parts of the territory	
7	Street space attractiveness is low	
8	High dispersion of the territory	The solution of all the elements of the external improvement of urban space in the single style of Kayum Nasyri's fairy tales
10	The lack of artistic design in the spatial organization of the territory	



**Fig. 1.** Maps of the qualitative transformation of the territory

The map shows that the proposed solutions for the reconstruction of urban space are able to qualitatively change its visual image. Also, the balance of areas by functional zoning shows that urban development efficiency of the use of the territory can be increased 4 times. Thus:

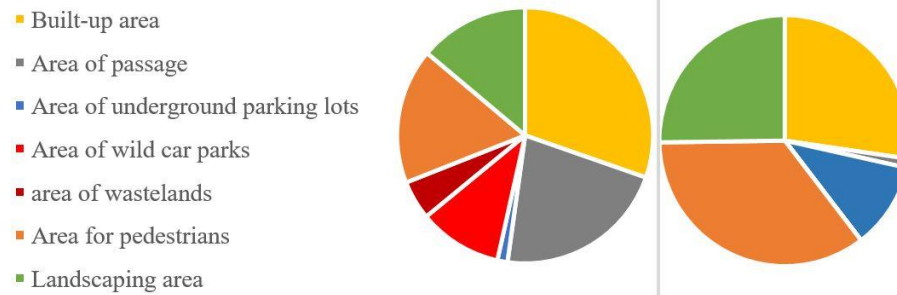
- Built-up area has not changed
- Area of passage reduced by 13,435 square meters
- Area of underground parking lots increased by 12850 square meters



- Area of wild car parks excluded
- Area of wastelands excluded
- Area for pedestrians increased by 26,690 square meters
- Landscaping increased by 17160 square meters.

In the design solution, the balance of areas is made up of a reasonable organized urban space. The new urban space of the pedestrian street consists of 3 parts united by a single use scenario with an infinite number of possible routes for moving citizens between public objects.

**Diagram 1.** Balance of areas by functional purpose (real on the left, project on the right)



Obviously, when changing the transverse profile of the street from the main to the pedestrian vacated area, pedestrians and landscaping get. Thus, without changing the development on the surface of the earth and intelligently creating travel routes from building to building, it became possible to form and develop “green corridors” for comfortable movements of citizens.

#### 4 Conclusions

As a result of the study, the used design techniques allowed us to solve key tasks.

1. As a result of a comparative analysis of the existing and planned spatial organization of the territory, it turned out that a change in the design of the street profile will increase the urban development efficiency of the territory.
2. The proposed changes in the layout of the territory on the basis of the new formative scenario “pedestrian street” will make it possible to create a single urban space from dispersed random fragments based on modern social and cultural use cases.
3. A comparative analysis of the models of the existing planned planning organization of the city street made it possible to understand the sequence and scale of the necessary changes in the city space.
4. The localization of the conflict areas made it possible to determine local measures for redecorating the elements that make up the visual and material environment of the territory.
5. The information received on the condition of equipment and landscaping in the territory is the data of ongoing monitoring of the state of external improvement of the territory.

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