# GEOINFORMATION MAPPING OF THE NETWORK OF MASS PASSENGER TRANSPORT IN OSH FOR A GENERAL ASSESSMENT OF TRANSPORT SERVICES TO THE POPULATION

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***https://doi.org/10.5281/zenodo.10523968***

***Abstract.*** *This article examines the passenger transport network of the city of Osh. Passenger transport was mapped using the ArcGIS program. An analysis of the operation of the city's public transport was carried out using Spatial analyst tools. Based on the results of the network analysis, the provision of the population with public transport was determined. When organizing passenger transportation, the main problems were identified, including non-compliance with the traffic schedule, which leads to an increase in the travel time of passengers on transport, systematic violations of traffic rules, excessively long stops at key stopping points due to an increase in transport on the roads, etc.*

***Keywords:*** *public transport, passenger flow, bus, service, passenger transportation, route, quality of service.*

## Introduction

Passenger transport is an integral part of the overall transport network of any city. For a city with a large population, large territory, and uneven population distribution, the level of development of the passenger transport network and the quality of its work are of vital importance.

The main goal in organizing the urban transport system is, first of all, to minimize transport costs, save time, increase safety and comfort when transporting passengers. The real situation of the city, where passengers are transported mainly by trolleybuses and minibuses, shows that the level and quality of public transport services are still unsatisfactory and do not meet the needs of the urban population [1].

## The actuality of research

Currently in Osh, due to the increase in the number of cars, the transport situation remains difficult. There are a number of problems, in particular the constant occurrence of congestion situations (“traffic jams” on the roads), an increase in the length of time for citizens to move around the city. When considering the development of transport infrastructure in large cities, it is necessary to take into account the territorial features of the processes of formation and improvement of the transport complex, which can be more clearly studied using geoinformation thematic mapping.

In this regard, mapping the transport network of the city of Osh and its geoinformation analysis is very relevant.

Many scientists have studied passenger transport and used different methods to achieve their goals.

In the author’s work [2], for the construction of rational route networks of passenger transport, the approach of partial automation and further expert assessment of the results obtained is highlighted.

Work [3] made a visual analysis of the history of the development of the transport network using GIS technologies, as a result of which it became possible to establish patterns of location of the transport network in different years and discover spatial relationships.

In the work of the next author [4], an analysis of the city's population density and the availability of stop locations on passenger transport routes was carried out. Graph theory was used to analyze the city's route network, which made it possible to estimate the time spent by passengers moving between existing public transport stops.

Osh is the second largest city, which is located in the south of Kyrgyzstan. The city's population is 302,100 thousand people. The population density is 4935 people/km$^2$.[5].

The length of the city along the axis from south to north is more than 10 km, and from west to east – more than 9 km. The total area is 182 km$^2$.

Every day, most city residents use public transport to travel within the city. The number of residents using public transport exceeds the number of citizens using private vehicles. Passenger transportation services are provided by the municipal motor transport enterprise and private carriers. The volume of passenger traffic is distributed between trolleybuses, buses and minibuses. Minibuses serve city residents, including isolated new buildings and residential areas, where, due to specific conditions, the operation of buses and trolleybuses is impossible [6].

**Formulation of the problem**

The purpose of the study is to create a geographic information system for the transport network of passenger transport in the city of Osh, which in the future would be the basis for monitoring carried out to assess the level of organization of passenger transport. The reason for the study was the decline in the quality of service provided to the population by mass passenger transport, as well as intensive motorization.

**Object and methods of research**

Passenger transport of the city of Osh was chosen as the object of study. To accomplish this task, a geoinformation model of a network of passenger transport routes was developed using ArcGIS tools. An electronic vector map of the city of Osh at a scale of 1:10,000 was used as the basis for the route network of the city's passenger transport. The base cartography of the city of Osh was taken in shapefile format from the open source OpenStreetMap (OSM). This map includes several vector layers such as roads, houses and city boundaries. Minibuses provide services to city residents, including new buildings and residential areas, which cannot be served by buses and trolleybuses due to special conditions.

Today, the route network of the city of Osh consists of 52 routes, of which 2 trolleybus lines, 6 bus lines and 45 routes are served by minibuses of private carriers. To assess the state of the network of mass passenger transport, a graph was formed; the diagrams of minibuses plying on 45 routes, the number of which exceeds 1000, were used as a base. The developed model includes the following objects: route diagram, final stops along the routes, stopping points, boundaries of municipal territorial departments of the city Osh (Fig. 1).

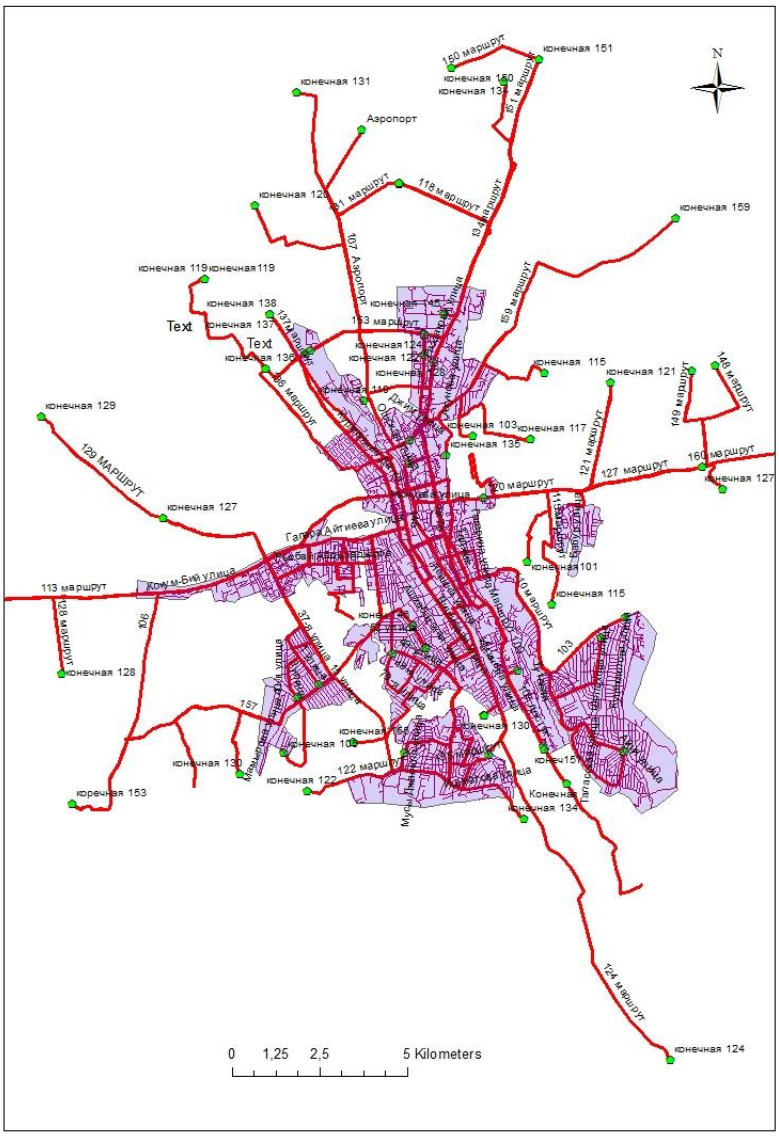



***Figure1. Route diagram of passenger transport in the city of Osh***

**Research results and discussion**

As a result of the data obtained, an assessment was made of the provision of municipal districts of Osh city with passenger transport.

Based on the urban division scheme, the city is divided into territorial departments:

RTD Kurmanzhan- Datka;

RTD Amir Temur;

RTD Manas Ata;

RTD Kerme-Too;

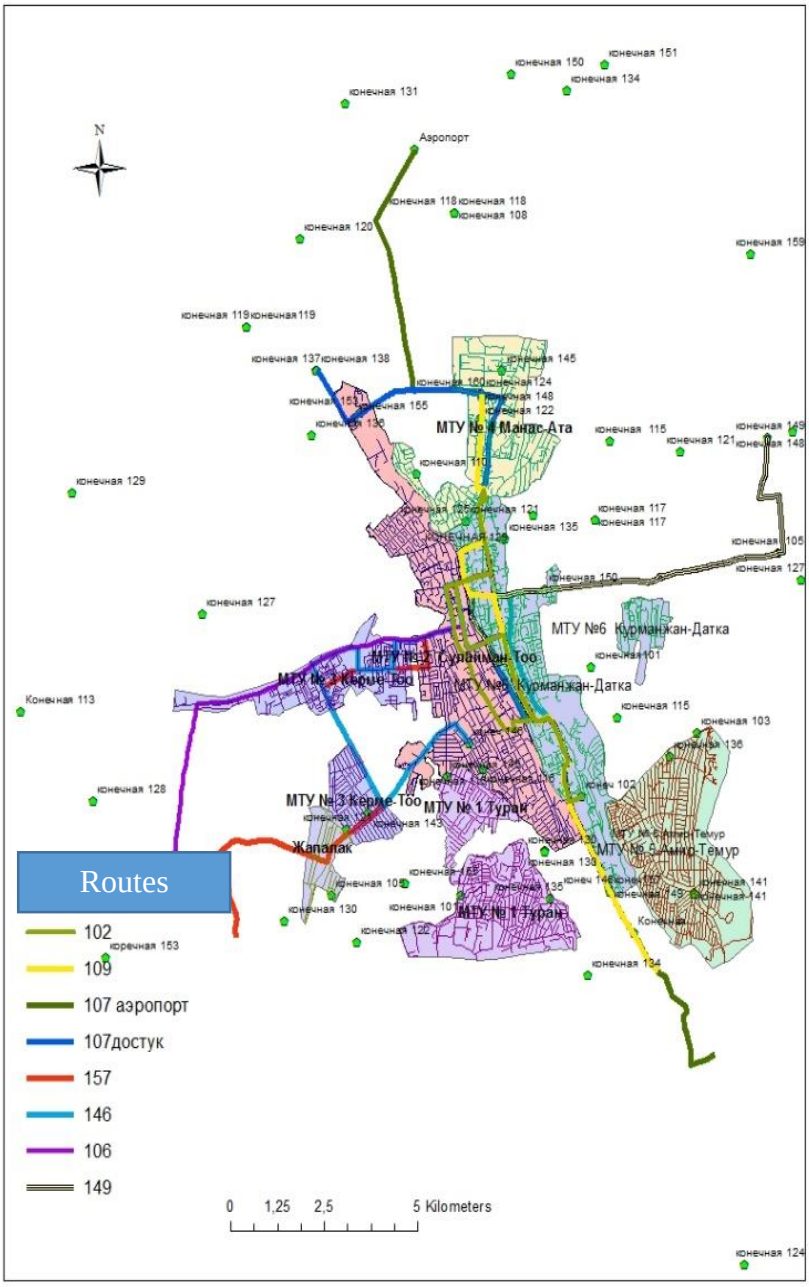
RTD Turan;

RTD Sulayman-Too;

RTD Japalak.

From RTD Kurmanjan- Datka followed this route : minibus 107 (South-East- Dostuk), 107 (South-East-Airport), 107 (South-East-Monik), 109 (Ozghur-Manac Ata), 157 (South-East-Arek), 146,142,102 (ring road), 149 (South-East-Furkat). The following routes operate on the Amir Temur RTD: 141,136,115,101(fig.2).

*Figure 2. Routes serving MTD Kurmanzhan - Datka*



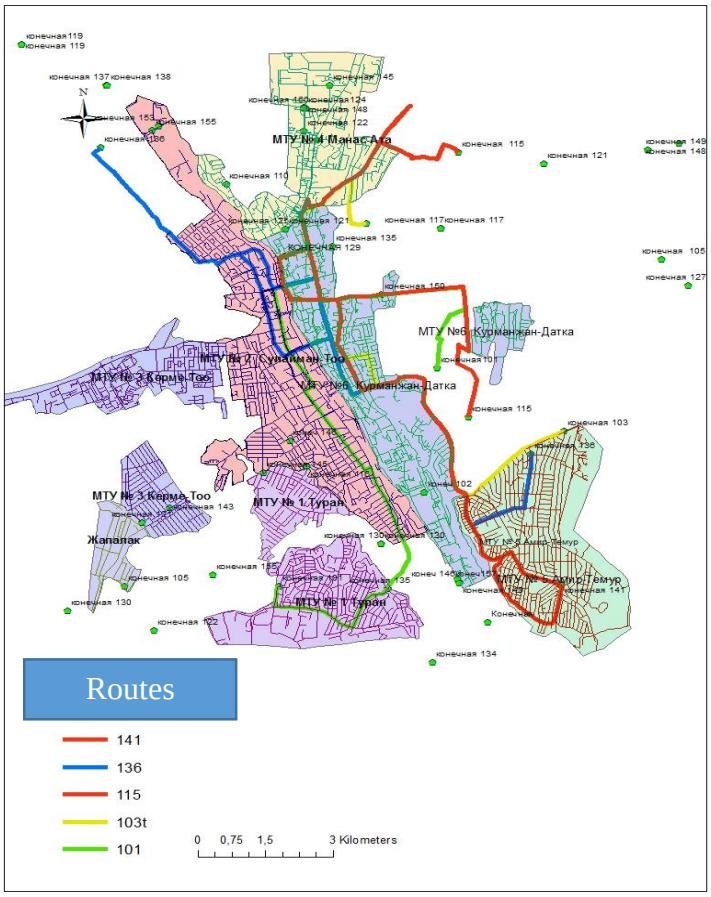



***Figure 3. RTD Amir-Temur***

The following minibuses operate on the Manas-Ata RTD: 109,160,148,122,124.

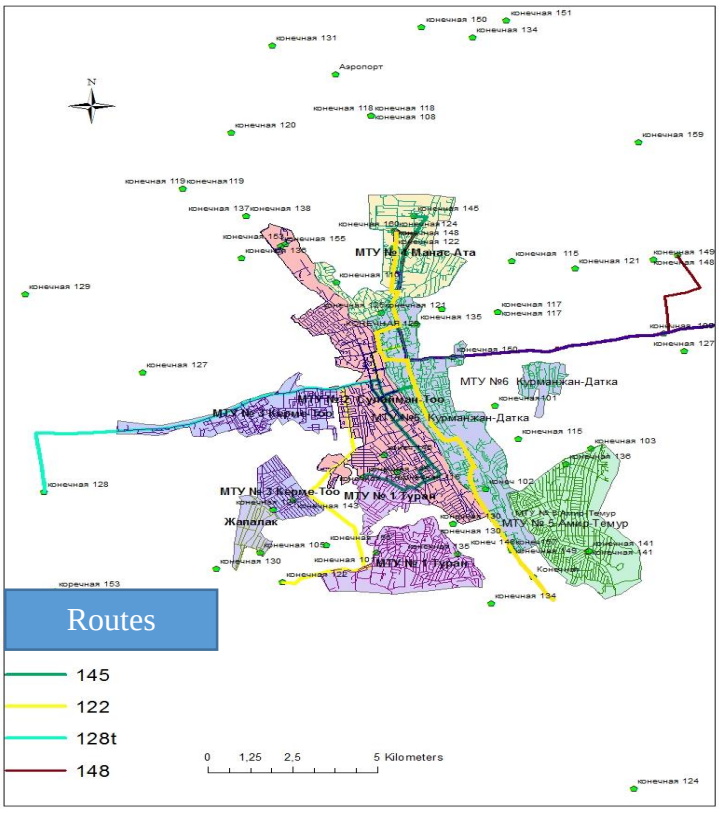



***Figure 4. MTD Manas-Ata***

The following minibuses pass through the Kerme-Too RTD:143,121,157,146,127.

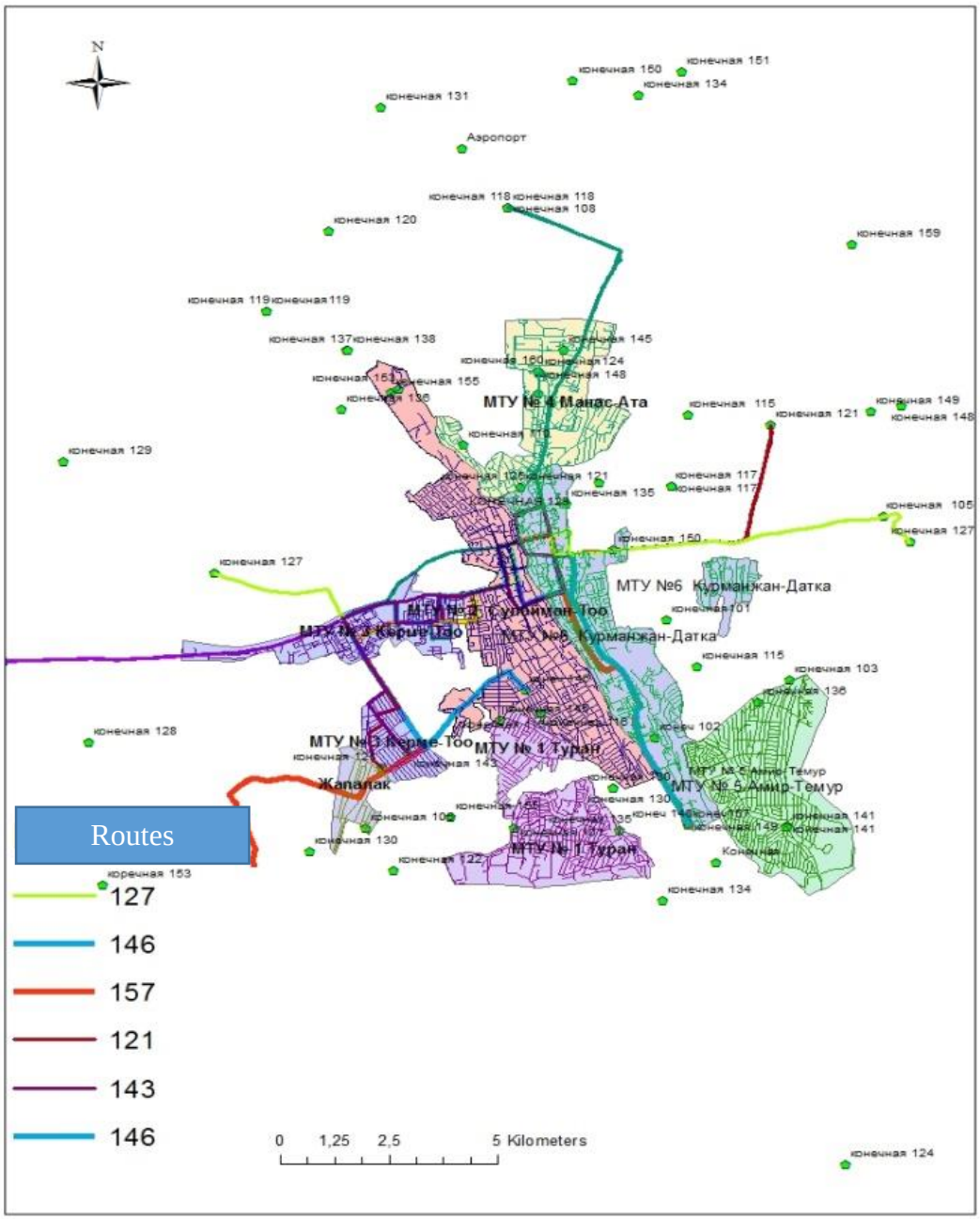



***Figure 5. RTD Kerme-Too***

The following routes travel through RTD Turan: 101,130,135,105. Most routes pass through the Sulaiman-Too RTD. All other routes connect the city with border villages.

The main passenger generating and passenger absorbing points in any city are public transport stops. There are about 200 public transport stops in the city (Fig. 6).

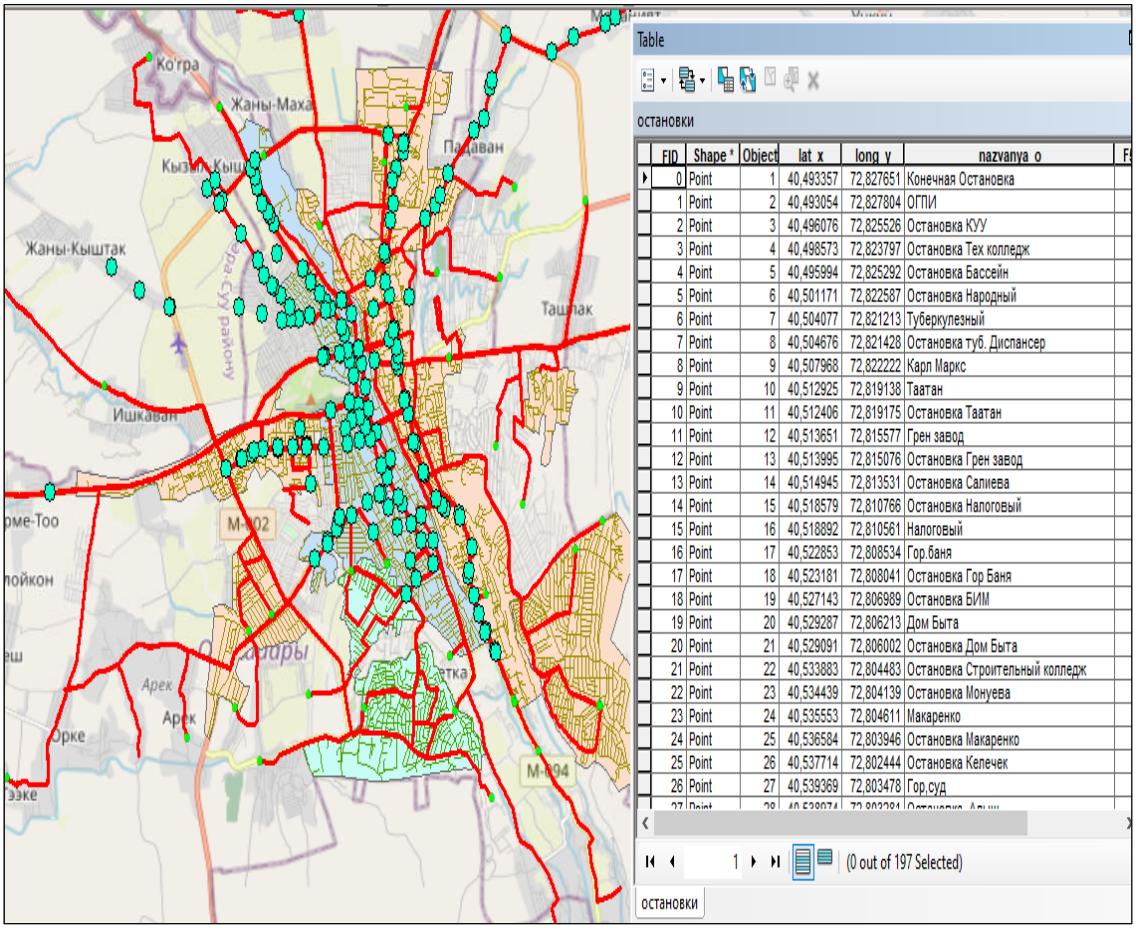



***Figure 6. Stopping points in the city***

Network analysis was used to analyze the accessibility of public transport stops.

In Fig. Figure 7 shows the areas covered by stopping points along the routes served by the transport company. Circles filled with solid color correspond to an area with a radius of 1000 m in residential areas. The centers of the circles are the stopping points of the routes located in Fig. 6, indicated by dots.

Based on the results of the analysis, we can say that stopping points are fairly evenly distributed within the city, which we cannot say about the border areas of the city. In some areas of new buildings there are no stopping points for passengers. People can stand and stop vehicles anywhere. This causes inconvenience and may affect their safety in some way.

Starting in 2022, the city has introduced a system as a pilot project to improve the operation of mass passenger transport, with the help of which passengers can observe the movement of the expected bus on the line. The cartographic basis for such dispatch can be implemented in the form of graphs that are correct from the point of view of topology and representation of the transport situation.

**Conclusion**

Based on the analyzes carried out, we can say that the existing route network of the city is multifunctional in nature: the same route, as a rule, provides multifunctional connections aimed at ensuring the implementation of labor, educational, cultural and everyday correspondence.

This is explained by the peculiarity of the route organization system. The majority of routes pass through the central part of the city. In this case, for example, one leg of the route performs

the function of transporting the population from the suburban area to the center, and the other leg serves to provide transportation within the city.

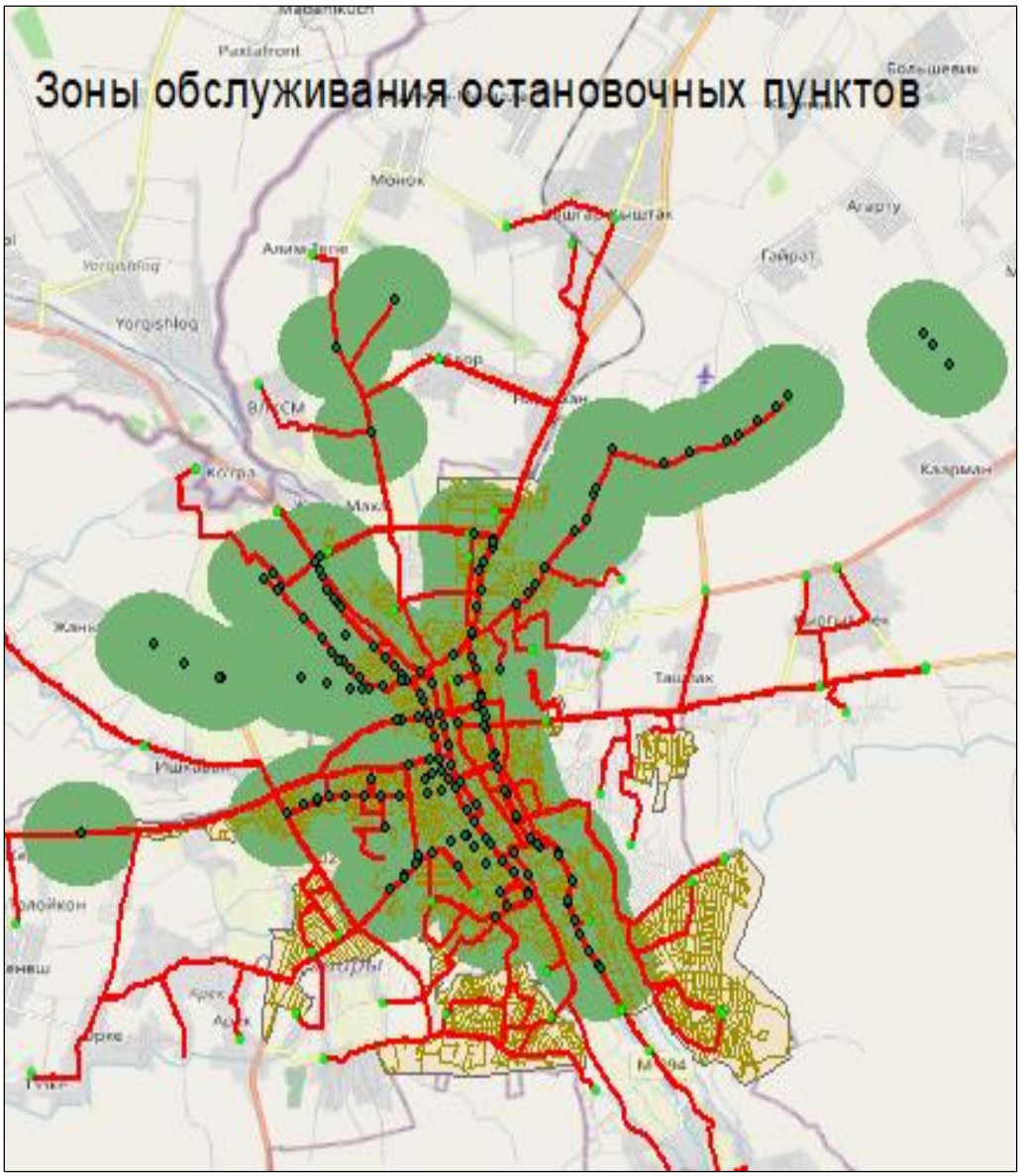



***Figure 7. Service areas of stopping points***

Correspondences from residential areas located in suburban areas, such as Zhapalak, Toloikon, Airport, Ozgur, Furkat, On Adyr, Nariman and others, are centripetal in the morning rush hour, and in the evening - in the opposite direction. Accordingly, the function of the routes serving these areas is to transport and transport the population from the center to the corresponding areas during the day. It includes bus routes: 121,149, 108, 127, 159,150,151 and partially 107,109, and others.

A special group consists of ring and semi-circular routes, which provide inter-district and intra-district connections on the most stable connections in terms of passenger traffic. This includes all trolleybus and bus routes providing inter-district connections, ring routes 102, 113, 125.

In general, the central part of the city is fully provided with passenger transport, and territorial departments are also sufficiently provided with passenger transport. The same cannot be said about the border areas of the city. Some border lines are not sufficiently provided with

passenger transport. Minibuses on these lines operate at intervals of 30 minutes or more, thereby causing inconvenience to residents of these areas. Some areas are covered by inter-district transport. Also, due to duplicate routes, congestion occurs on the central highways of the city. As a result, the routes carrying out transportation on these streets are behind their schedules.

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