

# THE DEVELOPED RING-RADIAL NETWORK OF THE ALMATY METRO

## AS AN ASPECT OF THE SMOG REDUCTION OVER THE CITY



Ppt-Presentation by Gleb K.Samoilov, 2016

## INTRODUCTION

### **Improving the infrastructure of passenger transport in Almaty on the basis of development of the Metro network as an aspect of improving air quality**

The Developed Almaty Metro network is the basis for creating an integrated system of the Public and the Private transport. This system will significantly reduce the length of trips by surface transport, reduce the number of units of the street traffic. This significantly reduces the amount of harmful emissions and improves the microclimate.

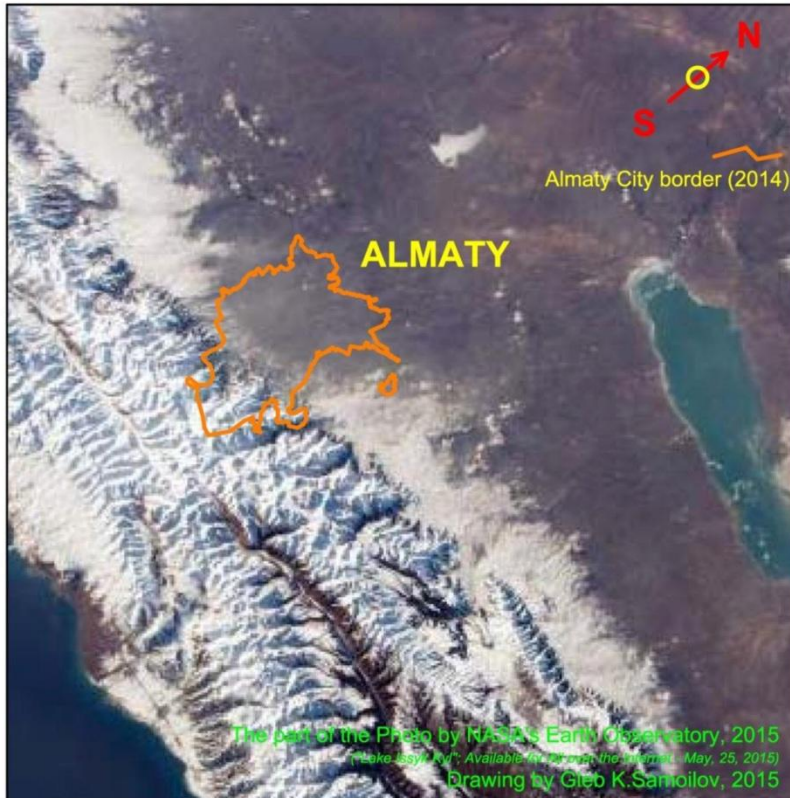
The System of integrated Public and Private Transport, which is generated on the basis of the developed Metro network, will improve the accessibility of different urban land sites.

As the result, significantly increase values of lands and investment attractiveness of the Almaty Conurbation.

*The Album includes of 16 illustrations: 11 photos and 5 drawings.*

**KEYWORDS:** *Air emissions, City Public transport, Integrated Public transport network, Metro Ring-radial scheme*

## 1. The smog over the territory of Almaty city (the satellite picture from space by NASA 2015)



The main area of the Almaty city is located in foothills (a topographic height from 600 m / 1968,5 ft to 800 m / 2624,7 ft above sea level).

Several gorges form the mainstream of a cold air from glaciers.

As result – above the town all year round there is the big layer of a cold air. This layer prevents the natural removal and dispersal of air emissions.

This leads to a constant smog, which is fixed by devices and visually (average topographic height of 1000 m / 3280,8 ft above sea level).

Some researches show, that the largest part of air pollution over the Almaty city is formed by automobiles (Ivanov 1994, Arystanbekova 2003, Asylbekova 2006, Daulbaeva 2012, Suleymenova 2012, Kisamedin 2015).

## Specificity of the problem at all

Despite the abundance of suggestions by many authors for measures to stimulate the movement acceleration of air masses over the City (including: directional thermal generators, installation of large-sized turbines, aerodynamic umbrellas, etc.), the real way to reduce such pollution is to reduce the flow of street freight and passenger traffic. The problem of emissions monitoring of road transport is an important aspect of environmental protection. Areas identified on the base of monitoring of the most active areas of contamination can form an appropriate set of recommendations to improve the situation. The most active portion of pollution on the roads happens at junctions, places of flow rebuild and changes in the flux density. A very important aspect of determining the actual saturation of air emissions is the account of wind conditions and precipitation. It shows the difference in the data depending on the terrain and wind conditions.

The predominance of the calm requires special measures to speed up traffic flow, reducing the flux density by redistribution of vehicles on various routes, time-based differentiation of freight and passenger traffic, improving intersections to provide mainly non-stop flow. The presence of strong wind considerably reduces the real concentration in the stop or traffic rebuild areas. Accordingly, in these wind areas it is not advisable to carry out reconstructive measures. Therefore, the monitoring of various parameters on selected sites allows the analysis to give specific, objectively justified recommendations for each site. This will significantly increase the economic efficiency of the cost of cleaning the air basin.

In addition, monitoring of transport and climate modeling parameters allows improving the situation, given the prospect of increased passenger and freight traffic. This makes it possible to determine the parameters of agglomeration development planning: the development of the road network, the improvement of built-up areas and the distribution of park areas. There is a decisive importance of improvement of the passenger and freight traffic structure. It becomes possible to determine the outcome of a possible reduction of individual trips by public transport or work at home. It is possible to evaluate the effectiveness of differentiation by time or by different routes of passenger and freight traffic.

Source: Photo by G.K.Samoilov, December-2015

**2. The Smog over the territory of Almaty city**  
(in the center of the picture - the “Springboard Complex”)



Source: Photo by G.K.Samoilov, December-2015

**3. The Smog over the territory of Almaty city**  
(in the center of the picture – the “Esentai Park” Complex)



Source: Photo by G.K.Samoilov, December-2015

**4. The Smog over the territory of Almaty city**  
(in the center of the picture – the “Nurly-Tay Complex”)



Source: Photo by G.K.Samoilov, December-2015

**5. The Smog over the territory of Almaty city**  
(in the center of the picture – the Hotel “Kazakhstan”)



Source: Photo by G.K.Samoilov, December-2015



**6. The Smog over the territory of Almaty city**  
(the right in the picture – the Complex of the TV-Tower “Kok-Tobe”)



Source: Photo by G.K.Samoilov, December-2015

## Specificity of the problem for the City central part

This is especially important in the central part of the City. Planning features of this area is a network of small rectangular street quarters. A large number of street intersections forms numerous and frequent stops of traffic.

Accumulations of cars at intersections create additional emissions. Public transport stops in "short" quarters create periodic interferences for movement. On most of streets parallel or angled parking is allowed, which is also partially hindering the movement of the main traffic flow.

To partially alleviate of this problem on some streets one-way traffic is organized. On several of these streets vehicles are moving in the "Green Wave" (at speeds of about 55 km/h), using of the coordinated work of traffic lights. Some major road intersections have an arc lane of the "Free Right Turn". In several places in the City center and on its borders multi-level road interchanges are constructed. Truck traffic is redirected to Big Almaty Ring Road to bypass the city center. On this road it is supposed to position intercity bus stations.

Despite the great distance between the buildings along streets, the provision of carriageway expansion on majority of the streets in the Central part of the City is almost exhausted. Historical features of the central part of Almaty are trees growing in sesquilinear or two-meter strip of a lawn between the sidewalk and the roadway on both sides of the streets. Now perennial trees with big evolution crown provide comfortable shade on the sidewalks and first 3-4 floors of facades on hot days. However, they form a sort of semi-open tunnels on the roadway.

As a result, year-round air circulation is hindered because of the dense foliage and thick branches. This partially contributes to the concentration of vehicle emissions along streets.

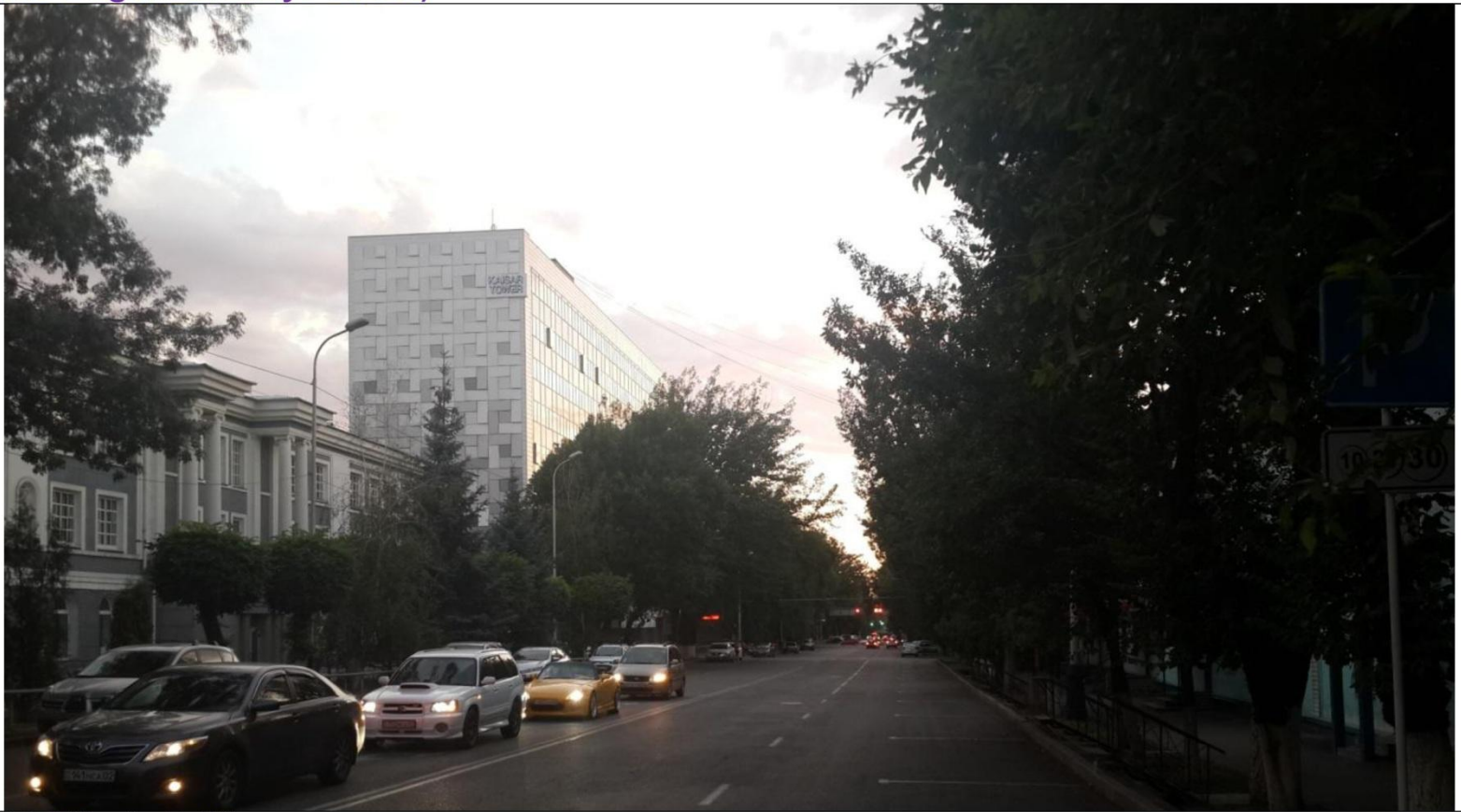
As a complex solution to significantly reduce car traffic in the City center it is advisable to form an integrated system of public and private transport based on the intensive development of the Metro. Currently, the public transport system of the city is represented by two tram routes, nine trolleybus routes and one hundred and eleven bus routes. The total number of units of public transport is about 3,000. The City has about 1,000 taxis. However, only a quarter of the necessary trips of residents are made by means of public transport.

## 7. Perennial trees form a sort of semi-open tunnels on the Almaty city roadway (the Kurmangazy Street)



Source: Photo by G.K.Samoilov, July-2015

## 8. Perennial trees form a sort of semi-open tunnels on the Almaty city roadway (the Bogenbai Batyr Street)



Source: Photo by G.K.Samoilov, July-2015

**9. Perennial trees form a sort of semi-open tunnels on the Almaty city roadway  
(the Shevchenko Street)**



Source: Photo by G.K.Samoilov, July-2015

**10. Perennial trees form a sort of semi-open tunnels on the Almaty city roadway  
(the Gogol' Street)**



Source: Photo by G.K.Samoilov, July-2015

## 11. The Almaty Metro Map (the “Almaly station” Hall, 2013)



Source: Photo by G.K.Samoilov, 2013

### **Start of operation of the Almaty Metro opens a new stage in the development of public transport in the City.**

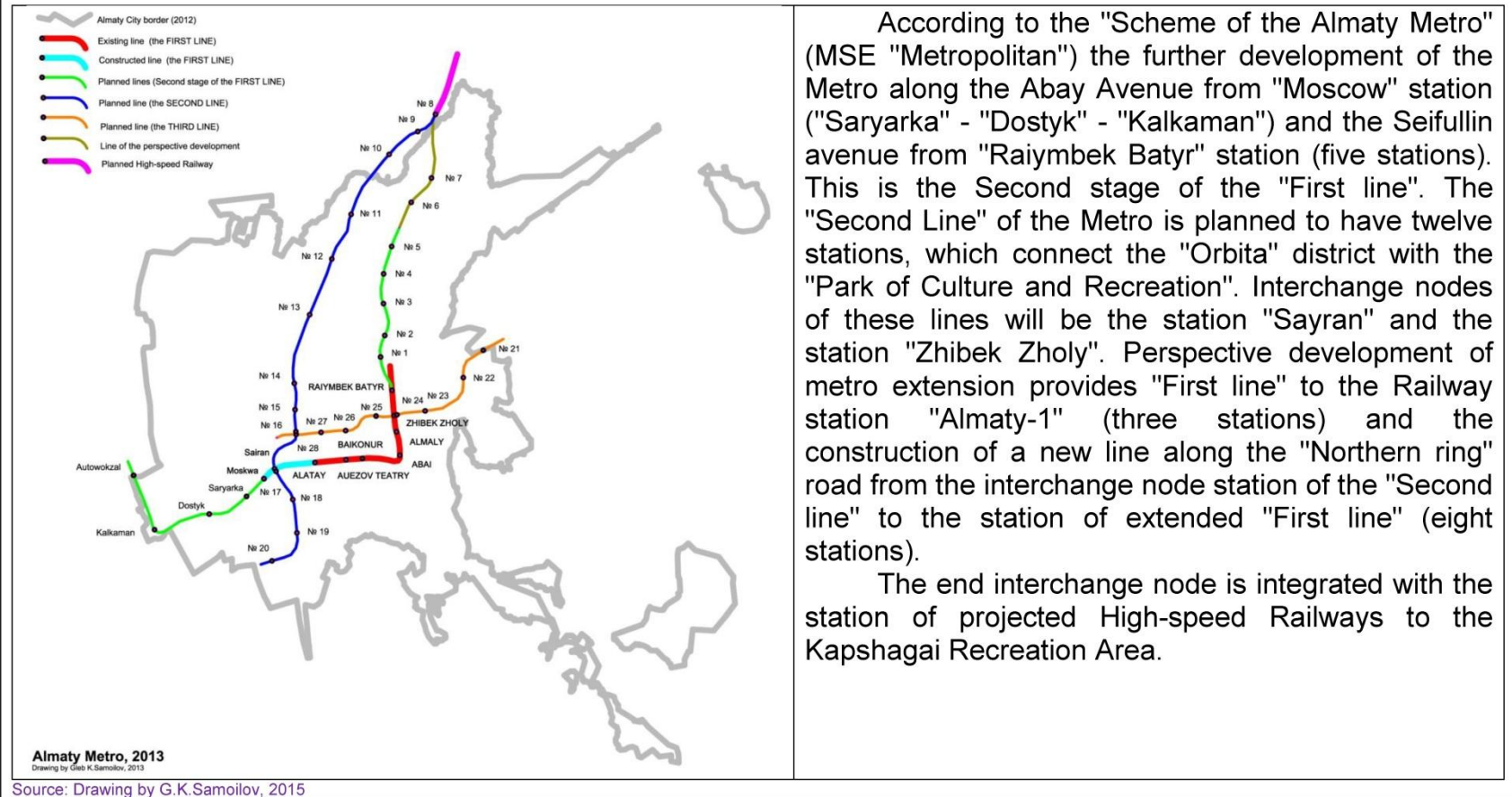
New kind of public transport for country - off-street public transport - will significantly improve the comfort and speed of daily travels.

So, a trip from the station "Raiymbek Batyr" to station "Moscow" takes 18-20 minutes; while traveling in a bus or trolley bus on the same route takes 30 to 40 minutes in normal times or 60 to 80 minutes in the morning and evening rush hour.

The ever-increasing passenger traffic at the section with nine stations of the first and second stages of the Metro development ("Raiymbek Batyr" - "Zhibek Zholy" - "Almaly" - "Abai" - "Baikonur" - "Theatre named after M.Auezov" - "Alatau" - "Sayran" - "Moscow") has already allowed to proceed to the optimization of the existing ground Public transport Route Network.

In addition, the actual reduction in traffic on the Abai avenue allowed to allocate a special lane only for buses and trolleybuses.

## 12. Existing, Constructed and Planned lines of the Almaty Metro (the Map, 2013)

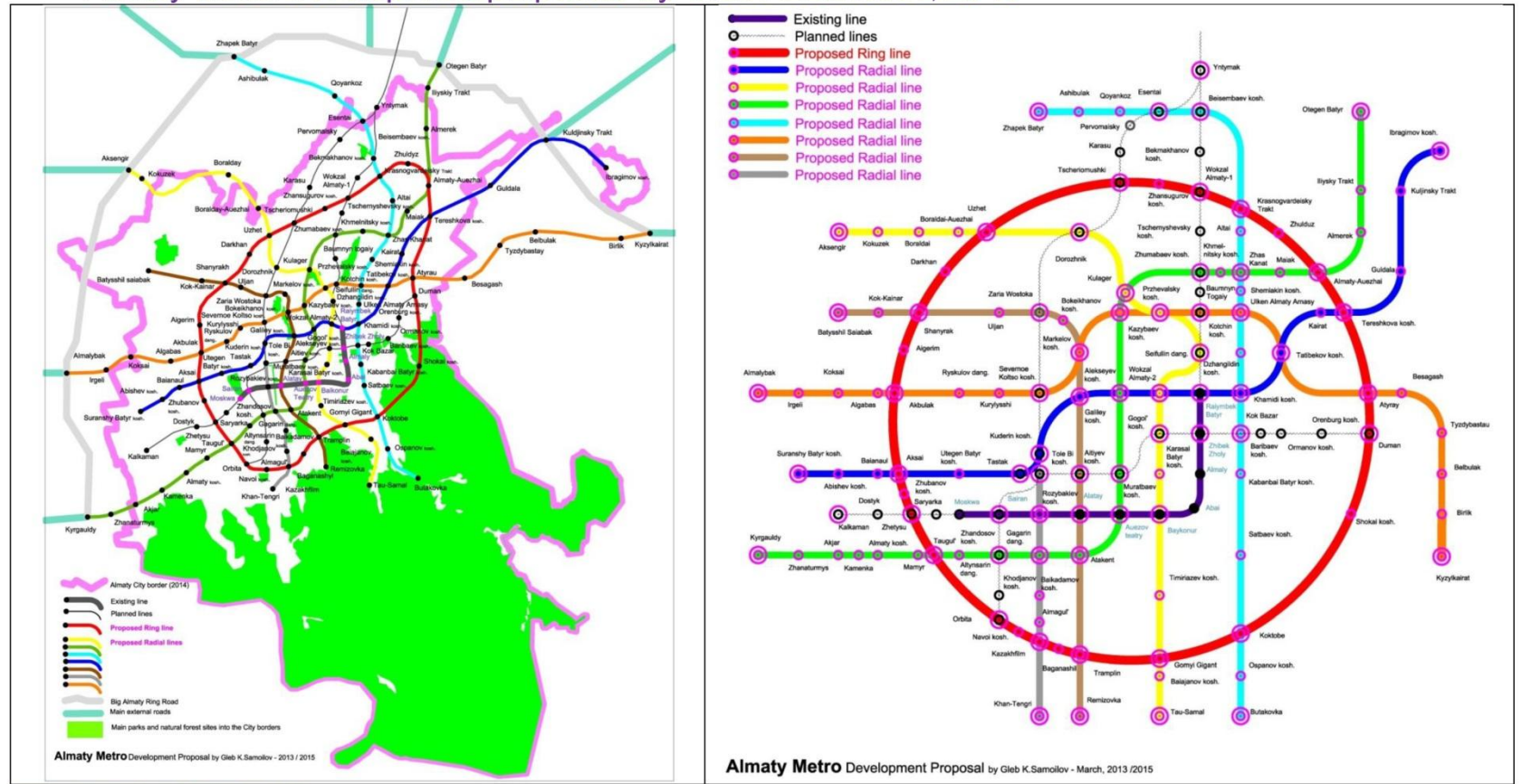


According to the "Scheme of the Almaty Metro" (MSE "Metropolitan") the further development of the Metro along the Abay Avenue from "Moscow" station ("Saryarka" - "Dostyk" - "Kalkaman") and the Seifullin avenue from "Raiymbek Batyr" station (five stations). This is the Second stage of the "First line". The "Second Line" of the Metro is planned to have twelve stations, which connect the "Orbita" district with the "Park of Culture and Recreation". Interchange nodes of these lines will be the station "Sayran" and the station "Zhibek Zholy". Perspective development of metro extension provides "First line" to the Railway station "Almaty-1" (three stations) and the construction of a new line along the "Northern ring" road from the interchange node station of the "Second line" to the station of extended "First line" (eight stations).

The end interchange node is integrated with the station of projected High-speed Railways to the Kapshagai Recreation Area.



### 13. The Almaty Metro developed network (the Map and the Scheme): Almaty Metro development proposals by Gleb K.Samoilov, 2013



Source: Drawing by G.K.Samoilov, 2015

## The Concept of Almaty Metro development proposals by Gleb K.Samoilov, 2013

But further development of the Almaty Metro network expedient to form to the radial-ring scheme. Figures show the Almaty Metro developed network (the Map and the Scheme). According to this Concept (Samoilov 2013) the developed network of the Almaty Metro might look like this - the Present line (9 stations, 7 interchange nodes - 11,0 km / 6,83 mi); Planned Lines (37 stations, 24 interchange nodes - 74,0 km / 45,88 mi); proposed Ring line and seven Radial lines (139 stations, 59 interchange nodes):

- the Ring line ("red" on the S scheme) "Orbita - Aksai - Uzhet - Almaty-1 Railway station – Almaty Airport - Kok-Tobe - Baganashil" - 26 stations, 18 interchange nodes (68,0 km / 42,25 mi);

- the Radial Line ("blue" on the Scheme) "Suranshi Batyr koshesi - Aksai – Tereshkova koshesi – Ibragimov koshesi" - 18 stations, 10 interchange nodes (48,0 km / 29,83 mi);

- the Radial Line ("green" on the Scheme) "Kyrgauldy – Taugul' - Almaty Airport – Otegen Batyr" - 24 stations, 12 interchange nodes (50,0 km / 31,07 mi);

- the Radial Line ("orange" on the Scheme) "Almalybak - Akbulak - Atyrau - Kyzylkayrat" - 19 stations, 9 interchange nodes (46,0 km / 28,58 mi);

- the Radial line ("brown" on the Scheme) "West Park - Shynyarak - Springboard - Remizovka" - 13 stations, 8 interchange nodes (26,0 km / 16,16 mi);

- the Radial Line ("yellow" on the Scheme) "Aksengir - Uzhet – Gorny Gigant - Tau Samal" - 17 stations, 9 interchange nodes (37,0 km / 22,99 mi);

- Radial Line ("celadon" on the Scheme) "Butakovka - Kok-Tobe - Krasnogvardeyskiy Trackt – Zhapek Batyr" - 18 stations, 8 interchange nodes (40,0 km / 24,85 mi);

- Radial line ("gray" on the Scheme) "Tole Bi Street - Kazakhfilm - Khan-Tengri" - 5 stations, 4 interchange nodes (10,0km / 6,21 mi).

End stations "Kyzylkayrat", "Kyrgauldy", "Suranshi Batyr koshesi", "Almalybak", "Aksengir", "Zhapek Batyr", "Otegen Batyr" and the station "Kulzhinsky trackt" proposed integrated with intercepting parking lots and bus stations, which will be located on relevant sections of road junctions in the Big Almaty ring Road.

Source: Concept by G.K.Samoilov, 2013

## The Integration of Bus and Trolleybus services with the Almaty Metro developed network

Proposed developed Radial-Ring Metro network is integrated with various types of external and internal transport. The external transport: Airlines - 2 points; Railways - 3 points; Intercity bus stations - 8 points.

The internal transport:

*the Taxi service:* at Metro stations outside the Ring Line - 13 taxi stations, 33 taxi stops; at Metro stations on the Ring Line - 18 taxi stations, 8 taxi stops; at Metro stations within the Ring Line - 7 taxi stations, 55 taxi stops.

*the personal transport:* from metro stations outside the Ring Line - 19 parking spaces, 46 bicycle and scooter parkings; at all Metro stations on the Ring Line - 26 multi-level car parking, 26 bicycle and scooter parking; at Metro stations within the Ring Line - 7 multi-level car parkings, 28 parking spaces, 62 bicycle and scooter smart parkings.

*the Bus and the Trolleybus services*

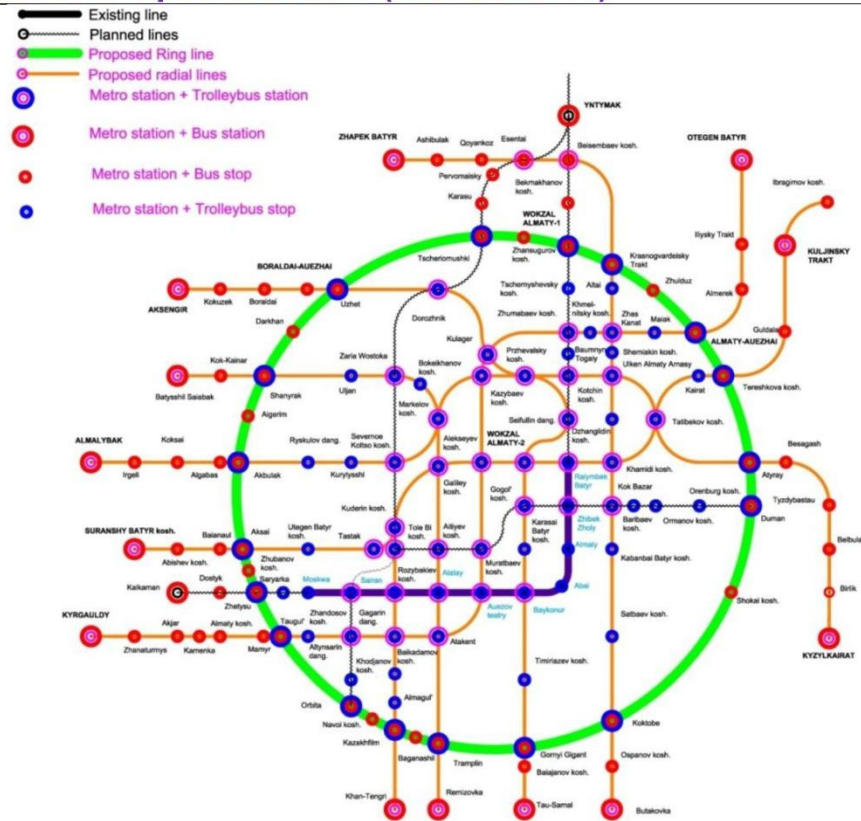
**(conceptually - a Bus service from the outside of the Ring line, a Trolleybus service inside the Ring line):**

at Metro stations outside the Ring Line - 15 bus stations, 31 bus stops; at Metro stations on the Ring Line - 26 bus stops, 18 trolleybus stations; at all Metro stations in the Ring Line - 61 trolleybus stops. The implementation of this scheme would allow for the foreseeable future even more to link bus and trolley routes with Metro stations. In doing so, bus and trolley routes will be significantly shorter, linking the individual parts of the City with one or two nearest Metro stations. As the result - forms some kind of "short route" system, which will greatly enhance the ease of use for passengers. On the basis of the Metro forms integrated network of all kinds of the urban public transport.

Thus, the bulk of the passenger traffic will be concentrated in the Metro system, as this Radial-Ring network provides the speed of delivery of passengers to the main facilities, comparable with the speed of a taxi or personal car. Well-functioning integrated public transport system will significantly reduce the number of cars on City streets (reduced number of buses, will be a convenient alternative to personal vehicles for most of daily trips).

Presumably, the number of journeys which citizens do by public transport in relation to the total number of trips will increase from the current 25% to future 70%.

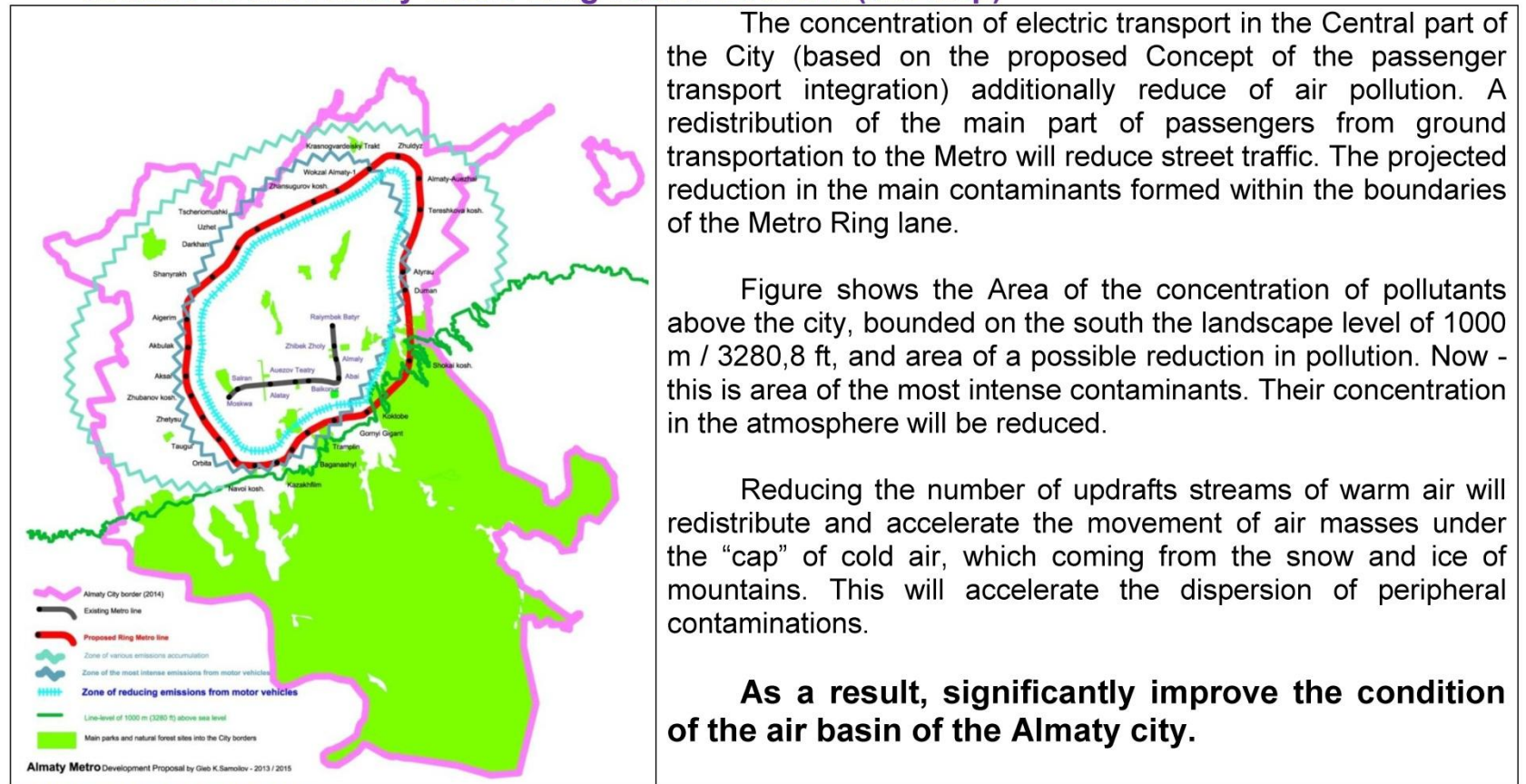
## 14. The Integration of Bus and Trolleybus services with the Almaty Metro developed network (the Scheme)



Almaty Metro Development Proposal by Gleb K.Samoilov - March, 2013 / 2015

Source: Drawing by G.K.Samoilov, 2015

## 15. Zone of reducing emissions from motor vehicles at base of the Almaty Metro Ring-Radial network (the Map)



The concentration of electric transport in the Central part of the City (based on the proposed Concept of the passenger transport integration) additionally reduce of air pollution. A redistribution of the main part of passengers from ground transportation to the Metro will reduce street traffic. The projected reduction in the main contaminants formed within the boundaries of the Metro Ring lane.

Figure shows the Area of the concentration of pollutants above the city, bounded on the south the landscape level of 1000 m / 3280,8 ft, and area of a possible reduction in pollution. Now - this is area of the most intense contaminants. Their concentration in the atmosphere will be reduced.

Reducing the number of updrafts streams of warm air will redistribute and accelerate the movement of air masses under the “cap” of cold air, which coming from the snow and ice of mountains. This will accelerate the dispersion of peripheral contaminations.

**As a result, significantly improve the condition of the air basin of the Almaty city.**

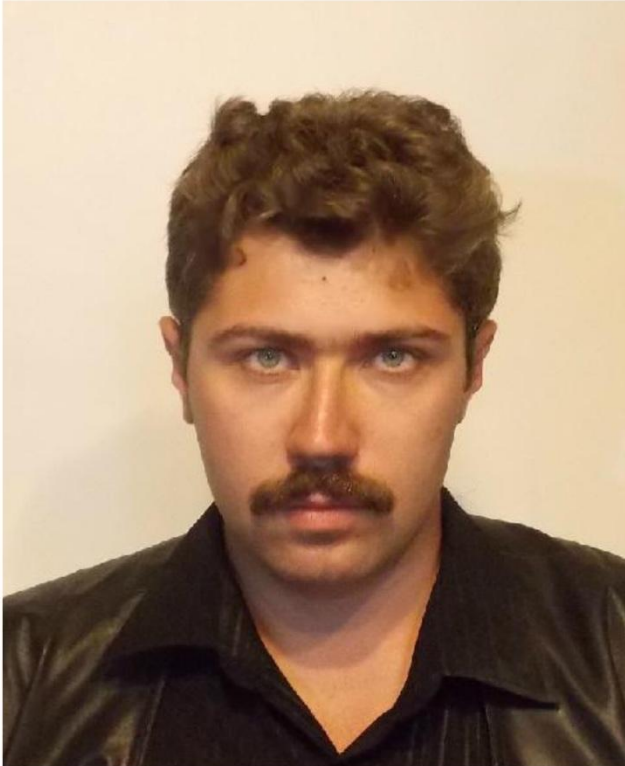
Source: Drawing by G.K.Samoilov, 2015

## REFERENCES

- NASA Earth Observatory**, 2015, 'Lake Issyk Kul', May 25, 2015, <<http://earthobservatory.nasa.gov/IOTD/view.php?id=85918>>, <[http://eoimages.gsfc.nasa.gov/images/imagerecords/85000/85918/iss042e295032\\_lrg.jpg](http://eoimages.gsfc.nasa.gov/images/imagerecords/85000/85918/iss042e295032_lrg.jpg)>.
- Ivanov, GV** 1994, 'Disposition of the city in view of reducing the negative impact of the motor transport traffic on the air basin condition', Candidate of Technical sciences Thesis Abstract, Kazakh Leading Academy of Architecture and Civil Engineering, Almaty.
- Arystanbekova, NKh** 2003, 'Simulation of air pollution in Almaty', Almaty.
- Asylbekova, BK** 2006, 'Condition of Almaty air basin', Kazakh National Technician University articles, Almaty, <[http://e-lib.kazntu.kz/sites/default/files/articles/asylbekova\\_2006\\_5.pdf](http://e-lib.kazntu.kz/sites/default/files/articles/asylbekova_2006_5.pdf)>.
- Daulbaeva, AN** 2012, 'Dynamics of changes in the concentration of major pollutants in the surface layer of the atmosphere of Almaty', PhD Thesis Abstract, Kazakh National Agrarian University, Almaty.
- Suleymenova, NSh** 2012, 'Main source of air pollution in urban areas Almaty', Proceedings of the National Academy of Sciences of the Republic of Kazakhstan, #6, 2012, Almaty, pp. 30-34, <[http://nblib.library.kz/elib/Journal/AGRARNI2012\)6/SULEIMENOV.pdf](http://nblib.library.kz/elib/Journal/AGRARNI2012)6/SULEIMENOV.pdf)>.
- Kisamedin GM** 2015, 'Nature, Society, Scientific and Technological Progress and Sustainable development Concept of Almaty' // Global international scientific analytical project - GISAP / The International Academy of Science and High Education, London, <<http://gisap.eu/ru/node/81918>>.
- Samoilov, GK** 2014, 'The Almaty metro ring-radial network (Prospects of creation and integration in the Urban Public Transport system)', London / Almaty - ISBN 978-601-06-2758-1, <<https://archive.org/details/AlmatyMetroRingRadialNetworkByGSamoilov>>; <<http://ru.scribd.com/doc/230693734/THE-ALMATY-METRO-RING-RADIAL-NETWORK-by-G-K-Samoilov>>.
- Samoilov, GK** 2015 The Developed network of the Almaty Metro (the Version of 2015), <[https://commons.wikimedia.org/wiki/File:The\\_Developed\\_network\\_of\\_the\\_Aلماتy\\_Metro\\_\(the\\_Version\\_of\\_2015\).jpg](https://commons.wikimedia.org/wiki/File:The_Developed_network_of_the_Aلماتy_Metro_(the_Version_of_2015).jpg)>.
- Samoilov, GK** 2015 Photo of Reducing emissions - Almaty Metro Ring-Radial network, <[http://www.free-photos.biz/photographs/transportation/metro/1592671\\_emissions\\_scheme.php](http://www.free-photos.biz/photographs/transportation/metro/1592671_emissions_scheme.php)>.
- Samoilov, GK** 2015 THE ALMATY METRO DEVELOPMENT as an aspect of the smog reduction over the City / Research Paper. – London, 2015, < <http://www.docfoc.com/the-almaty-metro-development-as-an-aspect-of-the-smog-reduction-over-the-city-research-paper-by-gleb-k-samoilov-2015> >

Source: the Selection by G.K.Samoilov, 2015

## BRIEFLY ABOUT THE AUTHOR



# Gleb K.Samoilov, engineer

**MSc**

– *Transport Engineering and Operations*  
(the University of Newcastle-upon-Tyne, 2012)

**BEng (Hons)**

– *Construction of railways*  
(the Kazakh Academy of Transport and Communications  
named after M. Tynyshpaev, 2010)

**MTPS**

e-mail:

[samglecon@yahoo.com](mailto:samglecon@yahoo.com)

Source: G.K.Samoilov (the Photo 2015)



**THE DEVELOPED RING-RADIAL NETWORK OF THE ALMATY METRO  
AS AN ASPECT OF THE SMOG REDUCTION OVER THE CITY**

Ppt-Presentation by Gleb K.Samoilov. – Almaty, 2016. – 22 p.