Social-oriented approach to street public spaces design

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Abstract. Global challenges for urban development determine the need to develop new approaches to urban environment design aimed on smart and sustainable cities. City streets become centre of human life and places where many public functions are concentrated. That's why nowadays the issue of street function relates non only to its transportation use, but also to the development of public interaction and a new progressive approach to the social-oriented design of the urban environment with the involvement of the population is becoming a great demand. The article offers a social-oriented approach to the functional zoning of public spaces along city streets to create comfortable and safe environments and to ensure the effective land use of the linear street space resource. The approach is based on the concept of demand and supply relative to territorial assessment of various public functions. It is proposed a model of functional planning of the territory and social space depending on the users needs. The proposed approach to urban development was tested for example in Moscow streets.

1. Introduction

Smart and sustainable city concept declares the relevance of a social-oriented approach with urban environment design and construction. The idea of “cities for people” is becoming one of the central ideas in the urban policy of many cities in different countries of the world [1-3]. The idea is based on expanding living space from a private interior housing space to the external open environment. Such activities as communication, self-expression, joint work and cultural pastimes are provided on the open air environments, and city streets become the focus of concentration of such activities. The developing shared-use policy of vehicles, things, houses and emotions is also implemented in the open space of city streets [4,5]. Thus, at the present time, the perception of the preference role of the town streets is just changing. Together with transport transit, a special attention starts to be given to public space functions that the street serves.

Moscow transport policy is aimed at reducing of individual car trips for more than 30% and, at the same time, increasing the share of pedestrian traffic. The existing city program “My street” presented on the official site of Moscow authorities (https://www.mos.ru/city/projects/mystreet/) is aimed at creating linear public spaces in the street plans and cross sections. This issue became especially relevant during a pandemic spring 2020, when the streets became the only accessible place for people’s movement allowing to keep a required social distance.

International experience in city streets design evaluate their quality by variety of functions performed for different groups of users. Thus, this article is designed to assess the hypothesis that
population opinion and behavior taken into account while expanding living space at the expense of the street territories will definitely improve the quality of urban environment and comfort of human

Figure 1. Example of city street reconstruction
Source: NYC Department of design and construction

habitation [6,7]. The purpose of the article is to offer a social-oriented approach to the use of urban public spaces in a street network based on the research study of population behavior and particular features of land use in Russia.

The research tasks are to analyze the existing description for users’ behavior and urban streets land use by case of Moscow, to develop a methodological approach to the formation of public spaces, taking into account the identified patterns, and to formulate practical recommendations for street design.

2. Methods and materials
In Russia, the problem is the lack of official definition of the “city street public space”. There is law definition that does not apply to real situation, and there are many creative definitions in the works of the native authors. In Europe, the concept of public space is more developed and almost every city has its own street design guide. Analysis of all formulations and monitoring public life and behavior on Moscow streets, allow to formulate the concept of a socially-oriented approach to the formation of public spaces, as the necessity to create comfortable and safe conditions for each group of users providing at the same time economic efficiency of urban environment usage and ensuring its ecological safety. Figure 2 shows graphically the boundaries of the functional zoning of the city street space.
Research on city streets was conducted in Berlin, Moscow and cities of the Moscow region in the period 2019 – 2020. Also, international experience of European countries, United States of America, and Asian countries was studied. The obtained results provide for identification of three functional areas in city streets shown in table 1.

**Table 1. Description of functional areas on a city street**

| Area                      | Street users                  | Pedestrian speed, km/h | Specific features                                           |
|---------------------------|-------------------------------|------------------------|------------------------------------------------------------|
| Transport transit area    | Cars                           | 30-120 km/h for transit | High traffic speed increase risk for other users on the street |
|                           | Public transport              | 0 km/h - parking and stops |                                                            |
|                           | Freight transport             |                        |                                                            |
|                           | other users                   |                        |                                                            |
| Bicycle and micro-mobile | Bicycles                      | 6 – 30 km/h            | Require separation from other means of traffic and pedestrians for safe movement |
| vehicles transit area     | Micro-mobile vehicles         |                        |                                                            |
| Public space zone         | Pedestrians                   | Not more 6 km/h        | Require safety for people moving by feet                   |

Conducted research on the problem permits to elaborate the theoretical model based on the transport demand and supply theory, adapted to the use of public territories. It defines socially oriented approach to street design taking into account the needs of population everyday life that can be satisfied on street public areas.

The implementation of the "black" box research model allows to systematic definition of incoming factors and outgoing optimization parameter and reporting them in graphical way (fig. 3).
Figure 3. Theoretical model of a social-oriented approach to the formation of public spaces in city streets

The research object in the theoretical model is a public space of a city street, which is affected by 2 main factors:

- \( X \) – factor – pedestrian demand expressed in the required width of the territory to perform functions that are required for the street space and the required width of the linear space for their placement, \( m \);
- \( Z \) – factor – a spatial-territorial supply expressed in the width of the public space that is enclosed within the red lines or other zones borders, \( m \) (see fig. 2).

The main resulting parameter \( Y \), which will determine the functional use of city street, is the width of the cross profile.

Thus, the mathematical description of the research goal can be presented as a dependency:

\[
Y = f(X, Z),
\]

(1)

\( Y \) – estimated width of public space in the cross section of a city street, \( m \):

\[
Y = \sum y(l-n), \text{ where}
\]

(2)

\( n \) - the number of public functions that the public space of city streets will perform.

The solution to the research problem was found by setting an optimization problem – how to find a balance between supply and demand for the public function of the street, shown in Fig. 4.

There are two zones on the graphic that describe 2 principal cases of an imbalance of supply and demand factors:

- \( X > Z \) – the demand of public space users is unsatisfied. This inequality makes conclude that the space is not socially oriented.
- \( X < Z \) – space intended for public functions rather than user activities. So, that fact makes conclude the irrational and inefficient urban land use.

The intersection point of the graphs is the optimum point, i.e. the equality \( X = Z \), in which the existing / calculated width of the public space makes it possible to place all public functions as part of its cross section.

3. Implementation

Practical implementation of the presented theoretical approach to city public space design was carried out on the example of Moscow city program “My street”. Observations of the streets were made to identify public space areas depending on the needs of the users (table 2).
Table 2. Functional zoning of public space on a city street

| PO   | Pedestrian transit zone | Areas of directed pedestrian traffic. |
|------|-------------------------|----------------------------------------|
| PU   | Short-term stay zone    | Benches location zone                   |
| LA   | Long-term stay zone     | Street cafes, squares, parks, fountain zones, historical monuments and cultural objects location zones. |
| TI   | Transport service zone  | Bus stops, parking lots, transport information zones. |
| ON   | On step service zone    | Shopping services, payment terminals, coffee and street food, newspapers, phone booths, etc. location zones. |
| DE   | Entrance zone           | Buildings steps and building entrance zones. |
| MAN  | Buffer zone             | Security zone insuring protection from snow descent and rain along building perimeters, division line between the zones, locations of utilities, areas of green plantings. |
| D    |                         |                                        |
| ON   |                         |                                        |
| PU   |                         |                                        |
| BL   |                         |                                        |
| IC   |                         |                                        |
| ST   |                         |                                        |
| RE   |                         |                                        |
| ET   |                         |                                        |
| SP   |                         |                                        |
| AC   |                         |                                        |
| E    |                         |                                        |
| FU   |                         |                                        |
| CT   |                         |                                        |
| IO   |                         |                                        |
| NS   |                         |                                        |

To confirm hypothesis that city public spaces functional zoning should be based on social demand, a project for monitoring street improvement was carried out in Moscow within the program “My street”. The article presents 3 planning solutions that cover the entire list of functional zones.

Novy Arbat street (Fig. 4) is one of the widest central streets in Moscow. The cross-section formed at the time of Soviet Union covers a wide public area on the street, bounded on one side by the roadway, and on the other side by administrative and public buildings with frequently visited shops, restaurants and offices on the lower floors. Public space of the street is a wide transit area for pedestrians separated from the roadway by the buffer zone of elevated landscaping and engineering facilities locations. Along buildings there are zones of summer restaurants for long-term entertainment, as well as significant entrances to shopping facilities.
Sadovoe Koltso (Garden Ring) is one of the main Moscow arterial roads which surrounds central historical part of the city. The street has a wide roadway of 10-12 lanes. Placing a large number of public and residential buildings along the street defines the necessity for safe public spaces design. The high intensity of pedestrian traffic makes it necessary to divide it into sections like a Boulevard. Pedestrians are protected from the roadway by a raised strip of decorative lawns and an additional buffer zone for street lighting. For the use of passenger transport, separate boarding and disembarkation fronts are organized on the territory without intersecting with transit flows. In the depth of the street there is a square that gives opportunity for long-term recreation and visiting tourist attractions. Entrances and exits from adjacent buildings are located directly at the transit zone.
Pushechnaya street is a prime example of a narrow local street in the city center. A one-way roadway can also be shared with other users, which is emphasized by the presence of tiles rather than asphalt. Public areas are located on both sides, separated from the roadway by decorative balloons in the buffer zone and high flowerbeds with green plants, which creates a safe environment for non-transport users. Also, there are special zones outside the pedestrian transit zone for parking bike sharing, as well as areas for short-term recreation of pedestrians.

![Figure 6. Pushechnaya street streets functional zoning](image)

The presented streets are good examples of the fact that functional zoning simultaneously fulfills the social role of meeting the needs of residents and visitors of the city, contributes to the environmental comfort of the city, allows for efficient and rational use of territories, and also has a positive effect on the aesthetic appearance of the city and its identification.

The study highlighted the following results:

- Social-oriented approach to the design of city streets as a public spaces allows the most rational and efficient use of the territory for organizing the life of the population outside their private property. Also, the formation of street public spaces has a positive impact on the environmental situation and aesthetic perception of the urban environment, which ensures its sustainable development.

- It is necessary to develop the special urban planning tool for functional zoning of city streets, which will allow at the stage of territorial planning:
  - to project the necessary width of streets recognizing their multifunctional public performance;
  - place all the necessary elements of urban street development to create a comfortable and safe urban environment without the problem of territorial and spatial deficit;
  - ensure efficient operation of urban spaces at the design, construction and further operation stages.
• Moscow, which demonstrates the best experience in Russia in developing public spaces on city streets, shows the visible city improvement results by implementing “My street” program. However, it is necessary to highlight the problem that currently, we are just using foreign norms and approaches. There is an urgent need in patronymic recommendations and local guidelines for the design of city streets public spaces.

4. Conclusion
The world urban planning experience confirms the need for further city development focused on creating comfortable, safe and smart environment and determines also the need for efficient, rational resources and energy saving policy. Anthropogenic activities in the cities are often destructive to the natural environment, but can also be aimed at creating quality living conditions. The 2020 pandemic, when people were forced to stay at home for a long time, highlighted the need for people to communicate and be engaged in various types of social activities in the open air. In this case special attention is paid to city streets as a multifunctional territory that not only provides transit, but also provides public place for everyday life being.

The topic of the development of city streets public space in Russia has a huge research potential. The lack of standards and design guides makes the problem relevant for ensuring sustainable urban development. The article emphasizes the need to develop new linear spaces on the streets, which provide both transport, pedestrian and recreational links in the city and can offer safety social distances due to directional traffic. Under stable conditions of a healthy city, city streets will become a linear point of attraction for the population's vital functions, which will ensure the country's strategic goal of improving the quality of life of the population and sustainability of our cities.

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