

Urban morphotypes and functional diversity of city environment

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Abstract. On the example of the urban space of one of the largest Russian cities, Samara, various environmental morphotypes are analyzed for: mixed use in the ratio of residential and service functions; the nature of the service objects, the spatial organization of the contact of public areas with the building surrounding them. Through the analysis of rental rates of commercial premises in different parts the connection between the demands for different morphotypes of the city is considered. It is found out that regardless of the density of the population in the study area, the development of public activities in the territories depends on the spatial organization of the urban environment: street arrangement, convenience of service function's access. Commercial demand for premises serves is an indicator of the quality of organization of public spaces of streets. Densely populated areas with chaotic development that does not form a street front are deprived of socially active spaces with developed street retail, while less populated areas with a high-density street network and quarter-perimeter buildings form active spatially organized traffic of people that support the development of street retail.

1. Introduction

Different spatial structures of environment demonstrate different ratios of residential and public-business functions depending on location relative to central city nodes.

It is possible to assume that there is a pattern between the space-planning nature of buildings, the morphotype, and the nature of public functions and the form of their distribution along common areas, as well as their ratio (combination) with residential function.

In order to verify this assumption, the authors decided to study the link of planning elements of urban environment with public areas, a street network with varying degrees of pedestrian activity, in areas where the presence of a residential function is required.

Spatial analytics used databases of the public cadastral map and 2GIS, on the basis of which the areas of various functions were calculated and their composition.

The analysis process includes rental rate maps, which we used to select places with maximum, average and minimum rental rates are selected. The places are selected equal in terms of pedestrian traffic and the existence of public transport stops. Then, depending on rental rates, it was defined whether the spatial organization of the morphotype affected the rental rate (demand).

Thus, the functional variety of the city environment and its dependence on morphotypes is determined by the ratio of various functions, their qualitative characteristics and spatial distribution.



2. Functional ratio and environmental convenience

A comfortable city environment is a space convenient for contacts between residents of a city, which is the highest expression of life in a city [1]. It is important that these public spaces should not have restrictions on their use [2], and be accessible to everyone. According to UN-Habitat, a quality environment is functionally, socially and typologically diversified and compact [3]. A key indicator of functional diversity is the proportion of non-residential functions of the total residential area (this indicator was studied by us in the selected territories. According to UN-Habitat, the share of commercial functions in a high-quality urban environment should be at least 40% [3].

3. Morphotypes of city environment as a reflection of the use of a territory

In the works of A. E. Gutnov and V. L. Glazychev, the concept of “morphotype” was introduced, which became “a kind of generally accepted typological unit that formed the basis of many studies of city environment” [4].

Peter Roe and Chen Hye Guan introduced the concept of Urban Intensity, with the help of which they characterized the changes in city environment in terms of density, diversity, compactness and connectivity [5].

4. Method of selection of research environments

The choice of studied environments was carried out on the example of the prevailing morphotypes of Samara. The following morphotypes were selected:

1. Parcel based (perimeter, different-story areas of historical center) (see Figure 1)

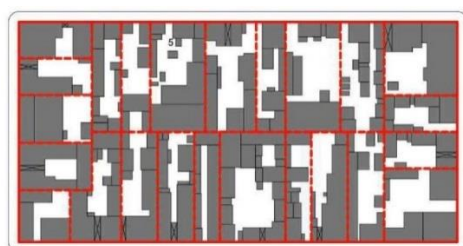


Figure 1. Historic area parcel example

The parcel based morphotype has two varieties, namely, two different space-planning principles for the location of buildings: dispersed (Figure 2) and perimeter (Figure 3) that is the structure of a area differs from each other only according to the space-planning principle, when the structure of land use (division by household ownership of a parcel) inside the area is unchanged.

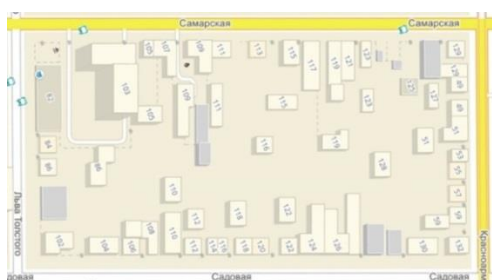


Figure 2. Distributed development example



Figure 3. Perimeter development example

2. Microdistricts, including:
Mass development 1950-60s, “Khrushchev-era development”, oriented to street (perimeter development)



Figure 4. Building of 60s – Khrushchev-era development, forming the street front (free planning)



Figure 5. Khrushchev-era development, ignoring street front (free planning)

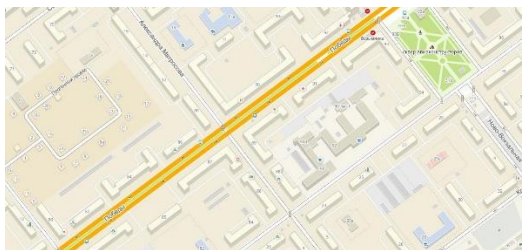


Figure 6. Building of 40-50s - Stalin-era development, oriented to street (perimeter)

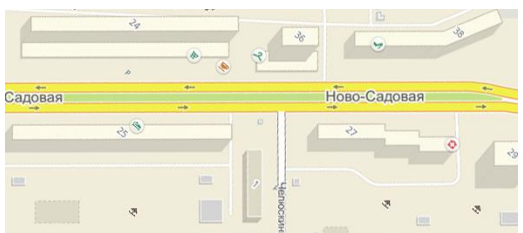


Figure 7. Multisectional development of the 70s – 80s forming the front of street (perimeter development)



Figure 8. High-rise development built after the 2000s, not forming the front of street (chaotic buildings)

Street retail and functional diversity of territory. The activity of street retail is an indicator of the public activity of a territory. The following types of street retail are distinguished: elite, which is characteristic of the central streets of cities, and dormitory, which is observed on the outskirts and in the depths of residential areas [6, 7] where “the built-in premises function as a support, i.e. ensure the functioning of the housing estate”.

There is a direct correlation between pedestrian traffic and rental rates, which can be expressed in such effect as: in the same house the premises facing traffic will have a cost several times higher than those that do not. The comfort of the environment for street retail is expressed in the low traffic density, the ease of access, as well as the presence of a wide, clean and illuminated sidewalk. “Parameters of the development - the configuration of streets, the size of blocks and the frequency of crossroads as well as the technical characteristics of the buildings and the general condition of building”, the presence of obstacles in the form of porches, lawns and trees affect the development of street retail.

5. Influence of building morphotypes on the functional filling of territories

The lines of the study include only the territories where the urban blocks are in touch with public areas and the street network (Figure 9).

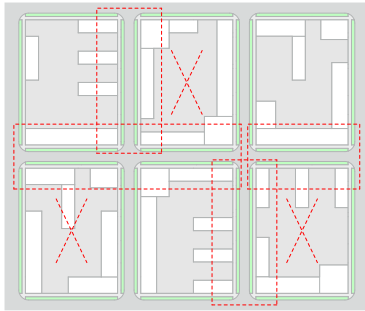


Figure 9. Schematic diagram of the selection of territories for analysis

In order to identify the necessary territories for further analysis, we used data on Samara rental rates provided by the Territorial Evaluation Agency for the period of 2008, 2012 and 2016 [9], based on which territories with maximum, average and minimum rental rates were determined (Figure 10).



Figure 10. Samara rental rates

The maximum rental rates, which are more than 1000 rubles per square meter, are present only in the territories of the historical center of Samara (Figure 11 – they are highlighted by a thin dotted line).



Figure 11. Territory of historical center



Figure 12. Territory between Gagarin street and Moscow highway

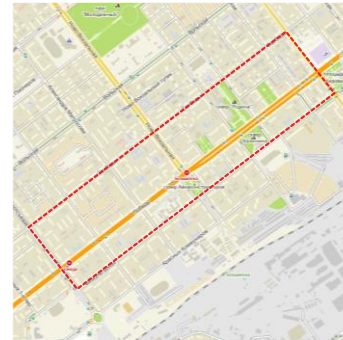


Figure 13. Territories adjacent to Pobedy Street

The territories with slightly lower rental rates, which amount to 880-1000 rubles / m², were located in 5 urban areas of Samara, including the historical center of the city (Figure 11, a thick dotted line), the territories within the lines of Gagarin streets and Moskovsky highway (Figure 12), the territories adjacent to Pobedy Street (Figure 13), the Golden Mile (Figure 14) and the territory of Voronezh Lakes (Figure 15). In the diagram of the Figure 10, these territories are painted in red (rents are more than 1000 rubles / m²) and orange (rents are more than 879-1000 rubles / m).



Figure 14. Golden Mile Territory

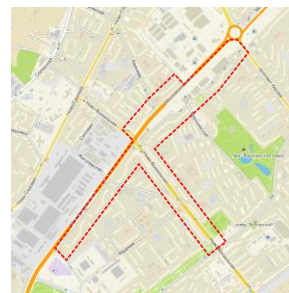


Figure 15. Territory of Voronezh Lakes

Average rental rates can be observed in the remaining residential areas of the city. It is worth noting that in these territories “Khrushchev development”, “Stalin development” and the buildings of the 70-80s prevail (Figure 16, 17). In the diagram of the Figure 1, these territories are painted in yellow (rental rates are more than 764-878 rubles / m²) and green (rental rates are more than 648-763 rubles / m²) colors. Since the number of territories that can be selected for the analysis within the framework of average rental rates is huge, additional parameters will be introduced when choosing territories for further analysis.

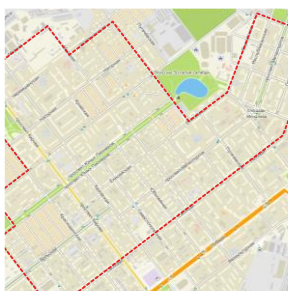


Figure 16. Residential areas with average rental rates

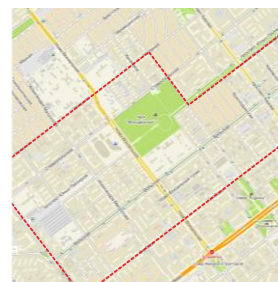


Figure 17. Residential areas with average rental rates

In order to conduct a comparative analysis, the territories will be selected on the basis of similarity to each other – the presence of similar car and pedestrian traffic, close population density, adjacent to the same street rank, similar usage pattern. The only thing that will be different is the morphotype.

The data on the volume of car traffic was provided by Samara-Informsputnik [9], which shows the total number of passing cars per day in each of the analyzed territories.

6. Analysis of territories with maximum rental rates (more than 1000 rubles / m²).

Table 1. Ratio of functions on Kuibyshev Street

	Accommodation (m ² / %)	Non-accommodation (functions other than residential) (m ² / %)	The average number of buildings
The 1 st Site	5067 , ² / 36,82 %	8695 , ² / 63,18 % including:	2-4 floors
		Education	15,7 %
		Commerce	0,7 %
		Business	24,09 %
		Religion	1,45 %
		Other	21,25 %
The 2 nd Site	5518 m ² / 48,83 %	5782 m ² / 51,17 % including:	2-3 floors
		Commerce	8,25 %
		Business	24,85 %
		Public food service	2,65 %
		Beauty salon	0,78 %
		Medicine	12,88 %
		Other	1,75 %
The 3 rd Site	10531 m ² / 57,29 %	7850 m ² / 42,71 % including:	2-3 floors
		Commerce	16,66 %
		Business	10,56 %
		Public food service	5,53 %
		Beauty salon	1,09 %
		Medicine	1,58 %
		Education	0,65 %
		Hotel	2,72 %
		Culture	3,92 %
The 4 th Site	7361 m ² / 27,45 %	19456 m ² / 72,55 % including:	2-3 floors
		Commerce	17,67 %
		Business	29,73 %
		Public food service	10,87 %
		Religion	1,49 %
		Medicine	2,05 %
		Culture	6,26 %
		Hotel	4,47 %
The 5 th Site	3521 m ² / 16,47 %	17853 m ² / 83,53 % including:	2-4 floors
		Commerce	6,46 %
		Business	37,64 %
		Public food service	0,47 %
		Education	29,42 %
		Other	9,54 %
The whole street	31998 m ² / 34,92 %	59636 m ² / 65,08 % including:	2-4 floors
		Trade	11,14 %
		Business	26,28 %
		Public food service	4,73 %
		Medicine	2,51 %
		Hotel	1,86 %
		Education	9,35 %
		Religion	0,65 %
		Culture	2,62 %
		Beauty salon	0,31 %
		Other	5,63 %

The territories with maximum rental rates are located exclusively in the historical center of Samara, where the parcel morphotype of residential building predominates. Due to the small number of quarters with maximum rental rates, two streets were chosen, one of which had a certain part of the street that was pedestrian – Leningradskaya Street and Kuibyshev Street, which did not have exclusively pedestrian parts, but had high car (more than 7 thousand cars per day) and pedestrian traffic.



Figure 18.
Kuibyshev Street

Kuibyshev Street. According to Figure 11, which shows areas with maximum rental rates, high rental rates are observed on Kuibyshev Street in the interval from Leo Tolstoy Street to Komsomolskaya Street. This gap is divided into 5 parts (Figure 18). The division into parts occurs relative to the division into districts - from street to street.

All 5 parts are located in perimeter building blocks with a solid line of the facade along the red line, except for part 1 with a discrete front.

The results are presented in Table 1, which shows the total area of residential and non-residential premises, including those with a minimum breakdown into categories of functions such as the establishments of public food service (cafes and restaurants), trade (various retail areas), beauty salons, and medicine facilities (pharmacies, dental Businesss, antenatal clinics and others), cultural, religious and educational functions, as well as Business premises (premises rented for various purposes, except for the functions listed above) and others (constructions, servicing apartment buildings).

According to generalized results, the investigated territory is saturated with various functions, the total share of which prevails over residential ones almost twice. Moreover, each site is separately heterogeneous.

The territory is functionally diverse and with unique services. In Sites 2,4,5, it can be seen that, as a whole, the predominance of social and business functions over residential ones is observed along the district boundary due to the actively developed street retail, as well as due to the low number of stores of buildings. As a rule, in these districts accommodation is located in the depth of it, when all public and business functions are concentrated along the front of the street.

Developed street retail arose against the background of perimeter building, forming the front of the street, as well as high pedestrian flows.

Leningradskaya Street. According to Figure 10, which shows the territories with maximum rental rates, high rental rates are observed on Leningradskaya Street within the lines of Maxim Gorky Street to Galaktionovskaya Street. This gap is divided into 7 Sites (Figure 19).

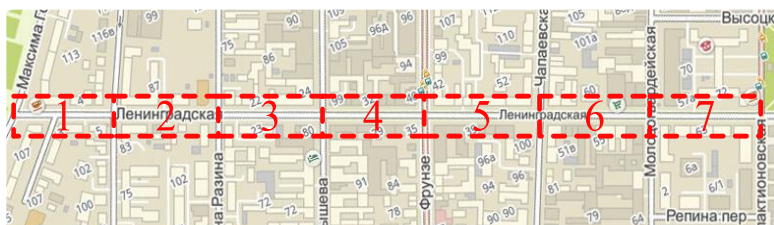


Figure 19.
Leningradskaya Street

In general, all the 7 Sites are located in the blocks of perimeter building. For all the 7 Sites, the lines of the districts end on the front line of the development, with no indentation relative to it. The considered street is divided into 2 Sites, one of which is a street with low car traffic (traffic is several times less than on Kuibyshev Street and amounts to 500 cars per day) and is located from Maxim Gorky Street to

Kuibyshev Street (1-3 Sites), and the second Site is a pedestrian zone and is located from Kuibyshev Street to Galaktionovskaya Street (4-7 Sites).

The results of quantitative analysis throughout the street are presented in table form (Table 2).

Table 2. Ratio of functions on Leningradskaya Street

	Accommodation (m ² / %)	Non-accommodation residential) (m ² / %)	(functions other than	The average number of buildings
The 1 st site	7775 m ² / 96,9 %	248 m ² / 3,1 % including:		2-5 floors
		Trade	0,95 %	
		Public food service	2,15 %	
The 2 nd site	9096m ² / 83,84 %	1753 m ² / 16,16 % including:		2-4 floors
		Trade	2,59 %	
		Business	2,91 %	
		Hotel	4,61 %	
		Beauty salon	2,07 %	
		Culture	3,98 %	
The 3 rd site	8572 m ² / 83,26 %	1724 m ² / 16,74 % including:		2-5 floors
		Trade	5,11 %	
		Business	6,02 %	
		Public food service	2,99 %	
		Medicine	0,87 %	
		Other	1,75 %	
The 4 th site	2308 m ² / 16,51 %	11674 m ² / 83,49 % including:		2-3 floors
		Trade	60,09 %	
		Business	7,80 %	
		Public food service	14,53 %	
		Medicine	1,07 %	
The 5 th site	7934 m ² / 51,9 %	7354 m ² / 48,1 % including:		2-4 floors
		Trade	8,53 %	
		Business	9,2 %	
		Medicine	8,83 %	
		Public food service	9,71 %	
		Hotel	9,81 %	
		Beauty salon	2,03 %	
The 6 th site	6505 m ² / 37,93 %	10643 m ² / 62,07 % including:		2-4 floors
		Trade	37,05 %	
		Business	1,59 %	
		Public food service	3,59 %	
		Medicine	0,47 %	
		Education	19,37 %	
		Beauty salon	2,03 %	
The 7 th site	6070 m ² / 81,68 %	1361 m ² / 18,32 % including:		
		Trade	15,25 %	
		Public food service	1,72 %	
		Education	1,35 %	
The whole street	48260 m ² / 58,13 %	34757 m ² / 41,87 % including:		2-4 floors
		Trade	21,77 %	
		Business	4,46 %	
		Public food service	5,71 %	
		Medicine	2,01 %	
		Hotel	2,41 %	
		Education	4,12 %	
		Culture	0,52 %	
		Beauty salon	0,64 %	
		Other	0,22 %	

According to the analysis, it is clear that the division of the street into pedestrian and non-pedestrian parts affects the results. The pedestrian section of the street is full of various functions, the total share

of which prevails over residential. Moreover, in the fourth site, living districts practically do not face the street front, a similar situation is observed in the fifth and sixth sites, but to a lesser extent. The pedestrian section of the street is rich in various restaurants and cafes for different levels of the population. A lot of objects of both mass market and high class are located.

As for the first, the second and third sections, a completely different picture is observed here. The scope of accommodation far exceeds the scope of public and business functions. There is generally no developed street retail and administrative functions, except convenience stores, as in a dormitory district. Pedestrian and car traffic on the transport section of Leningradskaya is extremely low.

After analyzing 2 separate streets, the results were summarized, according to which the following ratio of residential and public-business functions was obtained (Table 3).

Table 3. Results of the analysis of 2 streets of the historical center of Samara

	Accommodation (m ² / %)	Non-accommodation (functions other than residential) (m ² / %)	The average number of buildings
General results	80258 m ² / 45,95 %	94393 m ² / 54,05 % including:	2-3 floors
		Trade	16,19 %
		Business	15,91 %
		Public food service	5,19 %
		Medicine	2,27 %
		Hotel	2,12 %
		Education	6,86 %
		Beauty salon	0,47 %
		Culture	1,62 %
		Religion	0,34 %
		Other	3,06 %

Based on the results, it can be argued that the maximum rental rates are an indicator of the high diversity of public and business functions. The obtained results of mixed use are the maximum within Samara. Social and business function prevails over residential. This concentration of street retail is achieved due to the fact that almost the entire residential function is concentrated within the neighborhoods and only public and business functions face the front of the street. These streets meet the definition of a comfortable environment according to UN-Habitat, as the share of public functions in the total built-up area is more than 40%.

7. Analysis of territories with high rental rates (from 880 to 1000 rubles / m²)

The second category of rental rates included territories shown in Figures 12, 1, 14, 15. The streets play the role of linear district centers.

The considered streets are identical in rank (main city significance), equal indentation of the building from the roadway, approximately equal pedestrian and car flows. All three selected streets have a building located 16-18 meters from the line of the roadway. All roads have three lanes in each direction, and the average daily traffic is 19.5 thousand cars per day.

Building typology: on Pobedy Street - "Stalin apartments" on Gagarin Street - "Khrushchev apartments", and on Novo-Sadovaya Street - buildings of the 70s – 80s. All three types of buildings are parallel to the street.

Pobedy Street. High rental rates are observed on Pobedy Street in the interval the 22nd Party Congress Street to Kirov Avenue. This gap is divided into 6 sites (Figure 20).

**Figure 20.** Pobedy Street**Table 4.** Ratio of functions on Pobedy Street

	Accommodation (m ² / %)	Non-accommodation (functions other than residential) (m ² / %)	The average number of buildings
The 1 st site	21160 m ² / 92,04 %	1830 m ² / 7,96 % including:	5 floors
		Trade 2,48 %	
		Business 2,78 %	
		Public food service 0,26 %	
		Medicine 1,00 %	
		Hotel 0,87 %	
		Beauty salon 0,57 %	
The 2 nd site	26570 m ² / 89,76 %	3030 m ² / 10,24 % including:	5 floors
		Trade 3,99 %	
		Business 2,87 %	
		Public food service 0,34 %	
		Beauty salon 0,64 %	
		Medicine 1,39 %	
The 3 rd site	26410 m ² / 85,25 %	4570 m ² / 14,75 % including:	5 floors
		Trade 4,42 %	
		Business 5,16 %	
		Public food service 2,23 %	
		Medicine 2,29 %	
		Beauty salon 0,65 %	
The 4 th site	27766 m ² / 86,83 %	4212 m ² / 13,17 % including:	4-5 floors
		Trade 60,09 %	
		Business 7,80 %	
		Public food service 14,53 %	
		Medicine 0,25 %	
		Beauty salon 0,09 %	
The 5 th site	18180 m ² / 80,84 %	4310 m ² / 19,16 % including:	4 floors
		Trade 6,80 %	
		Business 6,80 %	
		Public food service 3,96 %	
		Beauty salon 1,60 %	
The 6 th site	4380 m ² / 63,48 %	2520 m ² / 36,52 % including:	2-3 floors
		Trade 22,17 %	
		Business 9,28 %	
		Public food service 0,87 %	
		Medicine 4,20 %	
The whole street	124466 m ² / 85,88 %	20472 m ² / 14,12 % including:	4-5 floors
		Trade 5,69 %	
		Business 4,67 %	
		Public food service 1,59 %	
		Medicine 1,19 %	
		Hotel 0,14 %	
		Education 0,21 %	
		Beauty salon 0,63 %	

The first floors of the buildings are actively filled with commercial and business facilities. Although the shopping and business functions prevail throughout the street, and food and health facilities prevail less commonly, there is a shortage of unique functions of cultural and entertainment facilities.

A common set of functions is typical for the "dormitory" district, high rental rates due to high flow, but focused on a low check. The street retail corridor is narrow along the main streets and facades of perimeter buildings.

Gagarin Street. High rental rates are observed on Gagarin Street in the interval from Myagi Street to Aurora Street. This gap is divided into 2 sites (Figure 21).

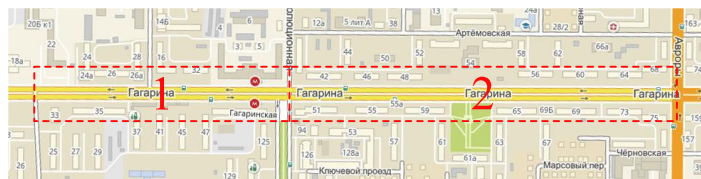


Figure 21. Gagarin Street

This territory is characterized by a large number of outlets, including street trading. A long time before the centralized elimination of street trading Gagarin Street was one of the main tent-market streets. Until now, this territory has a large number of non-capital buildings, which are used for trading function.

During a full-scale study of the territory, it was found that on average the first floors are actively filled with objects of the commercial and business infrastructure of everyday demand: supermarkets, pharmacies, canteens. In this territory, Khrushchev's building dominates, the facades of which face the street. The lines of the building are 16-18 meters away from the roadway.

Table 5. Ratio of functions on Gagarin Street

	Accommodation (m ² / %)	Non-accommodation (functions other than residential) (m ² / %)	The average number of buildings
The 1 st site	29518 m ² / 85,35 %	5067 m ² / 14,65 % including:	5-9 floors
		Trade	7,63 %
		Business	4,20 %
		Public food service	1,46 %
		Medicine	1,16 %
		Beauty salon	0,20 %
The 2 nd site	46642 m ² / 91,42 %	4380 m ² / 8,58 % including:	4-5 floors
		Trade	2,57 %
		Business	3,49 %
		Public food service	0,31 %
		Beauty salon	1,08 %
		Medicine	1,14 %
The whole street	76160 m ² / 88,96 %	9447 m ² / 11,04 % including:	
		Trade	4,61 %
		Business	3,76 %
		Public food service	0,78 %
		Medicine	1,14 %
		Beauty salon	0,72 %

The first site has a ratio of accommodation to non-accommodation similar to Pobedy Street and is characterized by a dense filling of the first floors of buildings with social and business functions.

The second site has a larger percentage of accommodation and is characterized by a lower filling of the first floors with non-accommodation functions, as the facades are separated by landscaping, which reduces commercial potential (Figure 22, 23).

The general ratio of public business to residential functions on Gagarin Street less than on Pobedy Street, due to the worst location of buildings, separated by landscaping from traffic.



Figure 22. Example of trees closing street retail objects



Figure 23. Example of trees closing street retail objects

Novo-Sadovaya Street. High rental rates are observed on a fairly large territory of the Leninsky district of Samara (The Golden Mile) (Figure 14).



Figure 24. Novo-Sadovaya Street

The lines of the study area are limited to buildings on Novo-Sadovaya Street, 38, 29, where buildings recede from the street (Figure 24).



Figure 25. Residential building, Novo-Sadovaya Street, 38

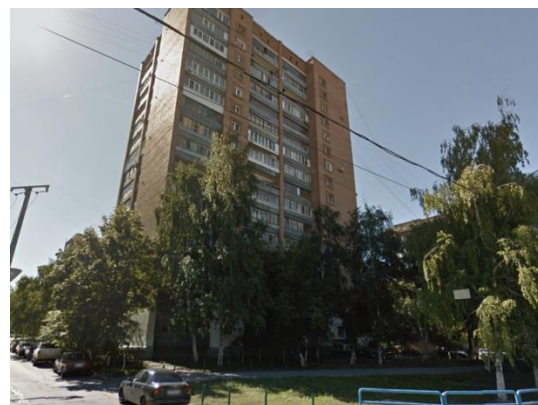


Figure 26. Residential building, Novo-Sadovaya Street, 29

The street had a sharp rise in rental rates after the metro station was launched here and the street opened for traffic.

The predominant multi-floored accommodation built of the 70-80s in 9-12 floors. Therefore, the overall ratio of accommodation to non-accommodation is lower here with a clearly larger volume of commercial space compared to Pobedy and Gagarin Streets. For a more correct correlation of all the 3 streets of the 2nd site, the second part of the table is presented, considering the situation as if the building of this section was also 5 floored.

A characteristic feature of the site is the predominance of trade due to several large supermarkets of the low price segment and a shopping center located in the stylobate. Everyday demand prevails in the set of objects, which indicates an insufficient centrality of the environment in comparison with the historical center, but a greater variety in comparison with other streets of the 2nd rental site.

Table 6. Ratio of functions on Novo-Sadovaya Street

	Accommodation (m ² / %)	Non-accommodation (functions other than residential) (m ² / %)
With the existing number of 9-12 floors	70773 m ² / 89,59 %	8220 , ² / 10,41% including:
		Trade 5,05 %
		Business 2,23 %
		Public food service 1,38 %
		Medicine 0,82 %
		Hotel 0,32 %
		Beauty salon 0,42 %
		Education 0,19 %
With the existing number of 5 floors	36155 m ² / 81,48 %	8220 , ² / 18,52% including:
		Trade 8,99 %
		Business 3,97 %
		Public food service 2,46 %
		Medicine 1,46 %
		Hotel 0,56 %
		Beauty salon 0,74 %
		Education 0,34 %

After the analysis of 3 separate streets of the 2nd rental site, the results were summarized according to which the following ratio of residential and public-business functions was obtained (Table 7).

Table 7. Analysis of 3 streets with maximum rental rates

	Accommodation (m ² / %)	Non-accommodation (functions other than residential) (m ² / %)	The average number of buildings
General result	236781 m ² / 86,13 %	38139 m ² / 13,87 % including:	5 floors
		Trade 5,89 %	
		Business 4,28 %	
		Public food service 1,48 %	
		Medicine 1,22 %	
		Hotel 0,16 %	
		Education 0,16 %	
		Beauty salon 0,68 %	

After the analysis of all 3 streets in general, the ratio of residential function to social business was 86% to 14% or 6 to 1. At this stage of the study, this ratio can be considered characteristic of developed street retail. It can be noted that there is a good supply of household infrastructure, within a walking distance, a large number of grocery stores and various services are available to residents.

Through the example of a site on Novo-Sadovaya Street it is shown that indeed the emergence of street retail is reasoned by the space-planning structure of building (Figure 25, 26).

8. Analysis of territories with minimum rental rates

The minimum rental rates are in areas with a minimum concentration of people - industrial areas of the city and individual housing construction (Figure 15, 16), as well as on densely populated residential areas adjacent to Solnechnaya Street (Figure 27). Active residential construction is being carried out here with the complete absence of integrated planning of the road network, the role of which is played by intra-district and fire routes. The area adjoins the city highway – Solnechnaya Street.

For a comparative analysis, it is important to choose similar streets, and in the territory under consideration only Solnechnaya Street is suitable for the necessary parameters which are the main transport artery of this residential area, the traffic volume of which averages 13 thousand cars per day. The on-site examination was conducted that showed the absence of street retail, as a result of which there is no research subject. In the depths of the building, of course, there are a number of commercial, business and service facilities that are loosely scattered, not generating pedestrian flows, and not creating a public street space. The exception is only one site, which can be characterized by street retail (Figure 27).



Figure 27. Territories adjacent to Solnechnaya Street

Residential buildings on the front of Solnechnaya Street exist, but they are located far away and generally not oriented towards it. The only street retail site is located in buildings facing the pedestrian part of the street.

The paradox is that with a high traffic flow on Solnechnaya Street pedestrian flow is not structured, scattered, not assembled into corridors, therefore, there are no conditions for the formation of street retail, and, as a result, the lowest rental rates are observed. Thus, due to the planned unformed public space, residents have to leave the area to satisfy various social, cultural and other needs.

9. Analysis of territories with medium rental rates

If in the case of maximum rental rates, the choice of territories is limited and only morphotypes with an oriented location of buildings relative to the street fall under the necessary parameters, then in the case of medium rental rates there is some choice. Using the example of a situation with a huge difference between territories with maximum and minimum rental rates, it was decided to look separately at the street-oriented and non-oriented morphotype.

After the study of all the territory of the city painted in green colors (Attachment 1), it was found that only one Revolutionary street fell under the necessary characteristics (within the lines from Moris Toreza Street to Aerodromnaya Street) (Figure 30) with oriented building, which is characterized by the location of the "Khrushchev development" with 5 floors in buildings. Other areas of the city either have different road parameters, more or less number of lanes in each direction, or a typical building belonging to other than those considered. The chosen street has a building located 18 meters from the border of the roadway, and the roads have two lanes in each direction. Daily car traffic is 8 thousand cars per day.

As for the non-oriented building, there were no territories for the necessary characteristics in two lanes and a step back of 16-18 meters. Therefore, the following streets were selected for the research: Aerodromnaya Street (within the lines of Aurora Street to Enthusiast Street) (Figure 32) and Novo-Vokzalnaya Street (within the lines of Stara Zagora Street to Karl Marx Avenue) (Figure 35). These

streets will not participate in the comparative analysis; they are more likely to be examined for the exclusive presence of street retail.

Revolutionary Street. Medium rental rates are observed on Revolutionary Street in the interval from Maurice Toreza Street to the Aerodromnaya Street (Figure 28).



Figure 28. Revolutionary Street

The results of the quantitative analysis for each site are presented in the form of a table (Table 8), which is performed similarly to the previous ones.

Table 8. Ratio of functions on Revolutionary Street

	Accommodation (m ² / %)	Non-accommodation (functions other than residential) (m ² / %)	The average number of buildings
The whole street	32900 m ² / 88,67 %	4204 m ² / 11,33 % including:	5 floors
		Trade	5,22%
		Business	1,32 %
		Public food service	0,75 %
		Medicine	0,96 %
		Hotel	1,87 %
		Culture	0,81 %
		Beauty salon	0,39 %

The data indicate the presence of a variety of street retail. The first floors of buildings, close to the carriageway and pedestrian parts, are filled with commercial and business facilities. The total scope of public and business functions is achieved through some separate administrative buildings. The predominance of trading functions is significant.

Despite the favorable location of the building facades relative to the street for the development of retail, the concentration of the population is rather high; retail activity is weakened due to the too long sides of the planning elements, which make it possible to form a saturated stream.

Aerodromnaya Street. The studied site has a part of residential buildings, which is located at the ends of the street. An on-site examination revealed the absence of street retail and the functional diversity of the environment. The objects of convenience stores, bank branches and pharmacies are located on the first floors of only those buildings that are parallel to the street (Figure 29).

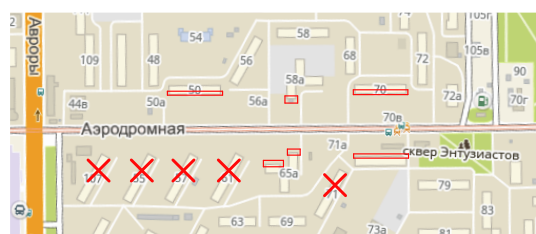


Figure 29. Aerodromnaya Street

This diagram shows the buildings on the first floors of which street retail objects are located, and it can be seen that in buildings that are not oriented to the street, such objects are absent (Figure 30).

On this site, all the residential buildings are located at the end of the street. The stores of everyday demand are practically absent in the first floors of residential buildings. Everyday demand objects are located only in buildings specially designed for this purpose, located parallel to the street.

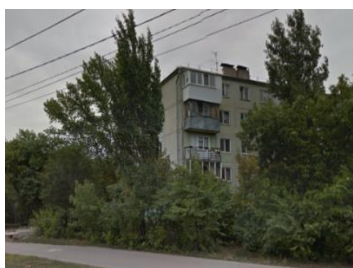


Figure 30. Example of the absence of street retail

10. Research conclusion

Thus, based on the presented analysis, it can be seen that each segment of rental rates is characterized by its own spatial structure of urban development. Thus, for example, territories with high rental rates are characterized by a morphotype with a street-oriented building, and in areas with low rental rates, a chaotic location of residential buildings relative to the street front is observed.

Street retail was observed only under a combination of certain conditions:

1. High pedestrian traffic
2. The parallel location of residential buildings relative to a street, especially if the facade has a solid line (perimeter block)
3. Minimum back steps or location on the front line of a street
4. The openness of the facade line, that is, the absence of obstacles to the movement of a pedestrian, for example, a tree covering the facade and, it is also preferable that there are no lawns in front of the entrances and shop windows of shopping facilities.

5. The problem is especially pronounced on Solnechanya Street where at the highest concentration of the population, the spatial organization of the environment does not allow the formation of either street retail or public spaces.

According to the study, it was found out that in the city there are only 4 sites with more or less developed street retail, which in turn fell at the maximum rental rates. After the analysis of these territories, it can be argued that the emergence of street retail is reasoned by the combination of certain conditions, among which, along with transport accessibility, population concentration and central location, spatial organization (morphotype) of the environment plays a decisive role.

These factors form a comfortable, functionally diverse environment which complies with international goal-setting reflected in UN-Habitat.

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