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The Impact of Metropolitan Transport on The Socio-Economic Development of The Country: Efficiency, Infrastructure and Environmental Aspects

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ABSTRACT

The role and importance of metropolitan transport in the socio-economic development of the country are great, not only ensuring economic stability, but also significantly improving the lifestyle of the population. The metropolitan system is important for a wide range of goals, including increasing transport efficiency, improving the environmental situation, as well as developing urban infrastructure and ensuring social equality. Role in socio-economic development - the metropolitan system contributes to the economic development of the country in several ways.

Keywords: Socio-economic development, lifestyle of the population, transport efficiency.

INTRODUCTION

The role and importance of metropolitan transport in the socio-economic development of the country are great, not only ensuring economic stability, but also significantly improving the lifestyle of the population. The metropolitan system is important for a wide range of goals, including increasing transport efficiency, improving the environmental situation, as well as developing urban infrastructure and ensuring social equality. Role in socio-economic development - the metropolitan system contributes to the economic development of the country in several ways.

Economic growth: The presence of the metro helps to strengthen ties between cities and regions. This leads to an efficient distribution of labor and resources, which means that people can quickly and conveniently get to their workplaces. In such conditions, enterprises can expand their activities, new jobs are created, and the city's economy develops.

Investment and infrastructure development: The metropolitan system helps to develop new business centers and retail outlets. It stimulates the implementation of many new construction and infrastructure projects in areas close to city centers. New housing, offices, shopping malls, and other important facilities appear in these areas, which stimulates economic growth.

Impact on the lifestyle of the population: The metro system significantly improves the lifestyle and daily life of the population. Its amenities include:

Fast and convenient transportation: The metro shortens long distances within the city, allowing people to quickly reach their workplaces, places of study, or other important points. This, in turn, increases the efficiency of working hours and helps people save time.

Affordable transportation options: The metro

reduces transportation costs for many residents, especially for low-income groups. Compared to other modes of transportation, the metro is often cheaper, providing easy access to the city center, workplaces, and services for everyone, even those with limited financial resources.

Ensuring social equality: The widespread use of the metro creates equal opportunities for different segments of the population. Since travel is easy and cheap, equal conditions are created for representatives of any social category. This reduces social inequality and brings all social classes closer together. Mobility of the population - The development of the metro increases the mobility of the city's population. People can quickly and conveniently move to other urban areas, new jobs and educational institutions. This makes living in cities more comfortable and desirable. Environmental impact The impact of the metro on the environmental situation is also significant. It provides less pollution and higher efficiency in cities compared to traditional modes of transport, namely buses and cars.

Reducing air pollution - The metro system runs mainly on electricity, so it reduces the level of gas emissions from transport. This leads to a decrease in air pollution in cities, which helps to improve the health of the population. Traffic reduction - The presence of the Metro leads to a decrease in car traffic within the city, which increases overall road safety and reduces traffic jams. Development of urban infrastructure The development of the Metro system also leads to an improvement in the city's infrastructure.

New infrastructure projects - New infrastructure facilities - restaurants, shopping centers, new residential areas and offices - appear in the areas around the construction of Metro stations and lines. This further develops the city and creates additional amenities for residents.

Urbanization and urban planning - The presence of the Metro plays an important role in the management of cities and settlements. It accelerates urbanization processes, stimulates the construction of new districts and housing, as well as the development of city centers. Metropolitan transport makes a significant contribution to the socio-economic development of the country. It not only stimulates economic growth and investment flows, but also improves the lifestyle of the population, stabilizes the environmental situation and contributes to the development of urban infrastructure. The conveniences of the metropolitan system make people's daily lives easier, help save time, and also help increase social equality and make cities better.

METHODS

As a result of the analysis conducted by authorized organizations in the republic, it was noted that due to the steady increase in the population, the demand for public transport has increased, but the quality of service in some public transport remains low, in particular, the number of public transport vehicles in the regions is insufficient and the established timetables are not followed, which further increases the problems.

These analyses also noted that the long waits of passengers at bus stops for public transport and the inability to reach their destinations on time affect their daily work, especially the dissatisfaction of the elderly, citizens with disabilities, and civil servants with the conditions created in public transport, the lack of proper behavior culture among some drivers and their failure to comply with traffic rules, and the presence of traffic jams when citizens go to and from work, which leads to widespread discussions on social networks and an increase in the number of appeals to competent organizations.

Due to the existing problems listed above, the number of metro users is naturally increasing day by day. This, in turn, forces trains to comply with the requirements of regularity, traffic safety and quality.

At the same time, the lack of differentiated fares and the lack of priority for public transport traffic reduce the attractiveness of public transport.

The current system of financing public transport does not allow for a systematic renewal of the rolling stock and the widespread attraction of private investment in the sector.

In order to fully satisfy the population's needs for high-quality and convenient passenger transportation services, introduce market principles in the sector, in particular, by improving the financing system and tariff policy, and create an attractive business environment for the private sector, it can be observed that the proposals of the Ministry of Transport and the Ministry of Economy and Finance, as set out in the Development Strategy of New Uzbekistan for 2022-2026, on the gradual introduction of a gross contract-based organization and financing system for passenger transportation on regular metro and city bus routes at limited tariffs, are being implemented slowly.

As a solution to this proposal, it is envisaged that settlements with carriers providing passenger transportation services on the metro and bus within the framework of the gross contract-based organization and financing system for passenger transportation on regular metro and city bus routes at limited tariffs will be carried out by the authorized state body based on the criteria of "mileage" and "quality".

In addition, in order to introduce favorable tariffs for passengers when using public transport and popularize electronic payments, it is indicated that preferential and free tariffs should be applied based on the number of transfers from one passenger transport route to another within an hour, daily, one-, three- and six-month, annual limited and unlimited tariff plans should be introduced for the use of passenger transport routes, regardless of its type, and tariffs should be set that encourage the use of electronic payment systems when paying for fares on routes.

According to available analytical data on social networks, the obsolescence and non-compliance with the technical condition of some vehicles increases the likelihood of accidents during movement, while environmental pollution is increasing and traffic jams are becoming an urgent problem every day.

Also, the comprehensive development of the passenger transport system in the regions, the provision of high-quality and safe transport services to passengers, the widespread introduction of digital technologies into the sector, in particular, the financing system of the sector are being further improved. In this regard, a number of decrees and resolutions of the President of the Republic of Uzbekistan are of great importance in the further development of the sector.

In particular, in accordance with the Resolution No. PQ-59 of February 16, 2023 “On measures to reform the public transport system”, settlements with carriers providing passenger transport services in the metro and buses were established based on the “mileage” and “quality” criteria.

At the same time, the establishment of favorable tariffs for passengers when using public transport, including preferential and free, limited and unlimited, and incentive tariffs, and the introduction of an automated payment system, serve to create convenience for the population and increase the attractiveness of using public transport.

In this direction, the metro is a type of high-speed electric rail transport designed to transport a large number of passengers and is equipped with reliable safety systems. Metro lines are located above and below ground.

Metro lines are determined taking into account the development plans of the city, passenger flows, the location of residential areas, industrial, commercial and recreational centers, as well as the engineering and geological conditions of the city.

Metro lines are laid over overpasses. Cars moving above ground travel at a height determined by the terrain and the location of city buildings. Such lines were built in New York, Chicago, Boston, Philadelphia (USA), Hamburg (Germany) at the beginning of the 20th century. However, later, due to the development of cities, metro lines were mainly built underground.

Entry and exit to metro stations are mainly carried out in two ways: via an above-ground (vestibule) or via stairs leading to an underground vestibule. Vestibules are designed to combine various entrances and exits and connect them to the metro station platform by means of stairs or escalators. Escalator complexes, which are built when necessary (mainly at deep stations), consist of escalators placed in inclined tunnels, a transfer station and weighing chambers.

RESULTS AND DISCUSSION

Metros are available in major cities in more than 80 countries around the world, with the largest metros being in New York (since 1868), London (since 1863), Paris (since 1990), Tokyo (since 1927), Moscow (since 1935), Mexico City (since 1902), Seoul (since 1927), and Tashkent (since 1977). The total length of the Tashkent metro is 70.8 km, with 50 stations. Note that the construction of the Tashkent metro began in 1972, and until the years of independence, there were Chilanzor and Uzbekistan lines with a total length of 32 kilometers and 23 stations. Over the next 27 years (1991-2017), only part of the Yunusabad line was built and 6 stations were put into operation.

Statistics on passenger volume, financial indicators, number of trains, and route length of countries with metropolitan systems in the last 4 years

Table 1

City	Year	Passenger volume (million)	Financial indicators (billion)	Number of metropolitan trains	Railway length (km)
Moscow	2021	2,400	$2.4 bln	4,100	420
	2022	2,700	$2.7 bln	4,150	430
	2023	2,800	$2.8 bln	4,200	440
	2024	2,900	$3.0 bln	4,250	450
New York	2021	1,600	$4.3 bln	6,500	390
	2022	1,750	$4.6 bln	6,550	395
	2023	1,800	$4.8 bln	6,600	400
	2024	1,850	$5.0 bln	6,650	405
Beijing	2021	3,200	$7.8 bln	5,300	620
	2022	3,500	$8.2 bln	5,350	630
	2023	3,700	$8.5 bln	5,400	640
	2024	3,800	$8.7 bln	5,450	650
Tokyo	2021	3,200	$8 bln	6,500	400
	2022	3,300	$8.3 bln	6,550	405
	2023	3,400	$8.5 bln	6,600	410
	2024	3,500	$8.7 bln	6,650	415
London	2021	1,100	$1.5 bln	4,000	400
	2022	1,200	$1.7 bln	4,050	410
	2023	1,250	$1.8 bln	4,100	420
	2024	1,300	$2.0 bln	4,150	425
Paris	2021	1,000	$1.9 bln	4,300	230
	2022	1,150	$2.0 bln	4,350	235
	2023	1,200	$2.2 bln	4,400	240
	2024	1,250	$2.4 bln	4,450	245

In recent years, additional underground and above-ground metro lines and metro stations have been built in order to develop the infrastructure of the capital's metro. During this period, a total of 33.2 kilometers of metro lines have been built and 21 modern metro stations have been commissioned. Also, the last 2 new stations of the Yunusabad line, the construction of which has been suspended for years, were completed in a short time. In addition, the Sergeli and Halqa above-ground lines, which include a total of 19 stations, have been commissioned.

In order to provide social support to the elderly population, from April 1, 2023, free transport services are being provided to retired citizens and persons with preferential rights to use the metro. Also, in order to create convenience for students of all educational institutions, in connection with the beginning of the “school year”, the interval between trains during rush hours was reduced to 1.5 minutes on the “Chilonzor” route, to 3-3.5 minutes on the “Uzbekistan” route, to 4-5 minutes on the “Yunusobod” route, and to 8-10 minutes on the “Earth Ring Road” route. The reforms being implemented show that the role of the metro in the public transport system of our capital is increasing day by day. Taking this into account, work is underway to modernize the metro infrastructure within the framework of modern standards to make it more convenient for passengers.

In general, the consistent reforms being implemented in the sector not only help passengers get from one point of the city to another quickly and conveniently, but also reduce the need for personal transport, as well as reduce traffic jams on the streets of the capital.

The average number of daily passengers in the Tashkent metro today is

1.03 million passengers, while in 2023 this figure was 464.1 thousand.

In January-November 2024, 245.6 million passengers were transported in the Tashkent metro. This figure increased by 90.6 million passengers compared to the same period in 2023.

It should be noted that every issue related to the daily life of the population is under the attention of our state, in particular, the public transport system is being developed based on growing demand.

In recent years, Tashkent has grown both in width and height. The number of permanent residents, temporary residents, tourists, and students has increased. Previously,

800-900 thousand passengers used public transport in the city per day, but now this figure has exceeded 1 million 300 thousand. Because of this, problems such as a shortage of buses and long waiting times have arisen.

The updated Transport Master Plan of Tashkent was developed based on the analysis of the expansion of the city and passenger flow, consisting of 167 routes. Of these, the procedure for determining the daily schedule was canceled in 17 of them and a calculation system was switched to a distance-based system. In June-July of this year, the remaining 150 routes were also transferred to such a system through tenders. As a result, the regularity of trips is ensured and the quality of service is expected to increase (Internet information).

In addition, the Presidential Decree emphasizes the importance of establishing a quality service. Instructions are given to regulate the fare system, digitize traffic control, and improve conditions at stops. The task of bringing public transport coverage to 2 million passengers in Tashkent is set.

It should be noted that the study of foreign best practices in order to improve the system for ensuring the safety of underground and surface metro facilities remains relevant today.

In large cities, there is strong competition between motor transport companies and other types of transport in the provision of passenger transportation services.

Although the metro does not bring direct financial income to society, its non-network effect is high. This is manifested in reducing traffic congestion on roads, saving on the cost of building new roads, as well as improving road safety, improving public health, and reducing the negative impact of transport on the environment.

Compared to other modes of transport, the metro is characterized by the lowest energy consumption per unit of transport work due to its large passenger capacity, is safer and more environmentally friendly, and transports passengers at higher speeds than cars (Table 2).

Table 2

Comparative analysis of the quality of urban public transport services

Transport type	Travel time	Comfort	Safety	Average score
Metro	**5**	**4**	**5**	**4,7**
Bus	**2**	**2**	**3**	**2,7**
Minibus	**3**	**3**	**3**	**3,0**
Taxi	**4**	**4**	**3**	**3,7**

The first stage of the Tashkent metro, consisting of 9 stations, was put into operation in November 1977. During the years of independence, the Yunusabad line, consisting of 8 stations, connecting the city center with a large residential area, was built and put into operation in Tashkent. An underground metro line with a length of 2.9 km and the Yunusabad and Turkiston stations were built on the Yunusabad route, and the first stage of the above-ground ring metro line, consisting of 7 stations with a length of 11.7 km, and 5 stations of the Sergeli above-ground metro line with a length of 6.2 km were put into operation.

The construction of the metro was carried out

using modern construction methods and new energy-saving technologies.

Currently, the total length of the Tashkent Metro is 59.1 kilometers (Chilonzor - 22.4 km, Uzbekistan - 14.9 km, Yunusabad - 10.1 km, Khalka - 11.7 km), and it includes 43 stations, 5 production and technical service stations, 2 electrical depots, and a rolling stock repair and spare parts production depot (Table 3).

Table 3

Stages of launching the Tashkent metro

№	Metro section	Number of stations	Launch date
	Chilanzar – 22,4 km		
1.	Olmazor — Amir Temur khiyoboni	9	06.11.1977
2.	H.Olimjon – Buyuk ipak yuli	3	18.08.1980
	Uzbekistan – 14.9 km		
3.	Alisher Navoiy – Toshkent	5	07.12.1984
4.	Mashinasozlar – Dustlik	2	06.11.1987
5.	Gofur Gulom – Chorsu	2	06.11.1989
6.	Tinchlik – Beruniy	2	30.04.1991
	Yunusabad – 10.1 km		
7.	Mingurik – Shahriston	6	24.10.2001
8.	Yunusobod — Turkiston	2	29.08.2020
	Yer usti khalqa – 11.7 km		
9.	Dustlik-2 — Qoyliq	7	30.08.2020
	Sergeli – 6.2 km		
10.	Olmazor — Sergeli	5	01.12.2020

As a result of the work carried out in 2016-2021, the total length of the metro line was increased from 38 km to 59 km, the number of stations from 29 to 43, the passenger transportation capacity of the Tashkent Metro increased by 2 times compared to 2016, and daily passenger transportation increased from 160 thousand passengers to 400-420 thousand passengers.

Construction work is underway in Tashkent on the "Koylyk - Kipchak" section of the above-ground ring metro line, which is 13 km long and consists of 7 stations.

By the Resolution of the President of the Republic of Uzbekistan dated October 16, 2021 "On measures to increase the efficiency of the Tashkent Metro",

the organizational and legal form of the "Tashkent Metro" was changed to a state unitary enterprise and transferred to the Ministry of Transport.

This resolution identified the following main areas for improving the efficiency of the metro:

Introduction of modern management mechanisms based on advanced foreign experience;

Infrastructure modernization and gradual renewal of the rolling stock;

Introduction of a digital process management system using modern information technologies;

Increase the level of passenger and traffic safety by improving the security system in the metro;

Integrate the network of surface passenger transport routes with the metro network in order to increase the popularity of the metro;

Introduce a system of service, trade and advertising activities in the metropolitan area within the framework of the requirements of regulatory documents regulating safety and urban development activities;

Provide the industry with qualified personnel by introducing a system of training professional personnel with modern knowledge.

Today, the Tashkent Metro transports 400-450 thousand passengers per day, and the annual traffic volume has increased by 54.5% over the past 10 years (Figure 1).

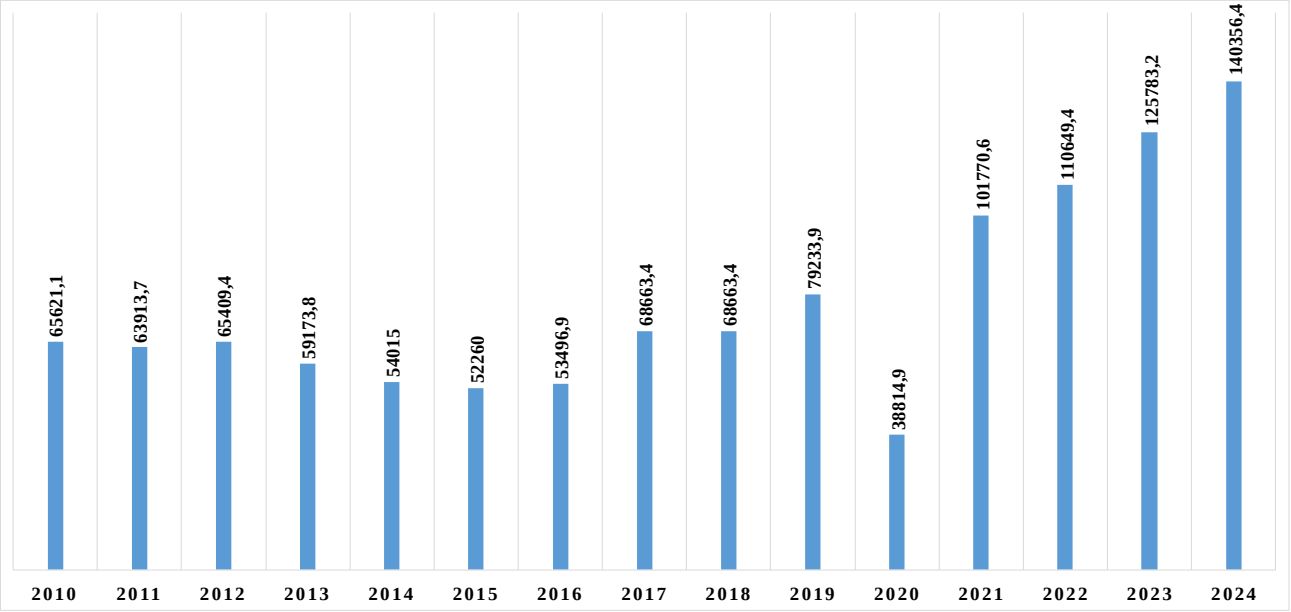

Figure 1. Changes in the volume of passengers transported by the Tashkent Metro, thousand passengers

Modern public transport, from a socio-economic point of view, forms a single passenger transport system of cities or regions and includes several types of transport. Therefore, when talking about the socio-economic significance of public transport, it is first of all appropriate to assess it from the point of view of a single transport system. Firstly, the development of all types of transport should be subject to a single law: to satisfy the population's demand for passenger transport with minimal costs, based on certain regulatory requirements for the quality of passenger transport. This ensures the systematicity of approaches to the formation of general criteria for the volume and quality of transport.

Secondly, there are similarities in the purposes and methods of using certain types of transport, which makes it possible to apply general models applicable to all types of transport in solving organizational and economic issues of system development.

Transport, along with its strong impact on changes in the production and trade sectors, is considered a sector with high capital and labor intensity, and as a resource consumer, it also has a strong impact on changes in the conditions of the product, capital and labor markets. Given the social significance of the transport sector, it is one of the important elements of the socio-economic environment.

However, the purchase of rolling stock, energy resources, fuel and lubricants and other materials by enterprises providing such transport services at market prices from commercial economic entities leads to certain financial difficulties, and their elimination requires state intervention.

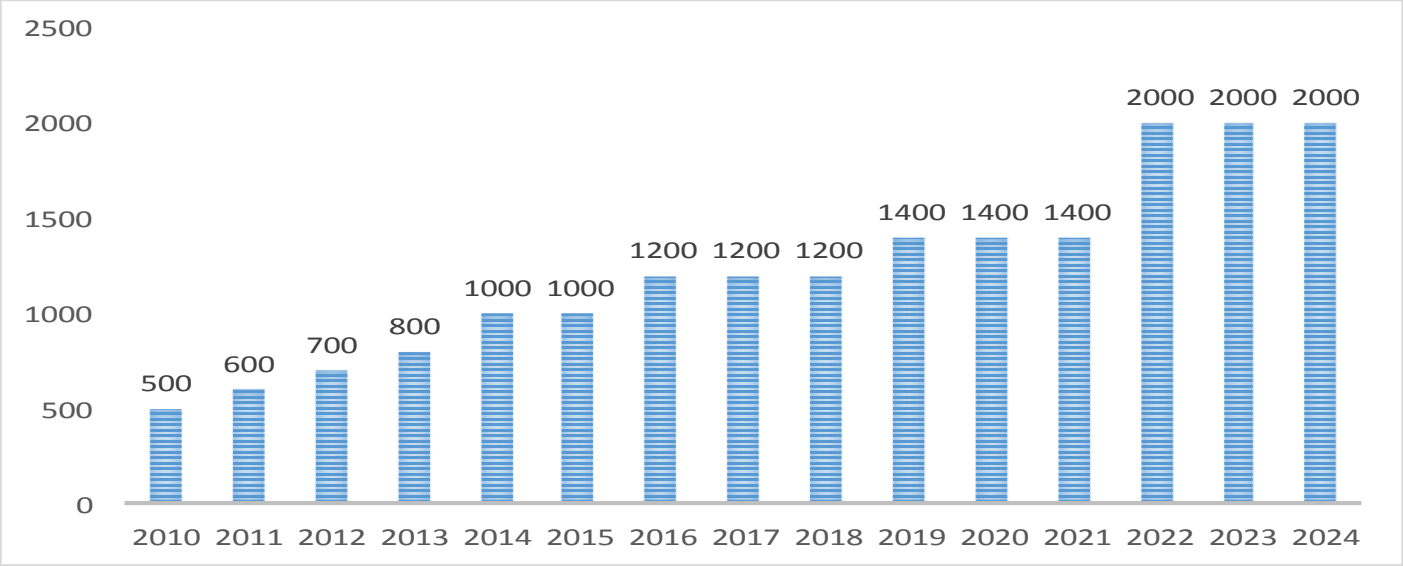

Figure 2. Dynamics of changes in the average fare in the Tashkent metro, soums

As can be seen from Figure 2, while the average growth rate of the consumer price index in the economy as a whole over the past 10 years has been 10-12 percent, transportation costs have increased 5 times, and tariffs have increased 2.8 times.

CONCLUSION

The results of the study show that metropolitan transport is an important strategic factor in the socio-economic development of the country. It plays an important role in improving urban infrastructure, effectively organizing the transport system, reducing traffic congestion, creating convenient mobility opportunities for the population, and ensuring environmental sustainability. The metropolitan system is recognized not only as a means of passenger transportation, but also as one of the key infrastructure projects supporting economic growth and urbanization.

World experience shows that the development of the metropolitan system plays an important role in increasing the competitiveness of cities, creating new jobs, and satisfying the population's demand for transport services. The Tashkent metro has undergone a significant growth phase in recent years, with the construction of new routes and the modernization of stations, resulting in a significant increase in daily passenger traffic. These results confirm that investments in the metropolitan infrastructure are paying off and are bringing socio-economic benefits.

The economic efficiency of the metro system allows for strengthening connections between cities and regions, increasing labor mobility, and forming new business centers. The development of the metro system also creates a favorable environment for the development of large shopping centers, residential areas, and social infrastructure facilities in urban areas. At the same time, the quality of passenger service increases, providing a comfortable transport environment for city residents.

In terms of its positive impact on the environment, the metro is one of the most environmentally friendly means of transport, helping to reduce air pollution by reducing the number of cars. The metro system, which runs on electricity, plays a major role in maintaining the cleanliness of the city's air and reducing carbon emissions. This, in turn, helps to improve the health of the population. However, for the metro system to function more effectively, it is necessary to pay attention to the following important areas:

Introduction of new technologies - expansion of digital payment systems, introduction of intelligent transport systems, and development of automated control systems;

Improving the financing system - using public-private partnership mechanisms in financing the metro, attracting investments and optimizing the tariff policy in the transport sector;

Expanding the metropolitan infrastructure - building new routes, modernizing existing stations and modernizing vehicles;

Increasing social significance - ensuring that public transport is convenient and affordable for all segments of society, especially improving

infrastructure for people with disabilities.

Future prospects show that the further development of the Tashkent metro will contribute to the comprehensive development of the city's infrastructure, increasing population mobility and forming an environmentally sustainable transport system. Through the introduction of digital technologies and innovative solutions, metropolitan transport can be raised to a qualitatively new level. Therefore, the development and implementation of long-term strategies for the development of the metro remains one of the important factors in the country's economic development.

Thus, the metro is an integral part of the modern urban transport system, which is of strategic importance in the effective management of transport infrastructure, ensuring environmental sustainability and creating convenient transport services for the population. Therefore, its sustainable development should be considered as an integral part of long-term plans for the comprehensive development of urban infrastructure.

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