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# SPATIAL DEVELOPMENT OF THE LARGEST RUSSIAN CITIES DURING THE POST-SOVIET PERIOD: ORIENTING TOWARDS TRANSIT OR MAINTAINING SOVIET TRENDS

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# SPATIAL DEVELOPMENT OF THE LARGEST RUSSIAN CITIES DURING THE POST-SOVIET PERIOD: ORIENTING TOWARDS TRANSIT OR MAINTAINING SOVIET TRENDS

Russian cities are traditionally characterized by high levels of public transport ridership, compared to the Western cities. Moreover, the cities were intensively developing during the Soviet era when the private transport was literally absent. Thus, it can be assumed that the spatial structure of Russian cities (as well as the spatial structure of the majority of the former USSR cities) is a perfect illustration of the Transit Oriented Development (TOD). In this paper the spatial development patterns of 13 Russian cities are analyzed to assess the current situation and the prospects for transit oriented development in the Russian Federation. A brief history of urban spatial development during the Soviet period is provided. Fundamental differences between TOD and Soviet Style Development (SSD) are discussed, such as the absence of competition between the private and public transport and the absence of private ownership of land.

JEL Classification: R14, R41.

Keywords: urban spatial development, urban land use, land use and transportation, Soviet Style Development, Transit Oriented Development

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# Introduction

Nowadays the development focused on public transport is seen as the most sustainable form of urban spatial development (Cervero & Murakami, 2008). The concept of Transit Oriented Development (TOD) was first formulated by the American architect Peter Calthorpe in his book *"The New American metropolis"* (Calthorpe, 1993). The first studies on the spatial planning and land use influence on travel behavior appeared in the 1970s (Handy, 2005), when scientists noticed the relationship between the urban population density and public transport usage. Scientific debate on the issue intensified in the early 1990s after the publication of Newman and Kenworthy (Newman & Kenworthy, 1989), which examined the interrelationship between population density and fuel consumption among large cities. To date, TOD model has been tested in many cities around the world as a tool to reduce the popularity of private car and to make public transport more attractive. The concept is taken into account in urban spatial development management in North America, Australia, and Europe. Great success in this field has been reached by the most developed countries and territories in Asia (Japan, South Korea, Singapore, and Hong Kong). The concept of TOD is being widely introduced in China, India and Latin America.

The TOD researchers mainly focus on such factors as housing density (density), land use diversity (diversity) and designing pedestrian-friendly urban spaces (design). This set of factors is referred to as 3-D (Cervero & Kockelman, 1997). Two additional factors are also mentioned in some publications: the distance to public transport stations (distance to transit) and the travel time to the destination (destination accessibility), resulting in 5-D group of factors (Ewing, et al., 2007; Hamin & Gurran, 2009; Cervero & Murakami, 2008). The importance of these factors is shown in greater efficiency of TOD development in comparison with the usual high density development near stations of public transport (Cervero & Murakami, 2009; Lin & Shin, 2008; Loo, et al., 2010). These characteristics enable the stimulation of public transport usage and the reduction of the car usage by area residents and people visiting the area (Boarnet & Crane, 1997). The distinctive features of the TOD, such as high density, diversity of uses and focus on pedestrians, greatly influence the travel behavior of the citizens and often encourage them to stop using personal vehicles (Kenworthy & Laube, 1999; Ewing & Cervero, 2001): the generalized travel cost by public transport becomes much lower.

Russian cities are traditionally characterized by high levels of public transport ridership, compared to the Western cities. Moreover, the cities were intensively developing during the Soviet era when the private transport was literally absent. Thus, it may seem that the spatial structure of Russian cities (as well as the spatial structure of the majority of the former USSR cities) is a perfect

illustration of the TOD. But in fact it is the illustration of a special development type – Soviet Style Development (SSD). In this paper the spatial development patterns of 13 Russian cities are analyzed to access the current situation and the prospects for transit oriented development in the Russian Federation. A brief history of urban spatial development during the Soviet period is provided. Fundamental differences between TOD and SSD are discussed, such as the absence of competition between the private and public transport and the absence of private ownership of land.

# A brief history of urban spatial development during the Soviet period

There are three important milestones in Russian history after which significant changes in urban spatial structures occurred: 1) the abolition of the institution of private real estate ownership after 1917 events, 2) *"Khrushchev thaw"* and the beginning of the industrial housing construction era in 1957, 3) the collapse of the Soviet Union, restoration of the market economy and private property institutions in 1991.

The development of Russian cities until 1917 was progressive, however, due to objective historical reasons, rather slow. The country's economy was actually an agrarian one and the level of urbanization was low. Typical FAR (Floor Area Ratio) for cities of that period ranged from 1.3 ... 1.8 in provincial cities (and even in some central neighborhoods in Moscow) to 3 ... 4 in St. Petersburg, i.e., there was a fairly high-dense development like in European cities. The proportion of the area of the central part of the city in streets and roads was fully consistent with European trends and amounted to 25 – 35%.

The 1920-1930s saw an intensive industrialization of the Soviet type, focused on the development of heavy and defense industries. This process led to the concentration of economic activity (and people) in cities. Plants, including industrial giants, designed for tens of thousands of workers, were usually built at the outskirts of the cities. Later many of them turned into vast brownfields. Inadequate housing construction volumes were made up for either by the construction of the low quality temporary dwellings (e.g. wooden 'barracks' near the big factories – the problem that still exists today), or (which was more common) by the multiple densification of the existing housing stock. At that time the dwelling area for one person could be 3 ... 5 square meters. Figure 1 shows a significant increase in population density in the central part of Moscow between 1907 and 1935, despite the fact that housing density has not changed much.

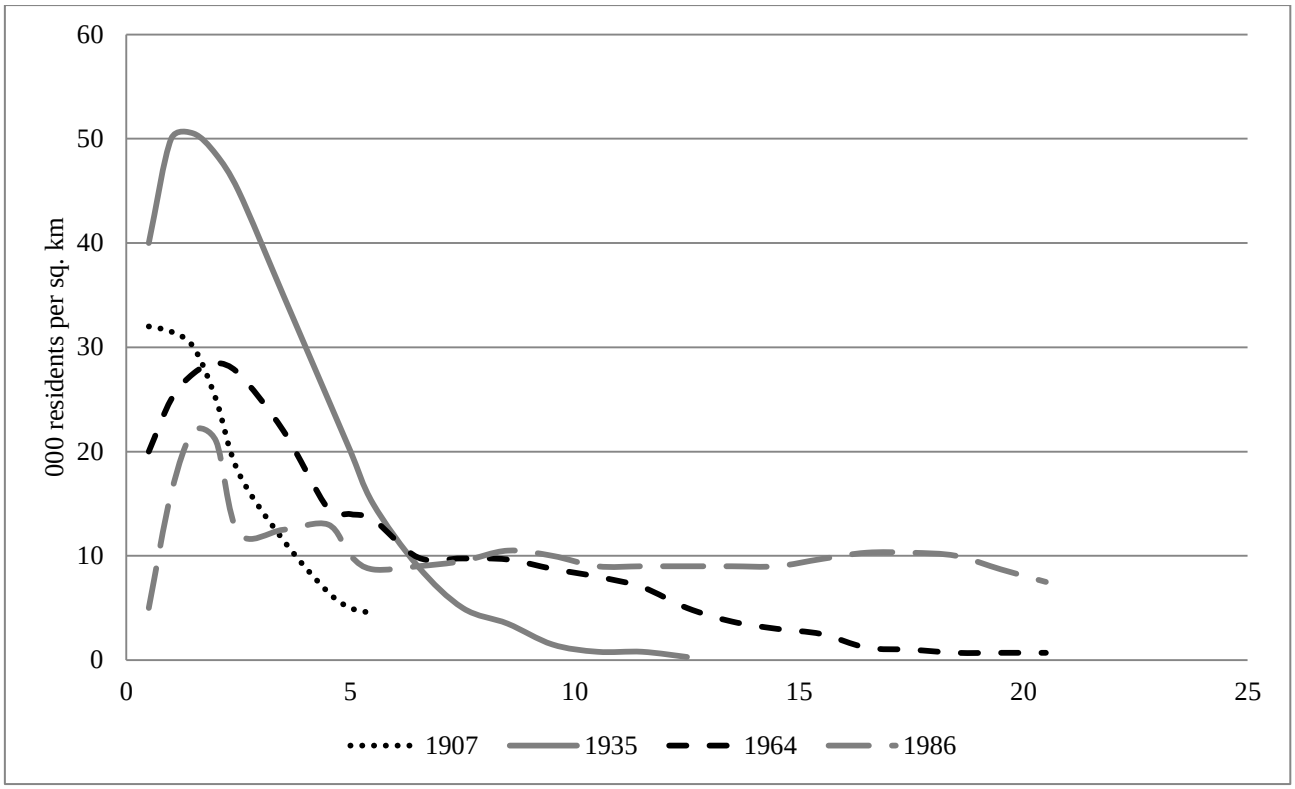



Fig. 1. Moscow density profiles in different years[3] (Петров, 1988).

Since the mid-1930s due to the development and enforcement of Moscow General Plan and general plans of other major Soviet cities, quite reasonable development and land use requirements have been introduced, as well as indicators of the insolation, green areas and various urban infrastructure provision. These new rules were obviously declarative (not to say propaganda) in nature. In reality, the high-quality housing construction of that period was concentrated almost exclusively in the elite segment, affordable for the higher layers of the Soviet bureaucracy, as well as for cultural and scientific elite (Хан-Магомедов, 2006). Houses of that period today are located in the central parts of the cities and are still perceived as high end real estate, which increases their price. Obviously, such kind of housing did nothing to solve the housing problem in general.

The era of cheap and rapid industrial housing construction started in 1957 with the construction of a pilot Cheryomushki District in Moscow (Annex B). It was a real breakthrough as millions of citizens received hitherto unavailable opportunity to live in single-family apartment (Хан-Магомедов, 2006). Per capita dwelling area in cities began to grow rapidly. Undoubtedly, mass housing construction required significant space, so the cities grew actively. Evolving cities overstepped the industrial zone, which led to the mass construction at peripheral areas beyond the industrial areas.

[3] The whole area of the city is taken into account, and not precisely urban area as it is in the density profiles in the next sections.

Thereby the unique in the world V-shaped height configuration was created in cities: 1) multistoried (partially - historical) buildings in urban cores; 2)“flat” industrial zones in yesterday’s periphery, which had evolved into the middle part of the city by the 1950s; 3) high-rise housing estates in the new periphery, even more remote from the urban center. This specific configuration was mentioned by foreign researchers as early as in 1979 (French & Hamilton, 1979).

More or less free choice of working place, which became possible in the 1960s was combined with the preservation of a ban for private housing ownership, thereby preserving an extremely low residential mobility level. Citizen could now select the workplace, but it was still very difficult to move from one residential area to another. This circumstance has caused obvious problems and extremely high demand for public transport in Soviet cities. At the same time, in the 1960-1970s, a package of regulations was formed, quite advanced from a humanitarian point of view, which defined, inter alia, the required distribution of the urban area between residential, green and industrial zones, and the level of the transport infrastructure provision.

In practice these regulations resulted in the expansion of neighborhoods of usually 5-storey apartment buildings accompanied with large green areas, with a typical FAR value being about 1. The implementation of more advanced building techniques brought about the growth in the number of floors: while the BCA (Built Coverage Area) stayed unchanged, the FAR value has increased greatly and exceeded 10. Obviously, these new high-rise housing estates were built on greenfield land, usually at a considerable distance from the center and/or major concentrations of employment. In many cases, these neighborhoods were dominated by “departmental housing stock”, i.e. houses, designed exclusively for the employees of certain large industrial enterprises.

From a humanitarian point of view these remote neighborhoods were a huge step forward compared to the former barracks near the factories. At the same time, this type of development has created demand for the high capacity public transport systems. In many cities the initiators of such systems development were the large industrial enterprises: the owners of the new residential areas, which were required to ensure transportation of employees from the place of residence to the plant entrance.

In any case, local authorities and managers of the plants (combined under the leadership of the party bodies) were primarily concerned with the issue of commuting. The employment concentration at such enterprises was so high that it made quite effective the organization of regular bus routes (buses of high and extra-high capacity), and even the construction of tram lines (with multi-car trams), designed exclusively to provide transport links between the plant and housing estates attributed to it. The most striking illustrations of this transport policy were Samara and

Nizhny Novgorod, where the same function of workers transportation between the plant and attributed housing estates was carried out by the local subways. In other words, subways existed in these cities, but didn't perform the functions of universal city-wide transport systems. The task of subway extension to the historic downtown area, that is, the transformation of the underground transport system from the departmental to the city-wide, was only addressed within the new economic reality, in the early 2000s.

Thus, the distinctive structure of Russian cities was formed by the 1990s, which is characterized by V-shaped height configuration (high dense city center and peripheral territories and ineffective land use in the middle zone) (Bertaud & Renaud, 1995). The main differences of the development of soviet cities from the contemporary transit oriented development in foreign countries are the absence of competition between the private and public transport and the absence of private ownership of land. The adoption of TOD paradigm doesn't (even theoretically) imply the reduction of the motorization rate to the limits defined by the norms of Soviet times. The motorization rate of Russian population had remained extremely low throughout the Soviet era: by the end of this era, in 1990, there were 80 vehicles per 1,000 residents in the USSR, including no more than 50 personal cars. In the long term ("*after the construction of communism*") it was assumed to reach the level of 150-180 cars per 1000 inhabitants. In the USSR, the low motorization rate was achieved with the simplest means: national production of cars was severely restricted (the only car plant, designed for mass production of more or less advanced for that time FIAT models, was built in 1960 in Togliatti); import of cars was banned; the price of a new car was equal to 3-5 annual salaries of a qualified engineer. Thus, car-oriented suburbs have never developed in the Soviet Union. The housing stock structure in large cities was absolutely dominated by the multifamily houses. In the 1950-1960s 5-storey residential buildings had been typical, since the 1970s and until the end of the Soviet era the buildings with 8, 12 or more floors prevailed. Soviet housing estates were territories used exclusively for the residential purposes; the mixed-use development was not practiced. Considering the typical for a Soviet city low level of car ownership the residents a priori had no choice of transport mode. The Soviet people used the overcrowded public transport without thinking about the relative convenience of such trips. Public spaces near the metro and suburban railway stations were physically present, but usually were neither convenient, no attractive. Within the specific development path of the country there was no place for the urban land markets. According to the classical models, the attractiveness of land for development is reduced moving away from the urban core, which leads to a decrease in density and development. In case of cities that have developed in countries with a market economy, this process is controlled mainly by market forces without the intervention of the state. The result is a city where

the maximum density is observed in the center and the housing and, accordingly, the population density reduce at the outskirts. If the current density of economic activity for any reasons does not correspond with the actual land value, effective mechanisms of renovation and redevelopment are launched, eventually forming the decreasing density profile. Under market conditions developers are aimed at maximizing the value of the final object, but in the conditions of command-administrative system, oriented towards the proposal, the task of new housing creation is solved simply through the construction of new square meters. Therefore, in the urban areas, which have been actively developing for a long time in a planned economy, the described decreasing density profile is not observed. According to the contemporary studies dedicated to the spatial structure of the post-socialist cities, in particular, the works of Bertaud (Bertaud & Renaud, 1995; Bertaud, 2004), the cause of this dissimilarity is the rejection of private property and the absence of land markets in cities. In socialist countries, the types of land use were determined basing on the perception of public importance of various objects. Exotic Soviet urban development conditions have a huge impact on present day urban spatial structure, as rapid urbanization occurred precisely during the Soviet period (the proportion of the urban population had grown from about 17% in 1917 to about the current level of 70% during the half of a century).

## Methodology for post-socialist spatial development measurement

The analysis the spatial development in post-socialist cities was conducted with the example of housing construction in the largest Russian cities, with the exception of Moscow and St. Petersburg. The source of information was the data base of the State Corporation *"Fund for assistance to reforming housing and communal services"*. Moscow and St Petersburg were excluded from the study because of their special status (these cities are also the subjects of the Russian Federation), as well as a significant difference in demographic, social and economic indicators, and especially in budgetary possibilities. Thus, 13 cities with populations over 1 million people were included in a study. The study analyzes information on residential buildings, constructed in 1992 – 2015, in terms of their distance from the city center and public transport stations.

The data base of the State Corporation *"Fund for assistance to reforming housing and communal services"* includes information about the year of construction and the total area of each apartment building. Buildings with unknown parameters were excluded from the survey. The data base doesn't contain information about the individual single-family houses, thus the additional analysis of satellite images was conducted. The territory of each of 13 cities was divided into hexagons (1 sq. km). For each hexagon the share occupied by individual single-family houses was

determined. The total area of individual single-family houses occupying 1 sq. km was assumed to be 100 000 sq. meters. Afterwards, the total volume of housing stock (including apartment buildings and single-family houses) was defined for each hexagon. The hexagons the larger parts of which are occupied by non-urban land uses (forests, agriculture, dachas) were excluded from the survey. For other hexagons the distance to the city center was calculated. The city center was considered as a point traditionally considered to be a city center (according to the Yandex.Maps, for example, Red Square in Moscow, Kazan Kremlin in Kazan, etc.).

The distance to the city center and the total volume of housing stock at each hexagon were used to create housing density profiles. The average housing density at certain distance from the city center was calculated as an average housing density of all hexagons at this distance. The density profiles of residential areas only were also created; for them only hexagons where there are apartment buildings or individual single-family houses were used. Apart from the density profiles creation, the allocation of the housing construction in the post-Soviet period by zone at the different distance from the city center was also analyzed. For this purpose the sum of the area of houses constructed after 1992 within the hexagons at certain distance from the city center was calculated. The other indicators used in the study include: the proportion of the area of apartment houses being built within the outskirts development in urban areas in the total amount of housing construction, the share of total area of buildings constructed during the post-Soviet period within a radius of a walking distance (800 m) from the subway stations, the share of post-Soviet housing located within a normative distance from the tram stops (400m). It should be noted that the indicator of pedestrian accessibility of metro stations has been and remains very important: in all these cities, metros maintain proper frequency and capacity. At the same time pedestrian accessibility of the tram lines is often becoming increasingly nominal indicator: tramways in most Russian cities is in deep stagnation.

## Spatial development of the largest Russian cities during the post-soviet period

The total area of houses built after 1991 comprises about a third of the total volume of the housing stock in studied cities. This indicator is strongly correlated with the growth dynamics of the city's population during 1991 – 2015 (Fig. 2). The highest value of the indicator – 44% – can be observed in Krasnoyarsk, which experienced significant population growth in 1991 – 2015 (over 20%). (Table 1)

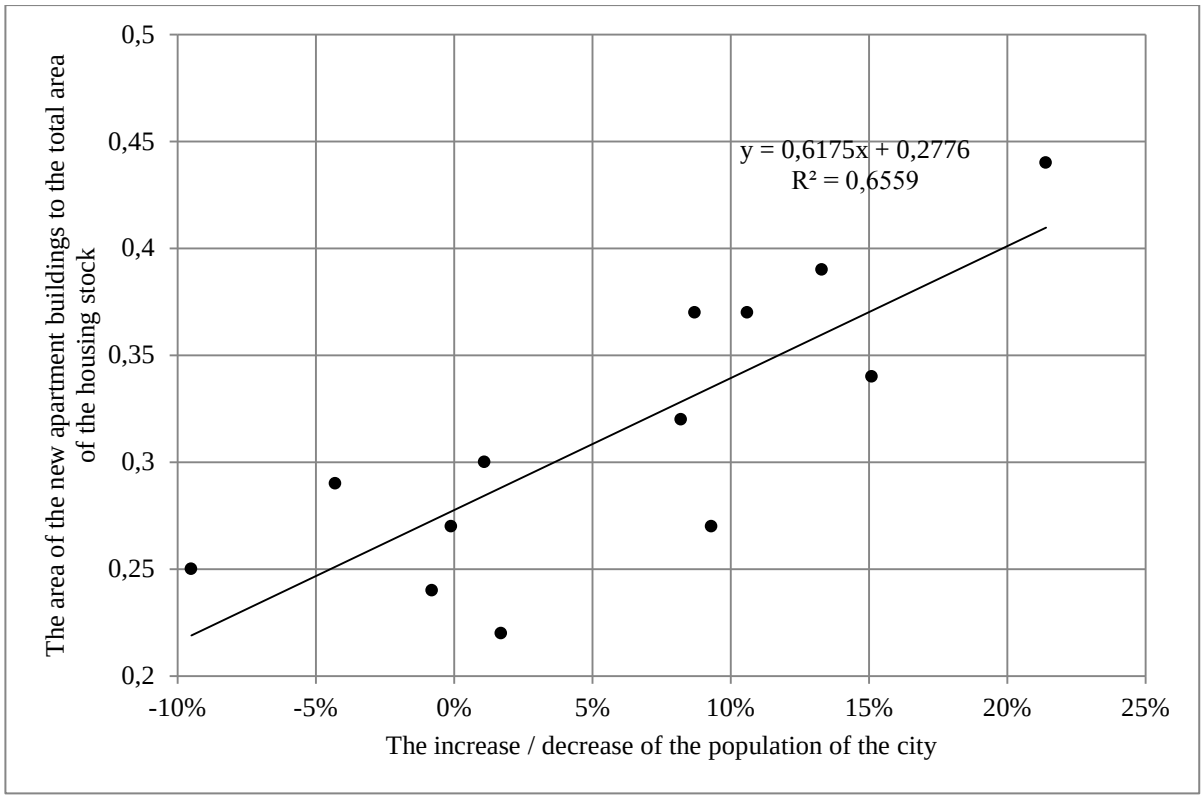



Fig. 2. The relationship of time series of the population growth and the volume of construction of new apartment houses (%% by 1991)

Even in cities, where the population in 1991 – 2015 decreased (Nizhny Novgorod, Samara) or remained essentially unchanged (Perm, Omsk, Volgograd), the proportion of houses built after 1992 in the total area of housing stock is 22% – 30%. Basing on the data on these cities it is possible to assess how much housing construction in post-Soviet Russia could change the spatial structure of cities and influence the supply / demand of transport services.

Building of the housing density profiles showed that in all cities the maximum density is observed in the central areas (Annex A). The density of residential buildings within a radius of about 1 km from the center is between 170 - 405 thousand sq. m. per 1 sq. km. The most clearly observed centers (335... 405 thousand sq. m per 1 sq. km) are characteristic of Samara, Novosibirsk and Yekaterinburg. Mean values of the indicator (303 ... 324 thousand sq. m per 1 sq. km) are characteristic of Rostov-on-Don, Chelyabinsk, Voronezh, Nizhniy Novgorod. The lowest density of residential buildings (168 ... 275 thousand sq. m per 1 sq. km) is typical for the central parts of Kazan[4], Omsk, Ufa, Krasnoyarsk, Perm, Volgograd.

[4] For Kazan it is reasonable to use density at 1-2 km from the city center, as the center in the city is clearly observed, but the area within a radius of 1 km from the center has low-density of residential buildings due to a number of reasons.

**Tab. 1. The characteristics of the housing stock changes in the largest Russian cities during the post-Soviet period**

| № | City | The proportion of the total area of the apartment buildings constructed after 1991 in the total area of housing stock | Population, 000, 2015 | Population growth, 1991 - 2015 |
|---|---|---|---|---|
| 1 | Novosibirsk | 32% | 1 548 | 8,2% |
| 2 | Yekaterinburg | 37% | 1 446 | 10,6% |
| 3 | Nizhniy Novgorod | 25% | 1 273 | -9,5% |
| 4 | Kazan | 37% | 1 191 | 8,7% |
| 5 | Samara | 29% | 1 172 | -4,3% |
| 6 | Chelyabinsk | 34% | 1 169 | 15,1% |
| 7 | Omsk | 27% | 1 166 | -0,1% |
| 8 | Rostov-on-Don | 27% | 1 110 | 9,3% |
| 9 | Ufa | 30% | 1 107 | 1,1% |
| 10 | Krasnoyarsk | 44% | 1 067 | 21,4% |
| 11 | Perm | 24% | 1 042 | -0,8% |
| 12 | Volgograd | 22% | 1 018 | 1,7% |
| 13 | Voronezh | 39% | 1 014 | 13,3% |

All cities except for Omsk are characterized by one or more (Ufa, Chelyabinsk) density peaks at different distances from the city center (Tab 2). These peaks in most cities can be revealed using the housing density profiles in general, but it is more convenient to use the housing density profile only within residential areas for this purpose. The additional peaks of density (housing density within a residential area of 150 thousand sq. m. per 1 sq. km and more) at the distance of 5-7 km from the city center are observed in Ufa, Krasnoyarsk, Yekaterinburg, Voronezh, Rostov-on-Don, Kazan, Chelyabinsk. The additional density peaks at the distance of 9-11 km from the city center are characteristic of Chelyabinsk, Ufa, Samara, Nizhny Novgorod. In Perm and Chelyabinsk the additional peaks are located at the distance of 15 – 17 km from the city center. The presence of

additional peaks at the largest distance from the city center (20 – 25 km) is typical of Volgograd and Novosibirsk. In such cities as Samara, Volgograd and Ufa density of the residential buildings in residential areas within the peaks is comparable with the values of the corresponding figure in the central parts of the city.

**Tab. 2. Housing density peaks in the largest Russian cities**

| City | Closest peak | Medium peaks | | Remote peak |
|---|---|---|---|---|
| Distance from the city center | 5-7 km | 9-11 km | 15-17 km | 20-25 km |
| Novosibirsk | | | | + |
| Yekaterinburg | + | | | |
| Nizhniy Novgorod | | + | | |
| Kazan | + | | | |
| Samara | | + | | |
| Chelyabinsk | + | + | + | |
| Omsk | | | | |
| Rostov-on-Don | + | | | |
| Ufa | + | + | | |
| Krasnoyarsk | + | | | |
| Perm | | | + | |
| Volgograd | | | | + |
| Voronezh | + | | | |

Analysis of changes in housing density profiles revealed that in varying degrees the density growth in the central areas happened in 1992 – 2015 in all cities from the sample. The density of residential development within a radius of 1 km from the city center has increased two and a half times in Kazan; two times in Yekaterinburg; more than one and a half times in Novosibirsk, Nizhny

Novgorod, Ufa, Voronezh, Samara; 1.3 – 1.4 times in Omsk, Rostov-on-Don, Perm, Krasnoyarsk, Chelyabinsk and Volgograd. Within the “closest” peaks in the cities there is also tendency of increasing housing density in the 1.5 – 2 times. In the some cities “closest peaks” have appeared or have become much more expressed as a result of large-scale construction in the post-Soviet period (for example, in Yekaterinburg, Voronezh). The “medium” and “remote” peaks haven’t seen such intensive growth of housing density.

Fig. 3 shows the distribution of housing construction in the post-Soviet period in each city by zone at the different distance from the city center.

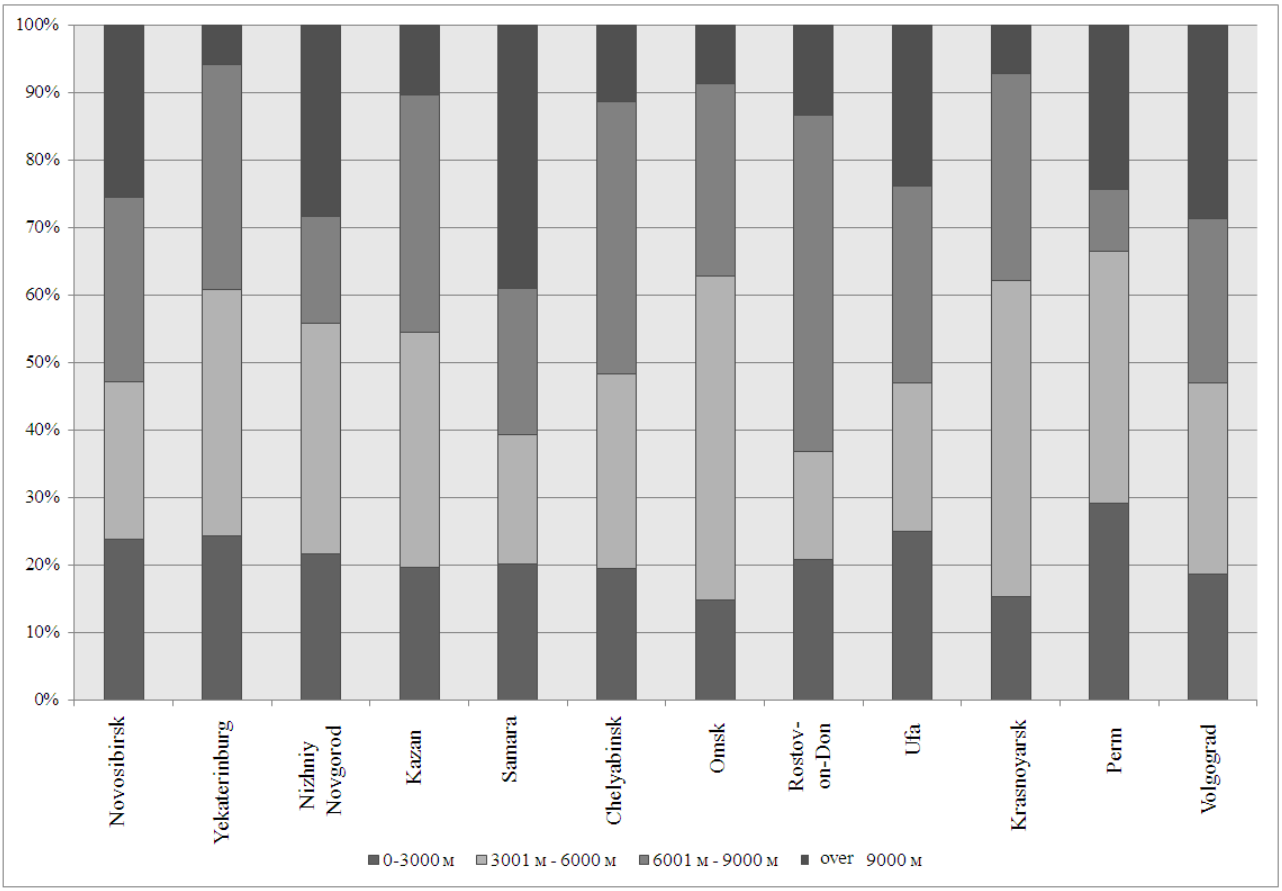



Fig. 3. Allocation of the housing construction in the post-Soviet period by zone at the different distance from the city center

The proportion of the area of residential buildings within a radius of 3 km from the center in the general volume of housing construction ranges in studied cities from 15% (Omsk, Krasnoyarsk) to 29% (Perm). This zone is not leading by the volume of housing construction in the post-Soviet period in any city. In some cities (Yekaterinburg, Nizhny Novgorod, Omsk, Krasnoyarsk, Perm), the largest volume of housing construction (34 - 48%) has concentrated in the area of 3 - 6 km from the center. In Novosibirsk, Kazan, Chelyabinsk, Rostov-on-Don and Ufa, the main volume of constructed housing (27 - 50%) is situated in zone 6 - 9 km from the center. Housing construction

took place mainly at the distance of 9 km from the center and further in Samara (39%) and Volgograd (29%).

Thus, it is possible to reveal two countervailing trends. Both trends are illustrated by the example of the city of Yekaterinburg (Fig. 4).

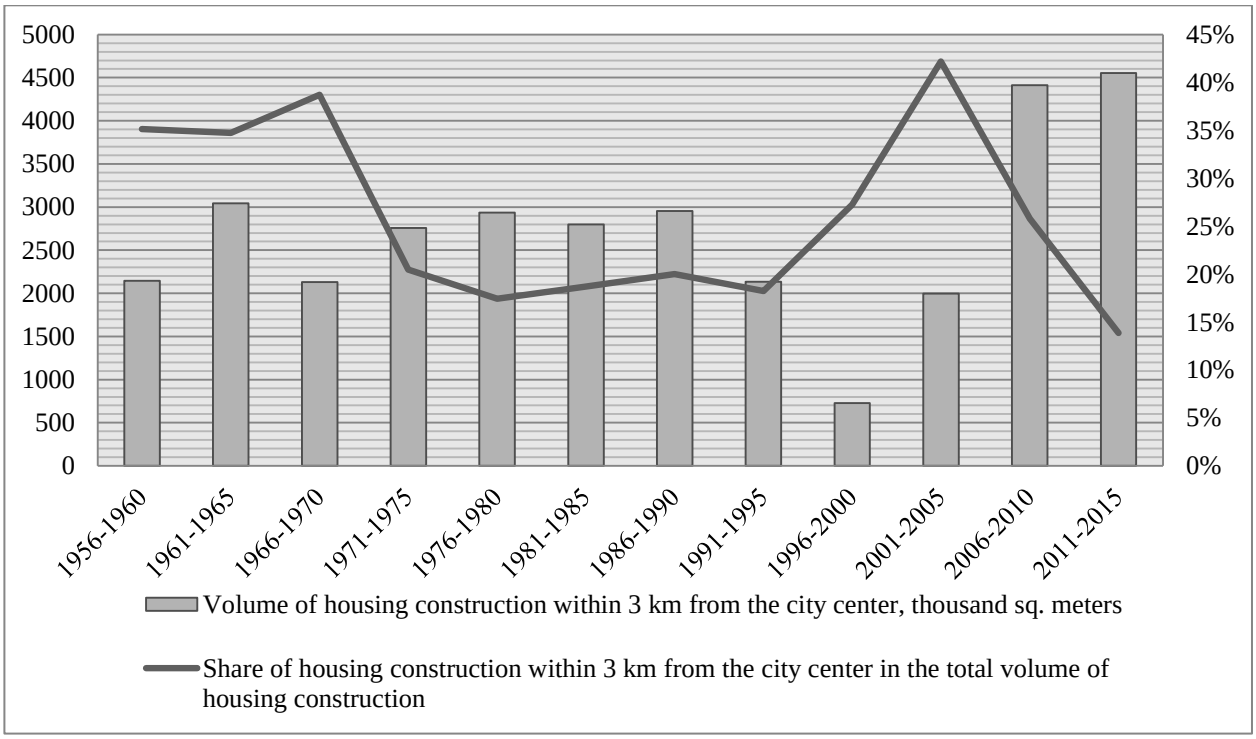



Fig. 4. The dynamics of housing construction in the central part of Ekaterinburg

Within the first trend all the cities from the sample have seen the essential increase in housing density within the central parts. This trend prevailed in the early post-Soviet years, i.e. during the initial formation of the market of housing construction. The second trend is the continuation of the Soviet urban planning practice of so-called integrated development of greenfield areas in the outskirts of cities (Косарева, et al., 2015). This trend prevailed during the housing construction boom, induced by high oil prices of the 2000s. The Russian model of the sprawl, in contrast to its Western predecessor, has been focused on a dense multi-story development. In addition, development of the new territories was only formally integrated: in fact residential areas of the Soviet type were built with a minimum number of jobs nearby. Meeting the transport demand of these areas (regardless of the level of motorization of the population living there) is extremely difficult. Cases of major projects of housing construction in the downtown area are quite rare, but still can be found. Examples include residential complex “Seventh Heaven” in Nizhny Novgorod (in the central part of the city on the Volga river near 2018 World Cup objects); new residential

complexes in New Savinovsky district of Kazan (also in the city center and near 2018 World Cup objects, approximately 2 million sq. m.).

Analysis of the proportion of the area of apartment houses being built within the outskirts development in urban areas, in the total amount of housing construction in different cities also confirms the idea that the large-scale construction in major Russian cities is associated with the sprawl. The maximum proportion of outskirts neighborhoods in the total volume of housing construction in the post-Soviet period is characteristic of cities that have experienced the most significant growth in the housing stock (Fig. 5): Krasnoyarsk (64%) and Voronezh (57%). In some cities, the value of this indicator is significantly lower: Samara – 9%, Perm –15%. In most cities, the value of the indicator is about 20 – 30%. These new neighborhoods usually are almost purely residential; jobs are mainly available only in the service sector. However there are regulations for social services provision: schools and basic medical provision are presented more or less evenly in every residential area. The majority of the outskirt neighborhoods are provided with commercial spaces, mainly groceries. Many car-oriented shopping malls have emerged at the outskirts of large cities since 1990s.

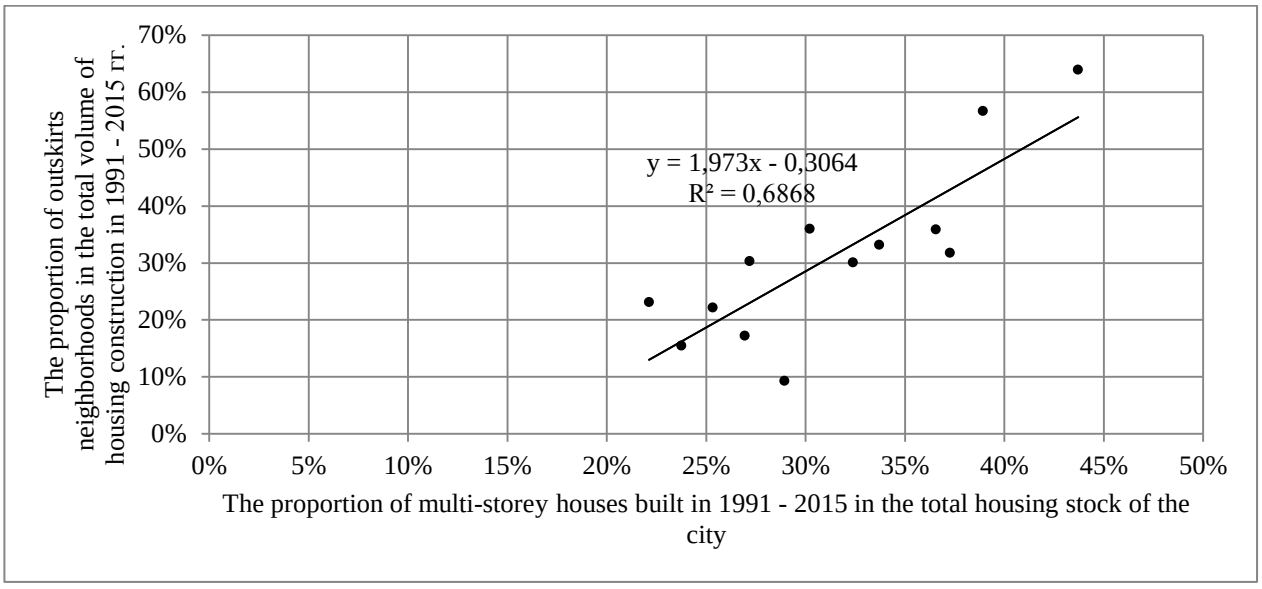



Fig. 5. The proportion of outskirts neighborhoods in the total volume of housing construction in the post-Soviet period

The share of total area of buildings constructed during the post-Soviet period within a radius of a walking distance (800 m) from the subway stations in the cities, where this transport mode is present, amounts to 12 – 24% (Fig 6). The highest value (24%) is observed in Novosibirsk, where the subway network is rather developed (two lines, 16 km, 13 stations). In Nizhny Novgorod, which has a comparable to Novosibirsk subway network (two lines, 19 km, 14 stations), the proportion of

housing built in the post-Soviet period in a radius of a normative accessibility is only 13%. In Samara, Kazan and Yekaterinburg there is only one subway line (10 stations in Samara and Kazan, 9 stations in Yekaterinburg). Among these cities leader in the share of housing built in the post-Soviet period in a radius of a normative distance from the subway stations is Yekaterinburg: 19% versus 12% in Kazan and Samara. The accessibility of the post-Soviet housing to the tram stations varies greatly by city. In Samara, the share of post-Soviet housing located within a normative distance from the tram stops (400m) is 60%; Krasnoyarsk – 5%.

Another problem is the transport services provision to the neighborhoods, which are being built in the urban outskirts. Usually the development of transport network is unable to "catchup" with the housing construction at these areas: many areas designed in the Soviet period have been provided with competitive public transport only recently. Examples include the districts Botanicheskiy neighborhood in Yekaterinburg, neighborhoods Azino-1 and Azino-2 in Kazan (Annex B).

*Botanicheskiy* neighborhood is located in the southern part of Yekaterinburg at about 5 km from the city center. In fact, it is the last Soviet residential district in the city, as its design was conducted during the Soviet period: the development of the area became possible after the removal of the airport in 1985. The main construction was conducted in the 1990s. Total area of residential buildings in the neighborhood is about 0.7 million sq. m. The neighborhood is mainly built up with 10 – 16-story buildings. Jobs in the area are available only in the consumer services sector. Currently, the neighborhood is connected to the central part of the city by subway ("*Botanicheskaya*" station opened in 2011, but was planned in the Soviet Union). The most remote from the subway station part of the area is served by the tram line (no priority) with a connection to the subway closer to the city center.

Neighborhoods *Azino-1* and *Azino-2* are located to the east from the center of Kazan at a distance of about 8 km. Total area of residential buildings in this two neighborhoods is more than 2 million sq. m. Like in *Botanicheskiy* neighborhood in Yekaterinburg the development took place mainly in 1990s. The area is located close to the Big Kazan Ring, where light rail was launched after the reconstruction in 2012. It provides access to the central part of the city and to the southern subway station "*Prospect Pobedy*" (built in 2008).

In the more recently constructed remote districts there is currently no public transport which is able compete with the private car in terms of the convenience for residents. At the same time, these districts are mainly being built according to the Soviet planning regulations. The whole private transport demand from commuters in the direction of the city center and back will have to

be met predominantly by the poor road network, built in the 1960-1980s. Competitive alternatives to the private transport in most cases simply do not exist. The examples of such districts are *Krutye Kluchi* in Samara and *Akademicheskiy* in Yekaterinburg.

Neighborhood *Krutye Kluchi* is being built 21 kilometers north-east of Samara city center. Construction began in the early 2010s; the project is expected to be completed by 2025. It is planned to build 5 million sq. m. of housing. Transport services area currently provided by municipal buses and buses private bus operators with high frequency (intervals less than 5 minutes), but without dedicated lanes.

Neighborhood *Akademicheskiy* located 7 km south-west of Yekaterinburg city center. Construction in the area began in the late 2000s, it is planned to build 9 million sq. m. of residential real estate and 4.2 million sq. m. of office and commercial real estate. Transport situation in the area today is similar to the situation in *Krutye Kluchi*. The construction of tram is planned using extra-budgetary sources, but the issue is not yet settled. In general, the practice of developers and owners of commercial properties involvement into the financing of public transport projects in Russia is extremely rare and is limited to several cases.

## Discussion and conclusion

Thus, there are two key ambivalent trends in the spatial development of large Russian cities during the post-Soviet period. On the one hand, there is a considerable density increase of residential development in the downtown area and in the areas properly served by public transport; on the other hand there is a continuation of the extensive high-density development in suburban areas. These trends are evident in each individual city: anywhere it is possible to find positive examples of efficient land use in the central parts of the city characterized by high levels of transport accessibility and the cases of large scale greenfield development. Two mentioned trends are also characteristic (and probably even more evident due to the economic activity concentration and considerable population growth) of Russian capital cities – Moscow and St. Petersburg, which are not included in our sample. For example, the changes that took place Moscow in 1989 – 2010 have not significantly impacted the density population distribution pattern of the city (Kosareva, Novikov, Polidi, Puzanov, 2013).

The first trend is a direct result of the transition to land and real estate market, and is a very positive factor in terms of transport services provision and the reduction of the need to travel. Many of the cities have inherited from the Soviet period and/or subsequently managed to develop public transport systems of quite a good quality in the city centers. The development of the areas served by

public transport can improve economic sustainability of the public transport operators and helps to prevent growth of car use. In those cities where, for some reasons, public transport systems are underdeveloped for the time being, the trend for density increase will significantly simplify the task of the transport services provision in future.

The second trend, on the other hand, has a negative impact on the transport services provision. Only in rare cases cities manage to keep pace with the housing construction and provide new areas with public transport of reasonable speed and capacity. New neighborhoods are served by bus operators at regular routes and schedules or by paratransit "*marshrutkas*". In both cases, the buses move in the general flow of vehicles, that is, have a ROW-C. Commuters – residents of the new neighborhoods – are usually car owners and often car owners of the first generation. It is very difficult to persuade such citizens to choose even the high quality formats of public transport, and they are unlikely to opt for the bus route with low ROW. These circumstances lead to the extensive use of cars for commuting, and, accordingly, to the further growth of car ownership, including the appearance of the second or third car in the household. Meanwhile, the new neighborhoods are not suitable for such a situation. There is a chronic shortage of parking spaces, as well as the obvious inconsistency between the adjacent road network capacity and real demand caused by widespread motorization.

Mass housing construction in remote areas is often combined with inefficient land use within the urban core which is properly served by public transport. An example is the *Ametevo* neighborhood in Kazan, located in close proximity to the subway station built in 2005. Here, despite the availability of transport resources, sufficient for transit-oriented development, the low-density individual buildings constructed 40 or more years ago are maintained. More typical examples of the ineffectiveness of land use are unused industrial zones, located in the middle parts of many Russian cities. Described negative trends can be first of all low explained by the low quality of land use regulation, characteristic for the majority of Russian cities. Currently, the main territorial planning documents in city include *"general plan"* (main urban planning document), as well as land use and development rules (zoning regulations). The quality of the development of these documents and, moreover, the thoroughness of their realization remained at a low level throughout the post-Soviet period. Moreover, huge part of urban land remains in the municipal property. As might be expected, the abolition of the planned economy and of the state monopoly on the urban development process did not immediately result in the creation of the full-fledged land market. The administration received the right to grant land to private investors and developers and to receive the money for the land and/or compensation in kind – constructed apartment buildings (Трутнев, 2011). Such situation increases the municipality's interest in the development of new territories. A similar

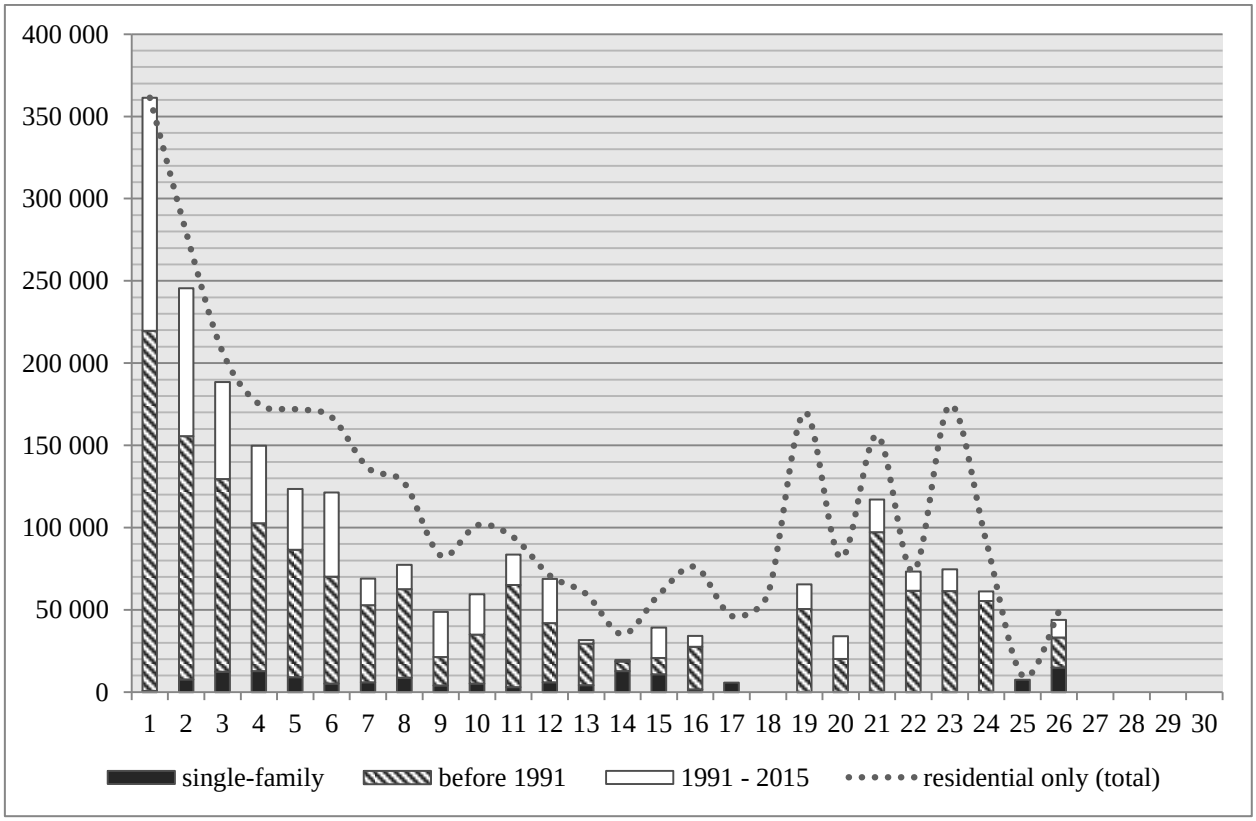
problem can be observed in China's cities, where land resources are also concentrated in the municipal property. Cities of Central and Eastern Europe also experienced difficulties in formulating a clear policy of spatial development in the context of choosing between the development of peripheral areas in response to the demand for new construction and the need to make urban core denser (Bertaud, 2004).

Things are made worse in Russian cities by such factors as monocentrisity and low residential mobility. With the increase of the service sector share in the economy employment is naturally concentrated in the central parts of cities, which are evident in all Russian cities. On the other hand, the level of residential mobility remains very low, which does not allow citizens to optimize their transport needs by changing their place of residence. According to the estimates based on the level of prices and mortgage lending rates, only 30% of the population in Russia in 2014 had the opportunity to purchase an apartment or house which was the highest figure in the decade. In the first quarter of 2015 due to the decrease in income and an increase in bank interest rates, the value fell to 24.7% (Косарева, et al., 2015).

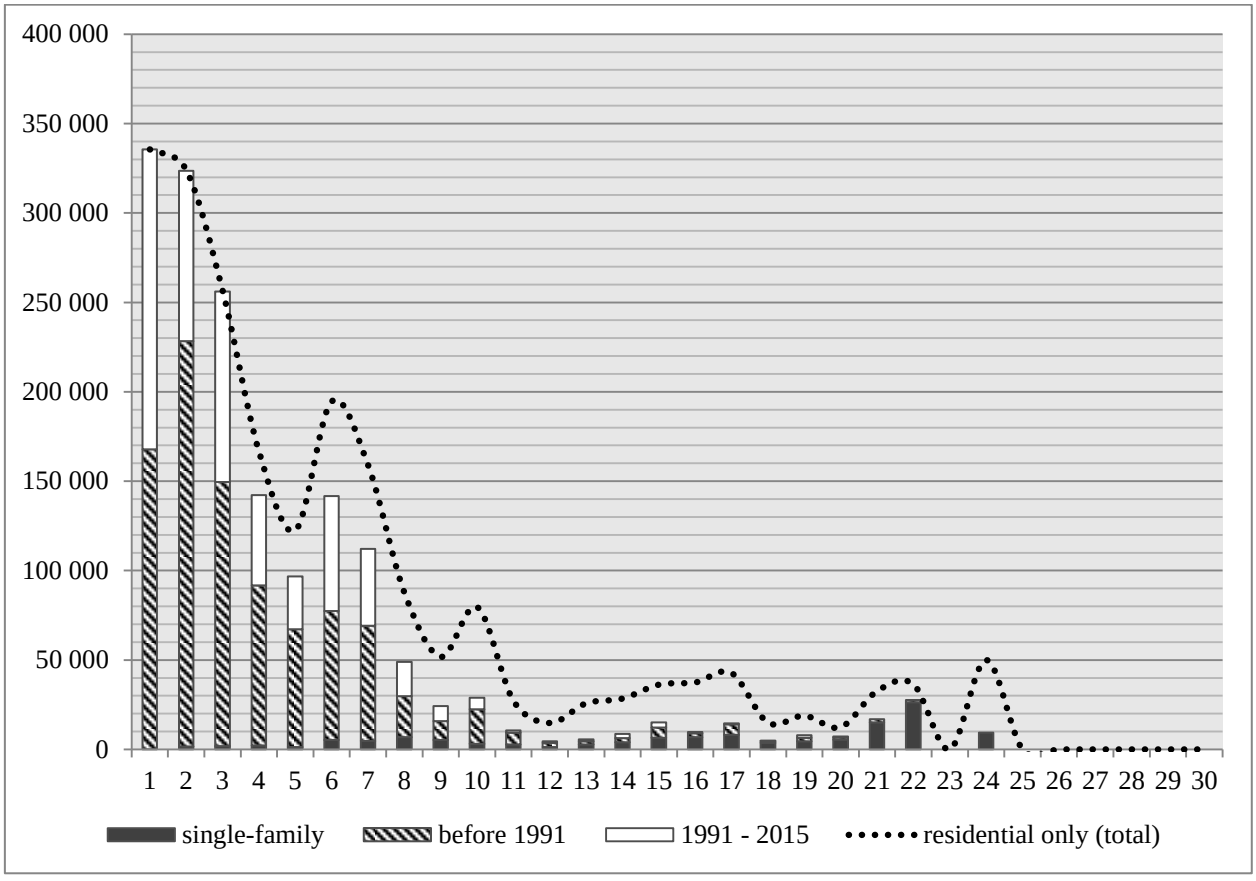
Partly natural, market transition to the intensification of urban land use next to the city centers should theoretically lead to an increase in the share of non-motorized trips and generally move in the direction of the social optimum. However, SSD principles, which are still used within the development of the remote from city centers greenfields, due to growing motorization rate lead to serious consequences in the form of severe congestion.

# Annex A: Density profiles the largest Russian cities

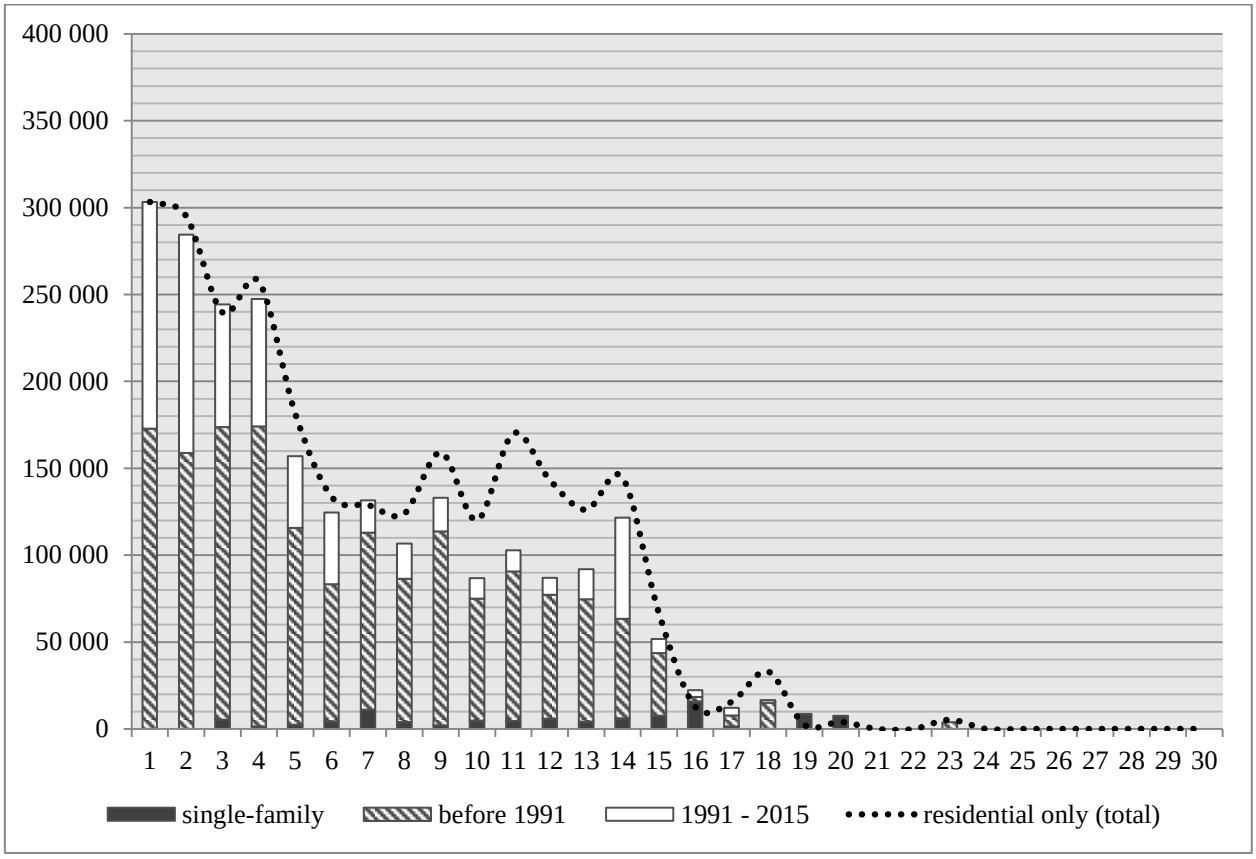
## Novosibirsk



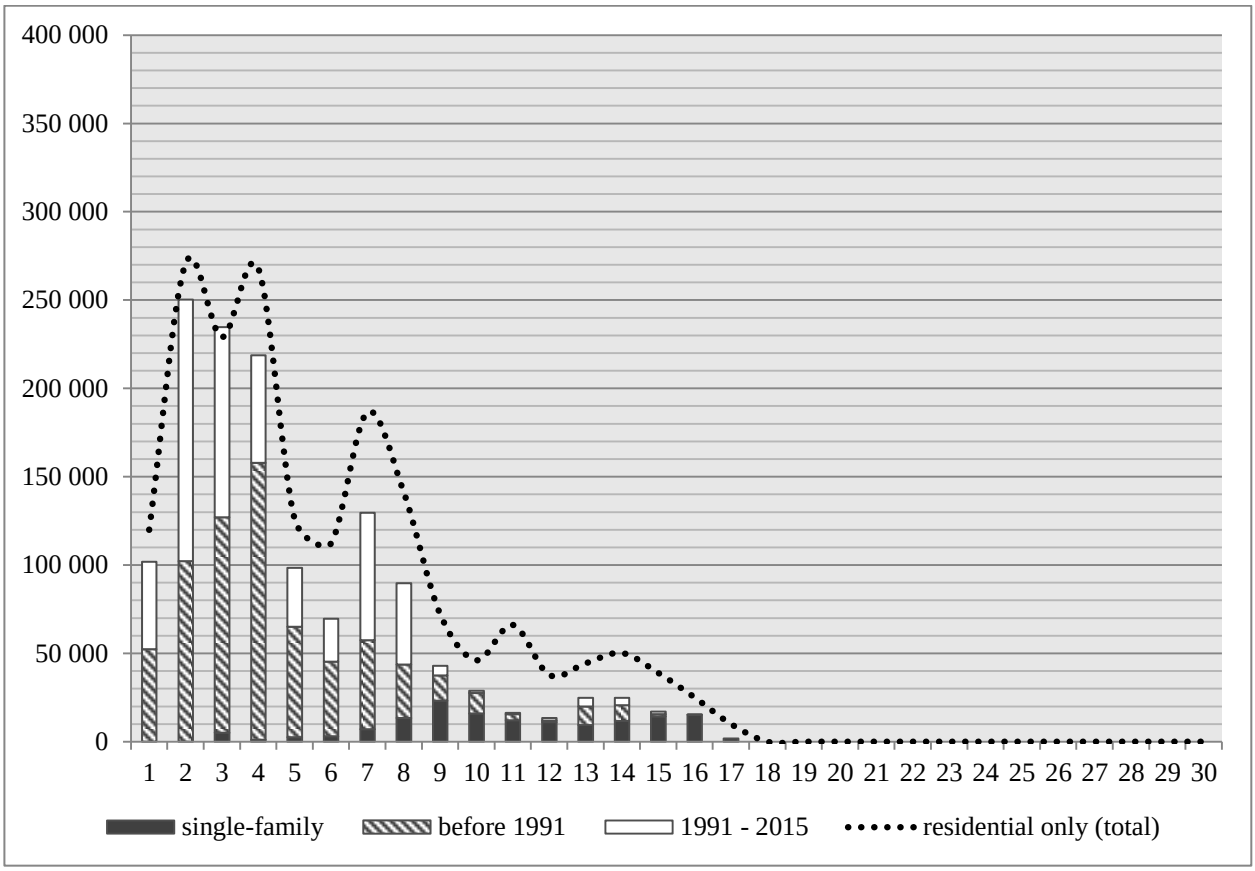

## Yekaterinburg



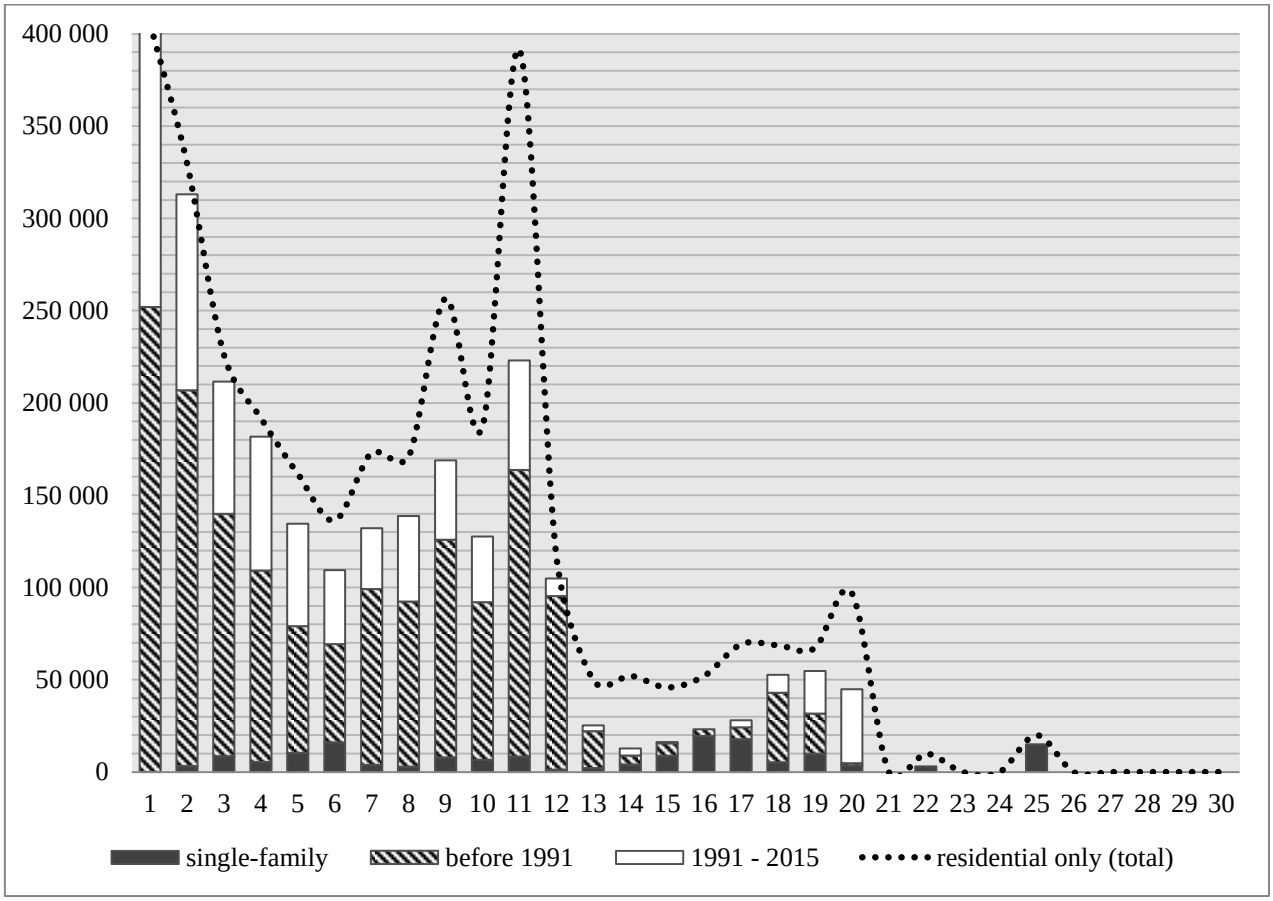
## Nizhniy Novgorod



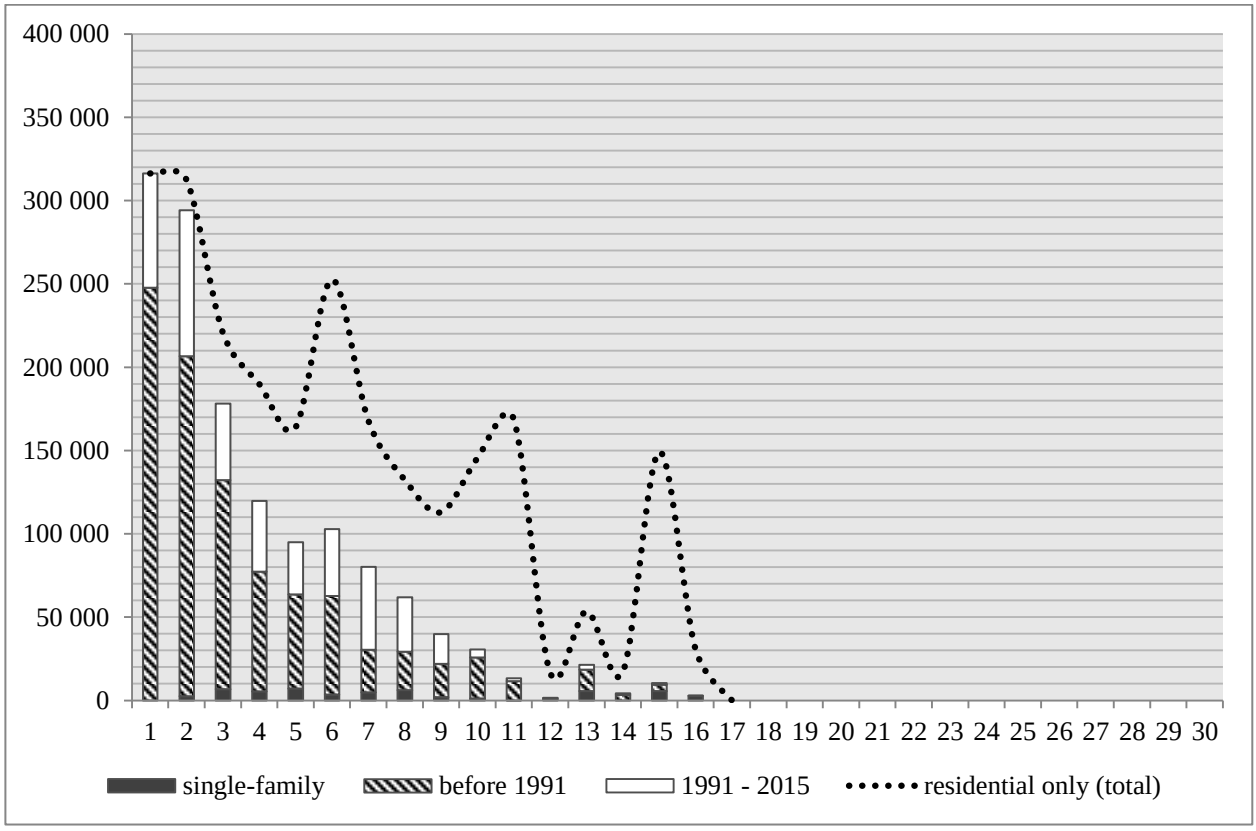

## Kazan



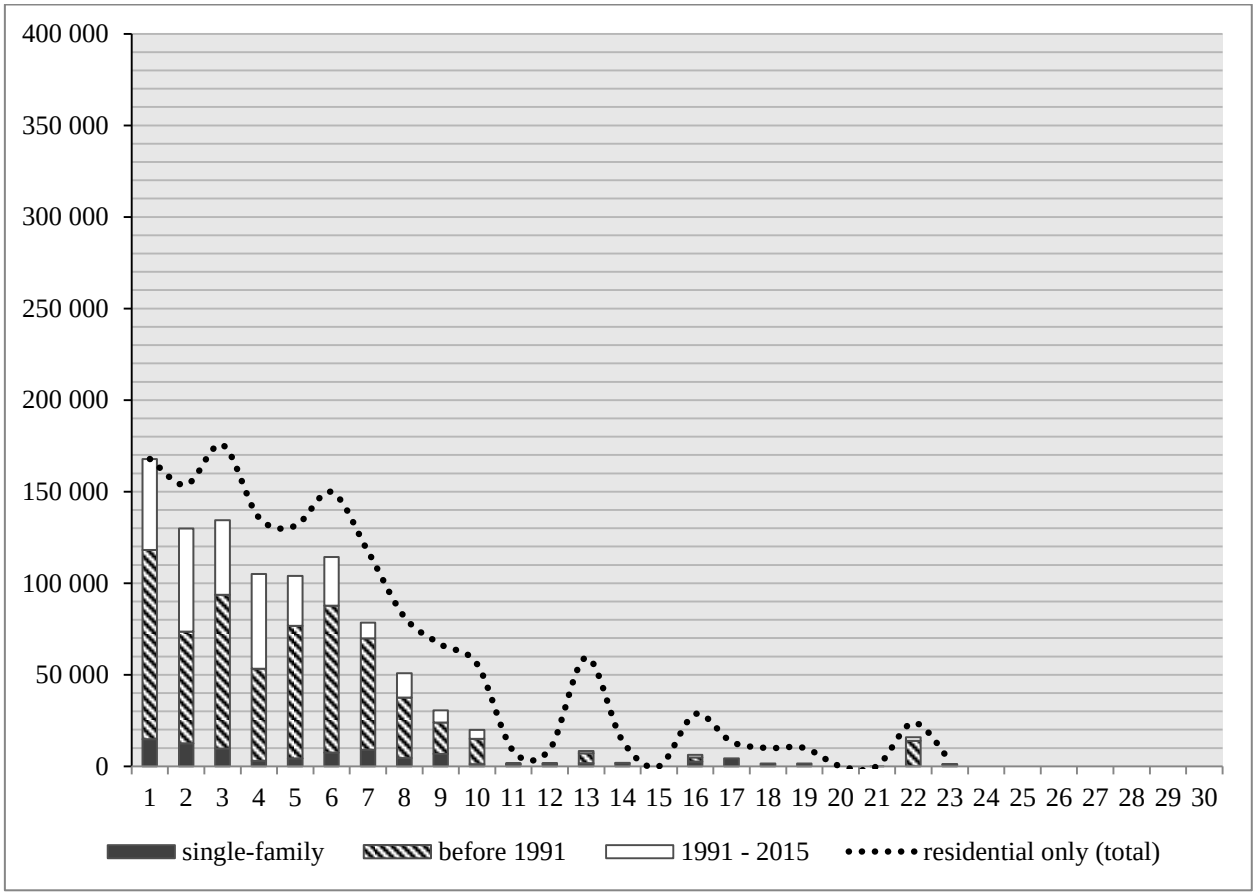
## Samara



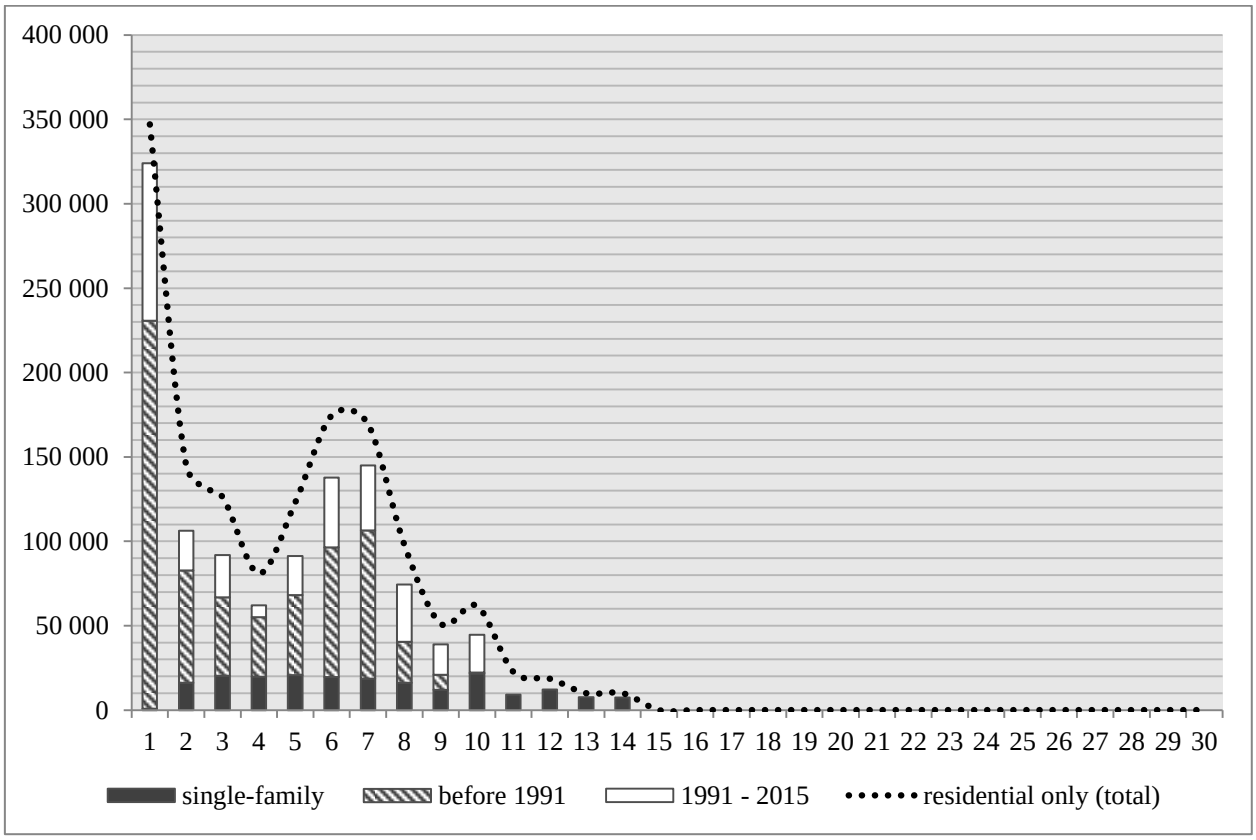

## Chelyabinsk



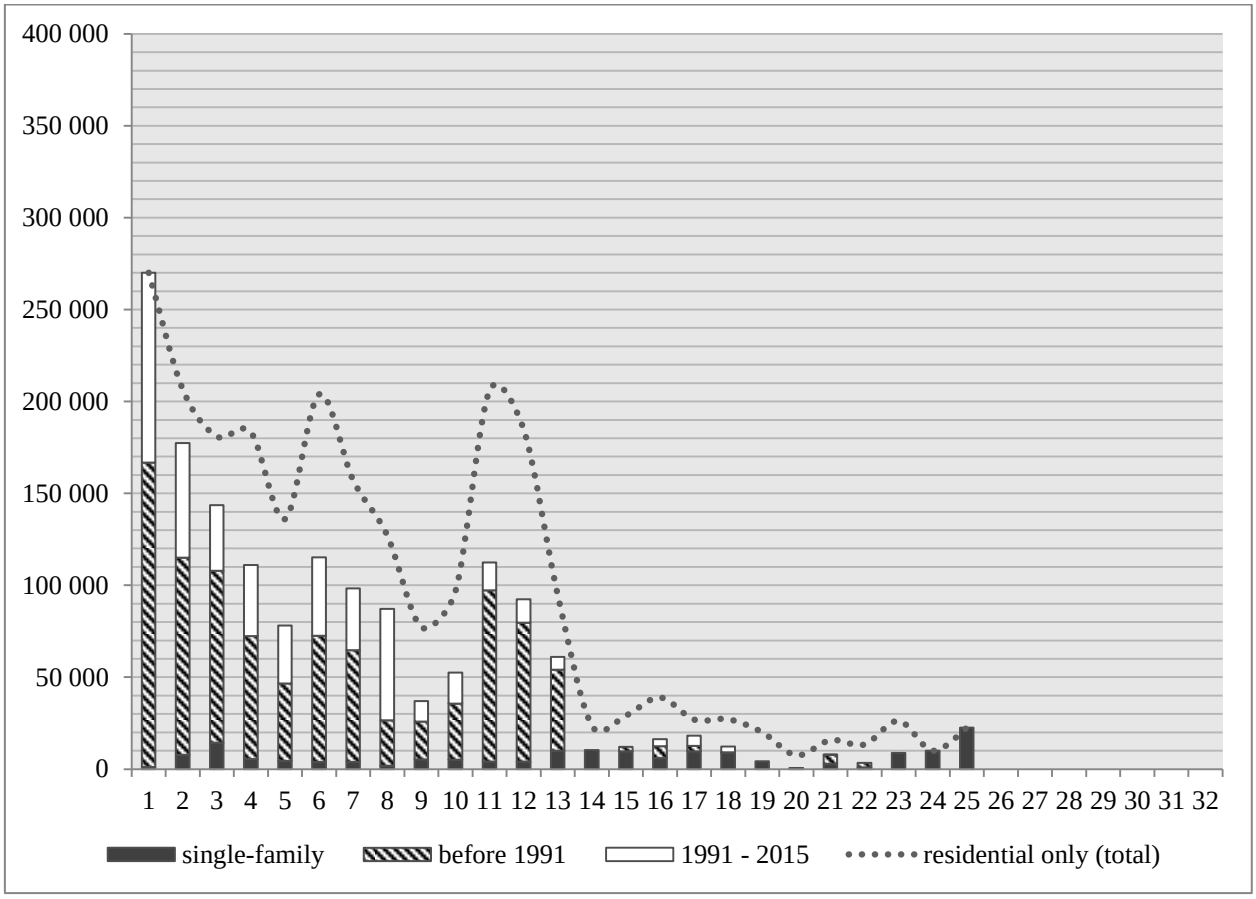
## Omsk



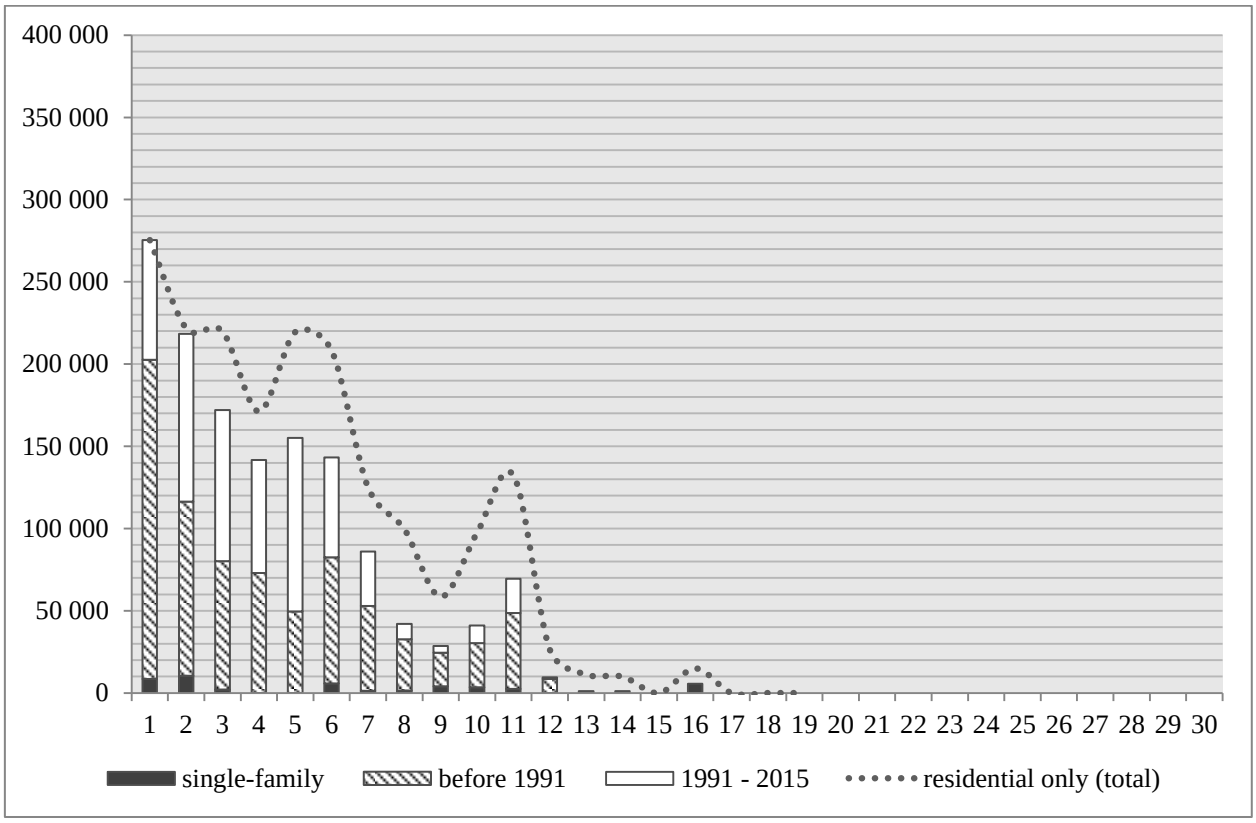

## Rostov-on-Don



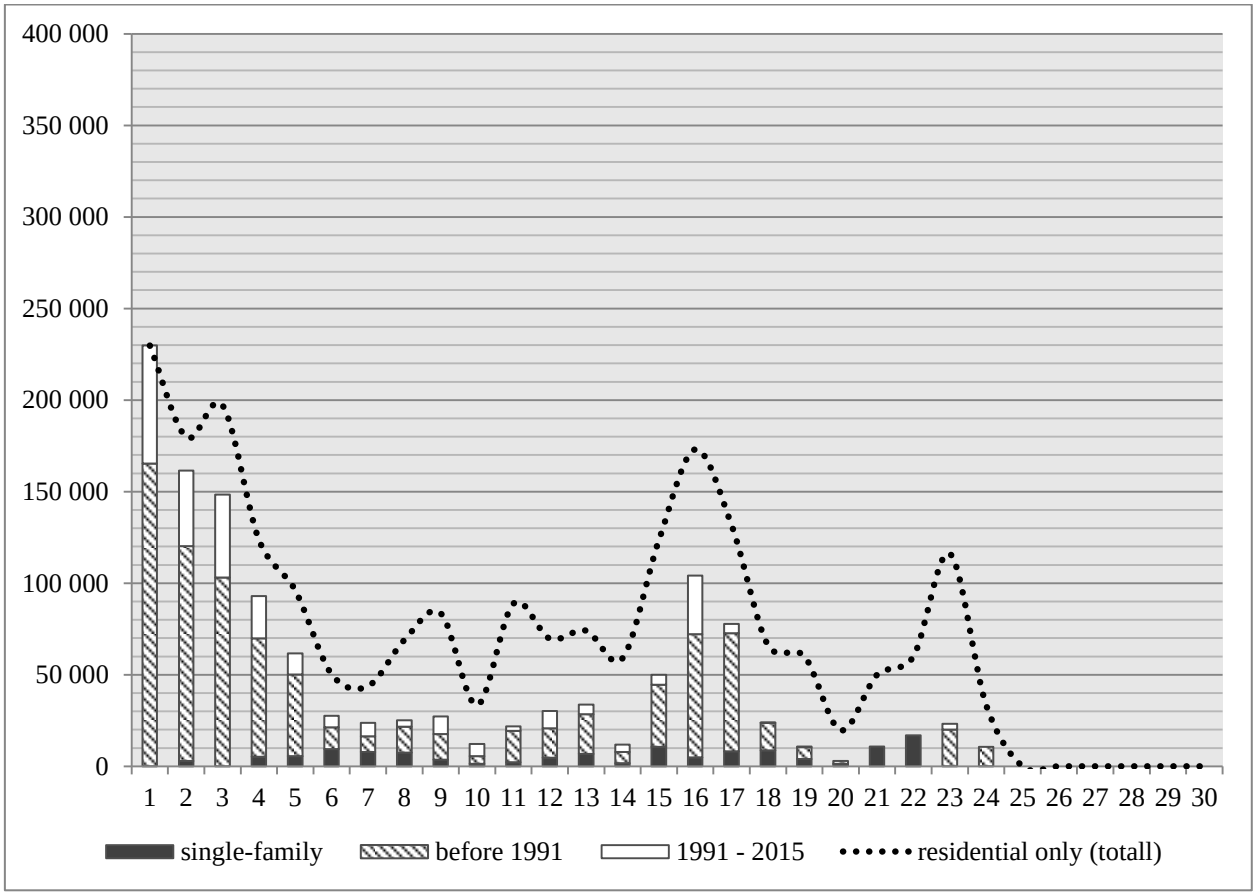
## Ufa



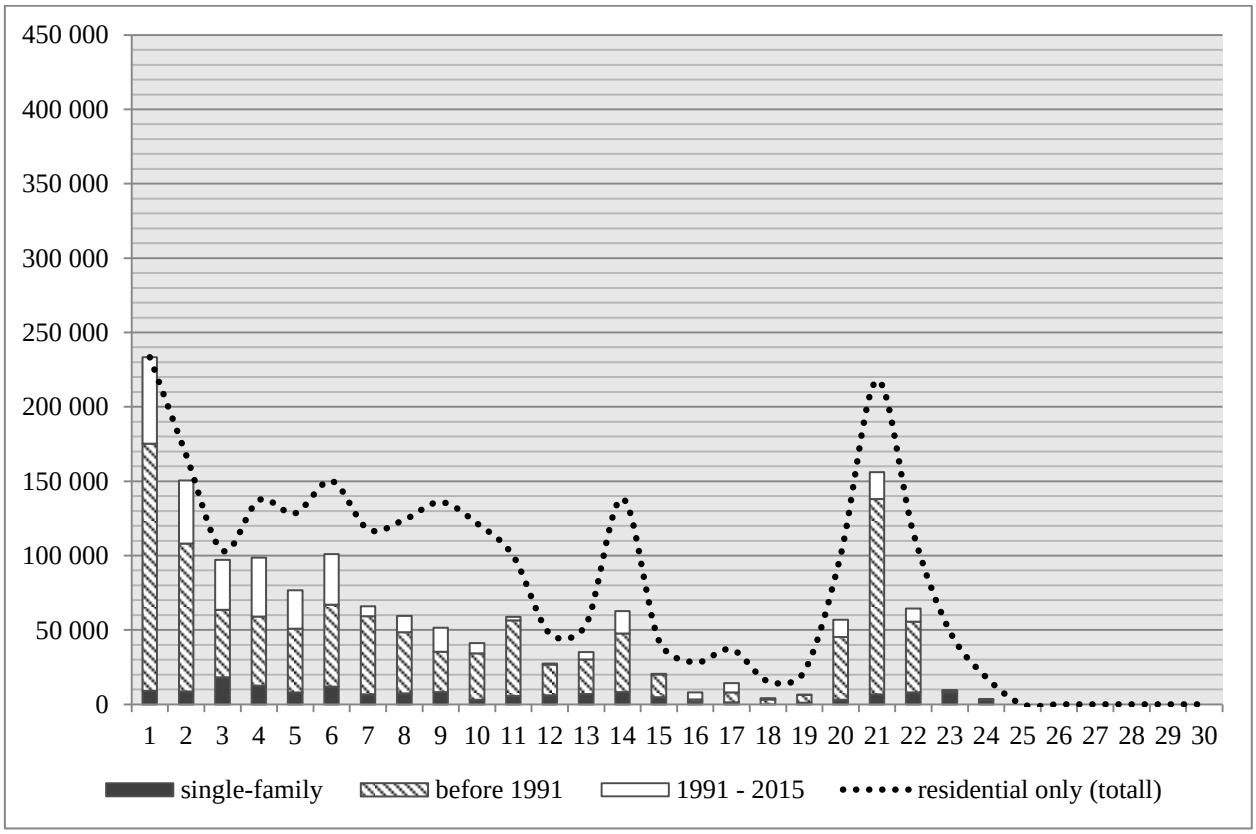

## Krasnoyarsk



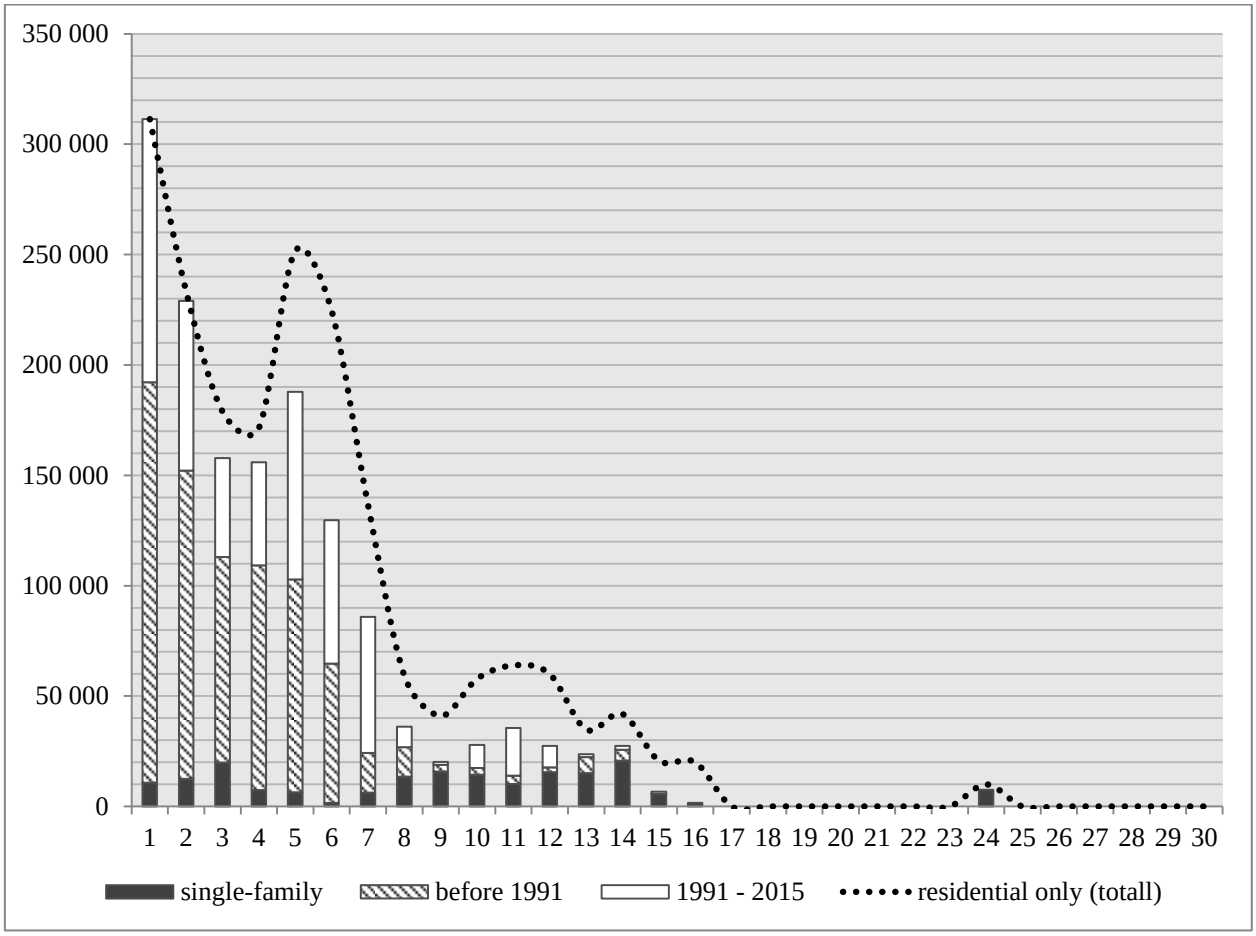
## Perm




## Volgograd



## Voronezh

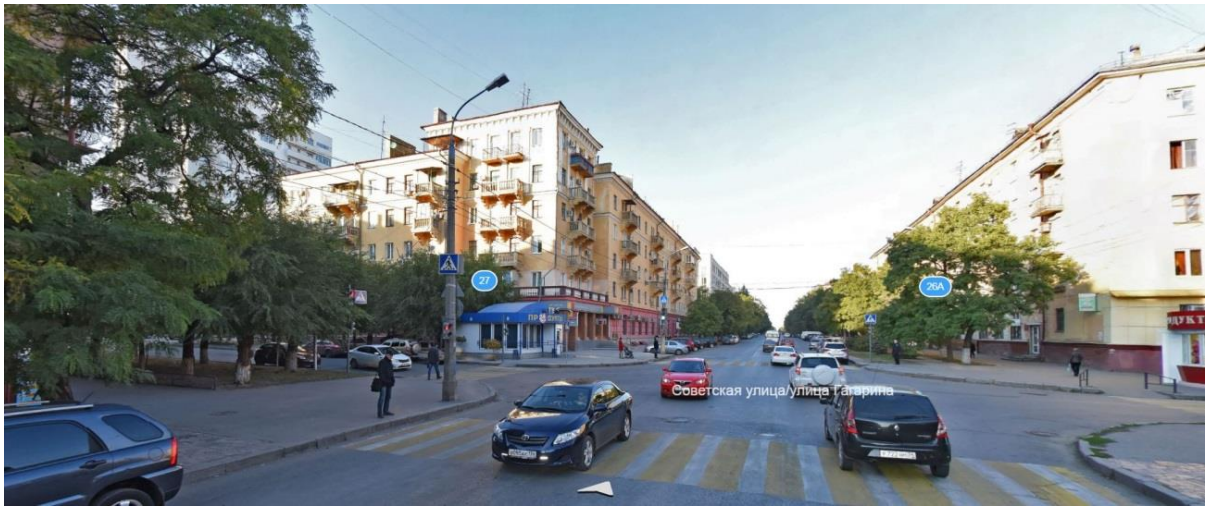

350 000
300 000
250 000
200 000
150 000
100 000
50 000
0
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
single-family
before 1991
1991 - 2015
residential only (totall)

# Annex B: Soviet and Post-Soviet neighborhoods in Russian Cities[5]

## Wooden 'barracks', typical development before 1957, Krasnoyarsk

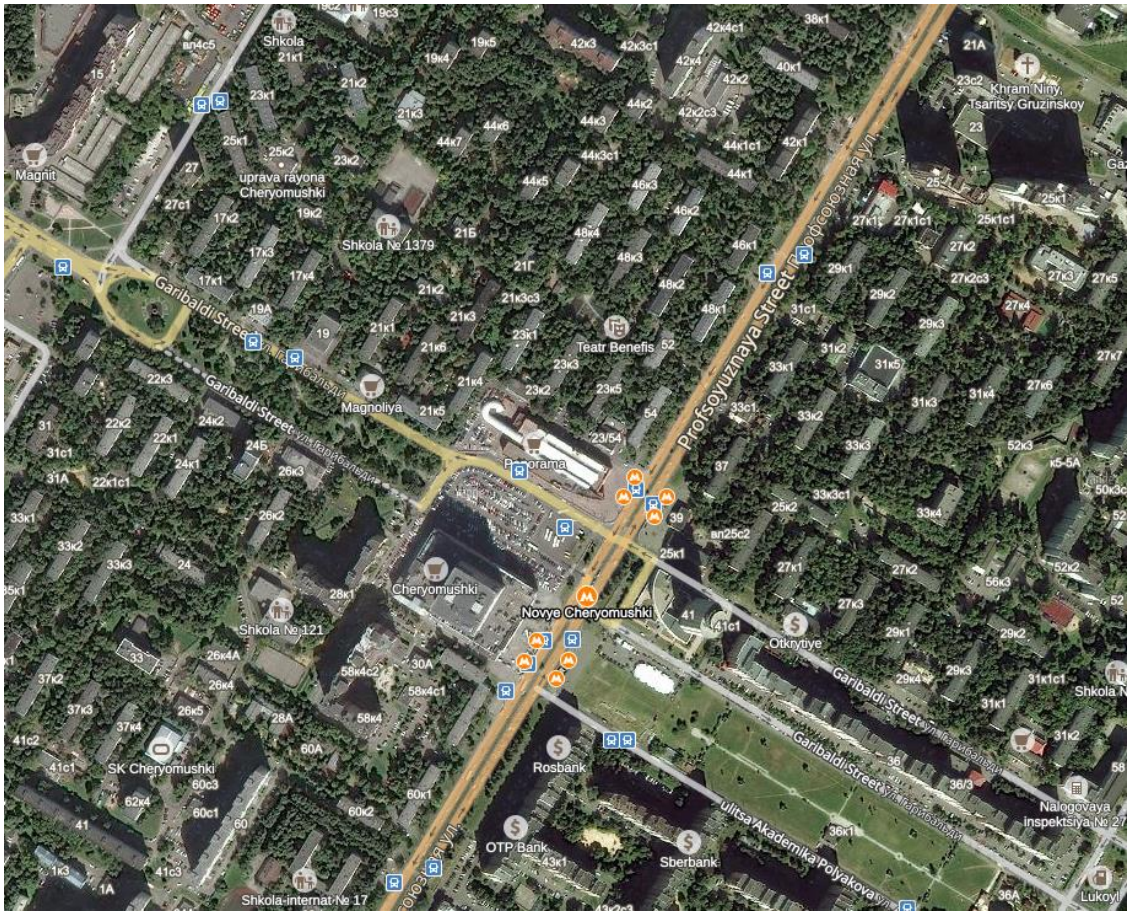
Yury Milevskiy's picture

## Typical elitist development before 1957, Volgograd

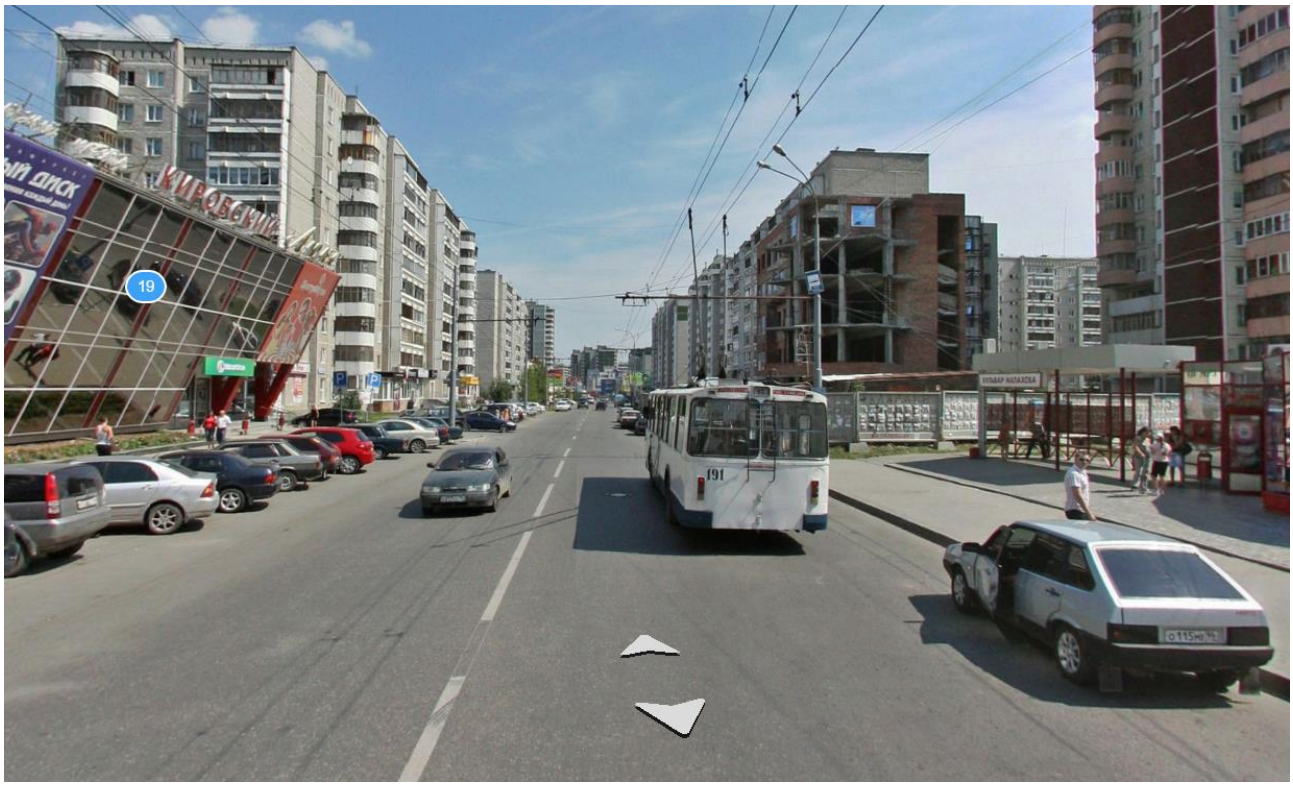



[5] Images from https://yandex.com/maps/, https://www.google.com/maps unless stated othewise

## Cheryomushki (Moscow)




## Botanicheskiy (Yekaterinburg)

## Akademicheskiy (Yekaterinburg)


## Krutye Kluchi (Samara)


## Azino 1 and Azino 2 (Kazan)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