

UPDATING AND EXPANDING CONTENT ON THE MOVE OF TASHKENT METRO

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Annotation: Urban passenger transport is an integral part of modern cities, allowing residents to reach any corner of the city to perform scheduled work. An important aspect of the sustainable socio-economic development of the city is the continuous operation of the city's passenger transport. For this reason, this article focuses on updating and expanding content on the move of Tashkent metro.

Key words: metro, development, updating, expanding, transport, vehicles.

Annotatsiya: Shahar yo'lovchi transporti zamonaviy shaharlarning ajralmas qismi bo'lib, aholiga rejali ishlarni bajarish uchun shaharning istalgan burchagiga yetib borish imkonini beradi. Shaharning barqaror ijtimoiy-iqtisodiy rivojlanishining muhim yo'nalishi — shahar yo'lovchi transportining uzluksiz ishlashidir. Shu sababli ushbu maqola Toshkent metropolitenining harakatdagi tarkibini yangilash va kengaytirishga qaratilgan.

Kalit so'zlar: metro, rivojlanish, yangilash, kengaytirish, transport, transport vositalari.

Аннотация: Городской пассажирский транспорт является неотъемлемой частью современных городов, позволяя жителям добраться до любого уголка города для выполнения плановых работ. Важным аспектом устойчивого социально-экономического развития города является бесперебойная работа городского пассажирского транспорта. По этой причине данная статья посвящена обновлению и расширению контента о движении ташкентского метро.

Ключевые слова: метрополитен, развитие, обновление, расширение, транспорт, транспортные средства.

Introduction

Tashkent transport system is one of the major parts of national and interstate communication networks. Currently, passenger vehicles in the city of Tashkent provide services in the form of buses, taxis, taxis and metro. Providing convenient and high-quality transport services to the citizens of our country, ensuring the stable operation of transport and communication systems is important for the development of our country.

Existing condition

Currently, there are a total of 260 cars in the Tashkent metro, of which 256 are in 64 trains with 4 cars, 1 intermediate motorless car, 1 laboratory car, 1 track measuring car and 1 educational car. 51 of the 64 rolling stock are in use (24 on the Chilonzor road, 15 on the Uzbekistan road, 7 on the Yunusabad road, 5 on the Khalka road), 13 rolling stock are under capital and current repair or in reserve for emergency situations.

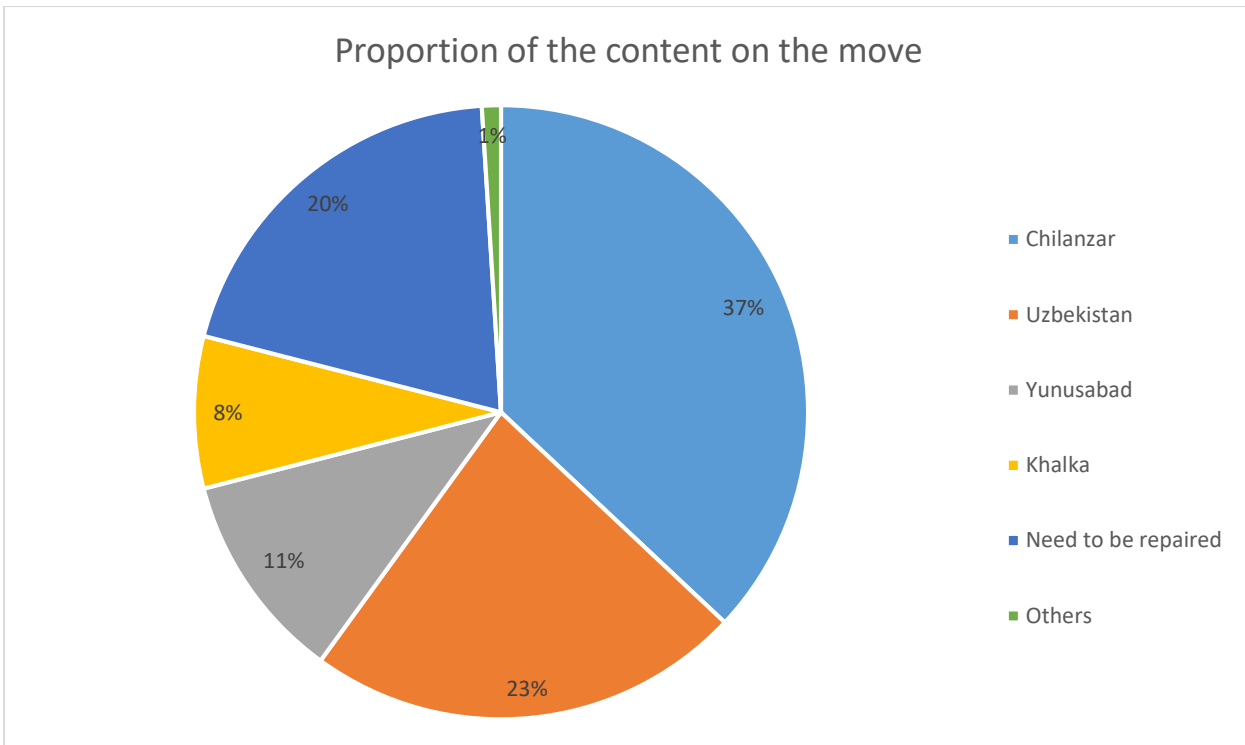
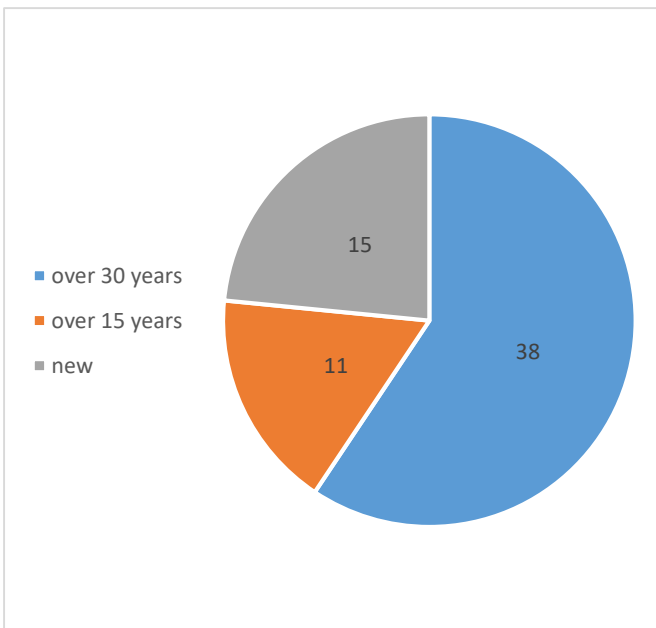


Figure 1. Proportion of the content on the move



The service life of 60% of the existing vehicles (38 vehicles) has exceeded 30 years, 27 of them have been repaired with capital modernization, the service life has been extended to 15 years, and the remaining 11 need capital modernization repair.

There are 2 depots for maintenance and current maintenance of rolling stock, Chilonzor depot for rolling stock on Chilonzor road, and Uzbekistan depot for rolling stock on Uzbekistan, Yunusabad and Khalka roads. In order to ensure high-quality service to the vehicles, it is planned

to put into operation an additional 9-track (kanava) building for the maintenance of the rolling stock in the territory of the Uzbekistan depot by August 15, 2022. According to the existing norms, there should be a separate depot for each road, therefore, the completion of the construction of the Yunusabad depot is required. This, in turn, allows closing the technical service point in Ming-Orik and eases the work of the Uzbekistan depot. Currently, a technical service point has been built for Khalka Road, and during the construction works on Khalka Road, a separate depot for this road is also required. An increase in the volume of passenger traffic requires an increase in the traffic structure and the number of service points. This will also create a need for 150 machinists and more than 100 engineering and technical staff over the next two years.

Opportunities

Reducing the range of motion. Currently, 51 vehicles in use provide the opportunity to ensure the existing traffic intervals in the metro: 3 minutes on the Chilonzor road, 4-5 minutes on the Uzbekistan road, 7 minutes on the Yunusabad road, 10 minutes on the Khalka road. The complete cycle time of the traffic structure is 76 minutes on the Chilonzor road, 54 minutes on the Uzbekistan road, 44 minutes on the Yunusabad road, and 40 minutes on the Khalka road. As passenger traffic increases, so does the need for rolling stock. It is planned to purchase 14 rolling stock this year. An additional 26 vehicles are required to be purchased. The total passenger transportation capacity of 20 4-wagon vehicles operating in 1 hour on the Chilonzor road is 49,600 people. If the running interval is reduced to 2 min, an additional 10 trains will be needed and the total passenger capacity will increase by 50% (74,400 passengers). Energy consumption also increases by 50%.

The total passenger transport capacity of 10 4-car trains operating on the Uzbekistan road in 1 hour with an interval of 6 minutes is 24,800 people. If the running interval is reduced to 4 minutes, 5 additional trains will be needed and the total passenger carrying capacity will increase by 50% (37,200 passengers). Energy consumption also increases by 50%.

The total passenger transport capacity of 9 4-wagon vehicles operating on the Yunusabad road in 1 hour at 7-minute intervals is 22,320 people. If the running interval is reduced to 5 minutes, 3 additional trains will be needed and the total passenger carrying capacity will increase by 44% (32,240 passengers). Energy consumption, in turn, increases by 30%.

The total passenger transport capacity of 6 4-wagon vehicles operating in 1 hour on the Halka road is 14,880 people. If the running interval is reduced to 7 minutes, 3 additional trains will be needed and the total passenger carrying capacity will increase by 50% (22320 passengers). Energy consumption, in turn, increases by 30%.

The total passenger transportation capacity is 111,600 people per hour at the current interval, and 166,160 people at the reduced interval. Therefore, the existing passenger transportation capacity of the metro allows to provide the current passenger flow with transport.

At the same time, reducing the movement interval creates the need for an additional 25 movements. It is planned to introduce 14 new vehicles by the end of the year. The missing 9 rolling stock can be compensated for by overhauling the end-of-life rolling stock. Energy consumption, in turn, increases by 49%.

In order to reduce energy consumption, it is advisable to start the traffic with a reduced interval during the periods of high passenger flow, that is, between 7:00 a.m. and 10:00 a.m. and 5:00 p.m.-8:00 p.m. In this way, it is possible to achieve an increase in energy consumption of up to 20%.

Adding the 5th intermediate car to the traffic. Due to the 25% increase in passenger traffic in the last year, additional intermediate carriages are planned to be attached. Currently, the use of 5-wagon traffic on the road to Uzbekistan has been started on an experimental basis. It is planned to add an additional 5-trailer (non-motorized) wagon to 10 vehicles on the Total Uzbekistan road, and a 5-trailer (motorized) wagon to 10 vehicles on the Chilonzor road.

If 5 trailers are added to the 10 vehicles, the total passenger capacity on the Chilonzor road (with 3-minute intervals) will be 55,800 passengers (increases by 9%). This indicator allows to ensure the existing passenger flow. Energy consumption increases by 10%.

As a result of the addition of the 5th wagon to the 10 vehicles on the Uzbekistan road, the capacity of passenger transportation will reach 31,000 people (increase by 20%). Energy consumption increases by 20%. Taking into account that 14 new rolling stock will be received by the end of the year and 6 rolling stock will be upgraded, adding 5 cars is more efficient in terms of energy consumption and maintenance compared to reducing the running interval to 2 minutes (at times of high passenger flow).

On average, 216,000 passengers are transported on the Chilonzor road. In the morning (between 7-9 o'clock) this figure is about 40-50 thousand people. Apparently, the rolling stock has the capacity to transport these passengers.

Regarding energy consumption: reducing the interval of a 4-car rolling stock to 2 minutes increases energy consumption by 50%, and adding a 5th car increases it by 20%. In order to reduce energy consumption, it is advisable to run the trains with the reduced 5th trailer car at times of high passenger flow, that is, between 7:00 a.m. and 10:00 a.m. and between 5:00 p.m. and 8:00 p.m. In this way, it is possible to achieve an increase in energy consumption of up to 9%.

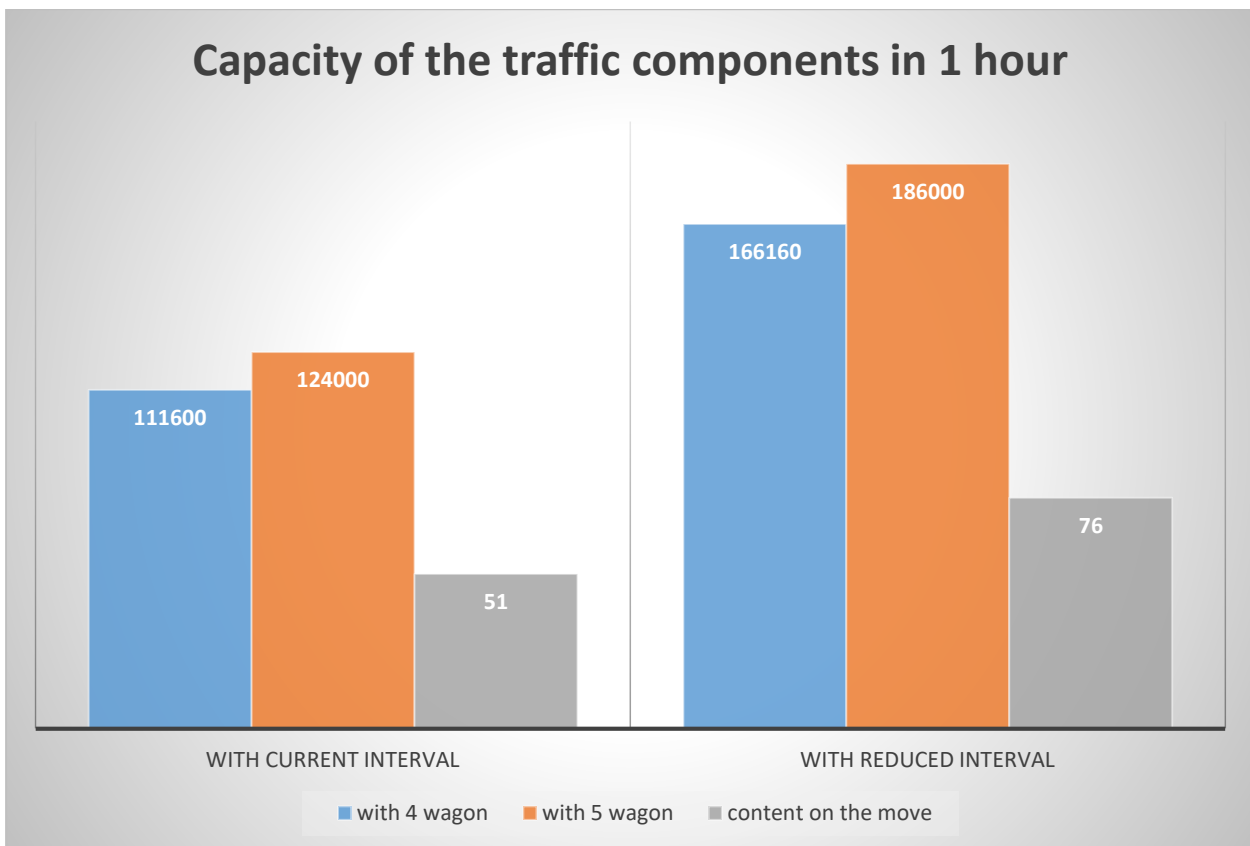
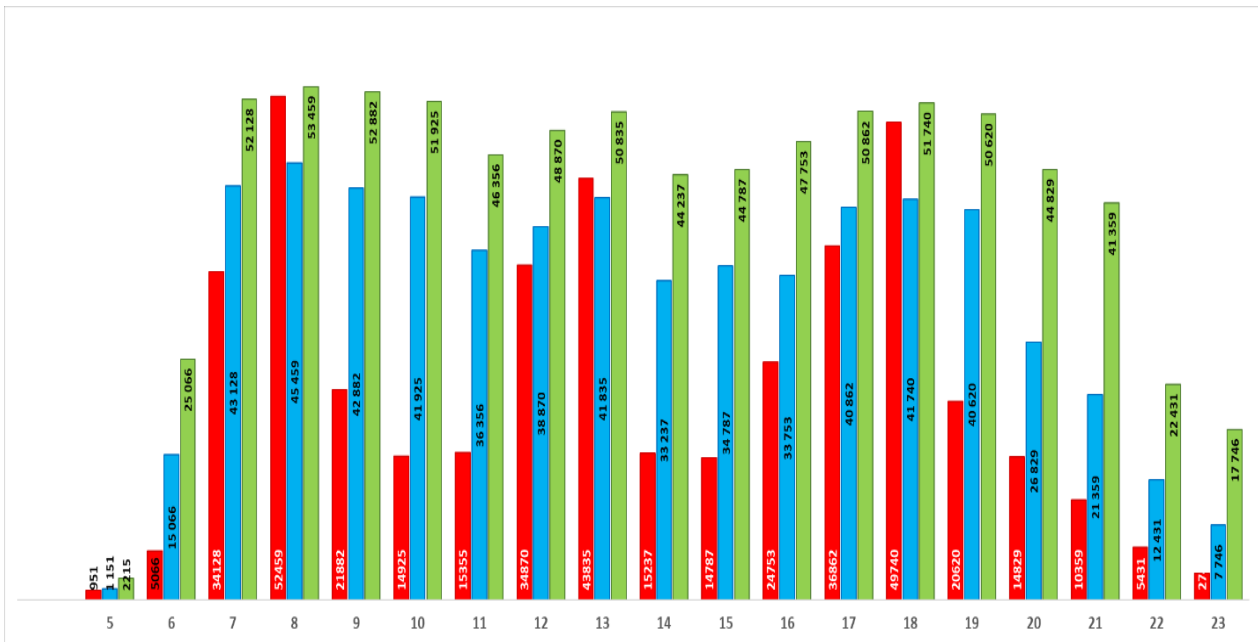


Figure 2. Capacity of the traffic components in 1 hour





Red- 450 thousand
Blue- 600 thousand
Green- 800 thousand

Figure 3. Dynamics of incoming passengers during hours

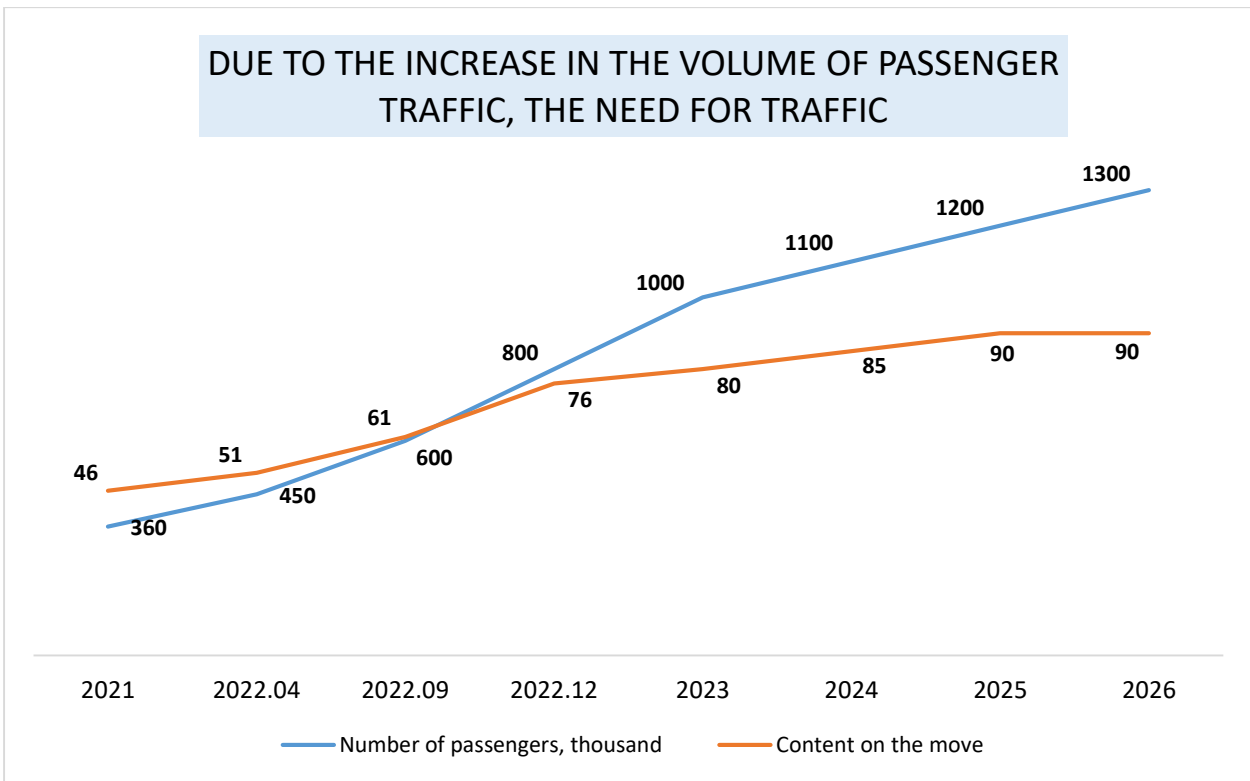


Figure 4. Due to the increase in the volume of passenger traffic, the need for traffic

Modernization of the content on the move

Modernization capital repair of rolling stock has been carried out in Azerbaijan, Georgia, Hungary and other countries, where rolling stock is in use as in Tashkent metro.

With the extension of the service life of one wagon to 15 years, the capital modernization repair amounts to 4 billion soums (\$350,000), \$1,400,000 for a 4-wagon rolling stock.

Such repairs in the Tashkent metro began in 2015, and so far 27 rolling stock have been repaired. Repair of 11 more out-of-service rolling stock is planned, requiring a total of \$15.4 million.

The price of new 4-wagon rolling stock is \$5-7 million and \$182 million.



Picture 1. Modernized trains of European countries

Modernization or renewal?

The service life of modern rolling stock is set by the manufacturer for 30 years. As mentioned above, due to the fact that the service life of 60% of the rolling stock in use in the Tashkent metro has ended, the service life of the rolling stock is being extended up to 15 years by means of modernization and capital repair. It is known that during the use of rolling stock, periodic technical inspection and current maintenance are carried out in order to ensure that they are in good condition. This requires some capital expenditure. As the service life increases, so do the costs. A natural question arises, will modernization work or is it appropriate to renew the rolling stock?

For this purpose, we perform calculations according to the method of determining the effective operational period of the rolling stock. As initial conditions, the average price of 1 new wagon, the average distance traveled by 1 wagon in one year and the annual costs for 1 wagon were taken.



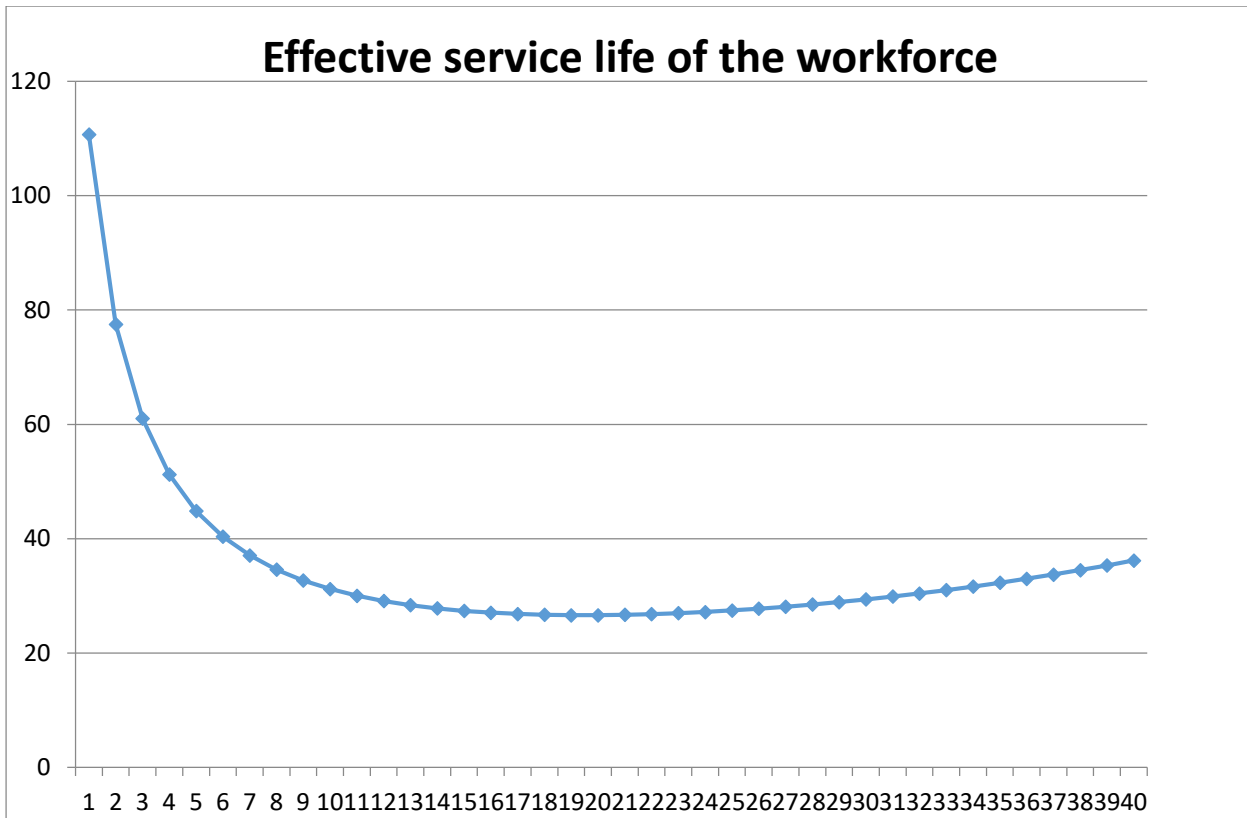



Figure 5. Effective service life of the workforce

Calculations showed that the effective service life of the new rolling stock will be 22-25 years, after which the costs will gradually increase. The period of technical operation of the rolling stock can reach 45-50 years. So, if we compare the cost of new rolling stock (\$5-7 million on average) and the cost of modernization capital repair (\$1.4-1.5 million), and if we rely on the experience gained in modernization capital repair, the service life of rolling stock will be on average 12- Extending up to 15 years is more cost-effective.

At the same time, the existing rolling stock does not cover the growing needs, and new rolling stock must be purchased.

Actions offered for purchase

electric train	manufacturer	Max speed km/h	Current intake and voltage, V	Number of passengers and seats	Management	Estimated price*, million \$
	HYUNDAI Rotem COPYRIGHT (c) 2014 HYUNDAI ROTEM COMPANY. ALL RIGHT RESERVED.	80	3rd rail, 750 direct current	326 (96 seats)	With driver	10-11

	 中国中车 CRRC ООО «CRRC Далянь» CRRC Dalian Co., Ltd.	100	3rd rail, 750 direct current	475 (82 seats)	With driver	5-6
	  АКЦИОНЕР НОЕ ОБЩЕСТВО «МЕТРОВАГ ОНМАШ»	90	3rd rail, 750 direct current	724 (138 seats)	With driver	5-7
	STADLER Stadler Bussnang AG Ernst- Stadler- Strasse 4 9565 Bussnang Швейцария	120	3rd rail, 750 direct current	302 (88 seats)	With driver	-
	ALSTOM ALSTOM, Saint-Ouen- sur-Seine (France)	100	3rd rail, 750 direct current	500 (96 seats)	Without driver	-

*** Prices are determined based on technical requirements**

Figure 6. Trains on offer with their technical characteristics

Conclusion

To modernize trains and make the working life of trains better, there should be taken several steps. These are the offers to make Tashkent metro more appealing:

- To issue a scientific opinion on the construction of 5 intermediate carriages and to make appropriate changes to the local instruction on train management on the basis of calculations
- Determination and technical design of the need for rolling stock and maintenance facilities (depots, maintenance points) that will be necessary in use as a result of the reduction of the movement interval and the construction of new metro lines;
- Development of technical requirements for newly purchased rolling stock;
- Development of time standards for technological processes of maintenance and repair (revision);
- Organization of training courses for metro train drivers and engineer-technical staff.

References:

1. Мамаев Э. А. Пространственно-технологическое развитие городских пассажирских транспортных систем. – 2015.
2. Вихрева Н.А. Потоки автомобильного транспорта в городской сети дорог (на примере города Ростова-на-Дону) / Н.А. Вихрева // Тр. Всерос. науч.-практ. конф. «Транспорт-2011». В 3 ч. Ч. 1. – Ростов н/Д, 2011. – С. 113–115.
3. Рейтинг устойчивого развития городов РФ за 2013 г. [Электронный ресурс] // ООО «АГЕНТСТВОЭСДЖИЭМ» SUSTAINABLE GROWTH MANAGEMENT AGENCY, 2014 г. – 24 с. – Режим доступа: <http://agencysgm.com/projects/SGM%20Rating2013.pdf>.
4. Ташкентский метрополитен [Электронный ресурс]: Википедия. Свободная энциклопедия. – Режим доступа: [https://ru.wikipedia.org/wiki/Ташкентский метрополитен](https://ru.wikipedia.org/wiki/Ташкентский_метрополитен) (дата обращения: 06.05.2022).
5. Новиков В. Г., Сафронов А. И., Кузюков В. А. Микропроцессорные системы управления движением поездов в Московском метрополитене //Автоматика на транспорте. – 2020. – Т. 6. – №. 3. – С. 268-293.
- 6.Машарипов. М. Н., Озодбоева З. З., (2022) Developing the economic efficiency of improving the digital services of the Tashkent metro. Экономика и социум. 8(99), 126-132 стр.
- 7.Машарипов. М. Н., Озодбоева З. З., Умирзаков Д. Д., Азамов Н. Ф., Алламуратова М. С., (2022) Transport hamkorligi istiqbollari, Markaziy Osiyo va Xitoy. Молодой специалист. 112-119 стр.
- 8.Абалонин С.А. Ценообразование - современные подходы. - М.: Транспорт, 2009. - 80 с.
- 9.Машарипов, М.Н., & Алламуратова, М.С.К. (2021). УПРАВЛЕНИЕ ЦИФРОВОЙ ЭКОНОМИКОЙ ПО ИННОВАЦИОННЫМ ТЕХНОЛОГИЯМ. Academic research in educational sciences, 2(4), 63-73.
- 10.Рейтинг устойчивого развития городов РФ за 2013 г. [Электронный ресурс] // ООО «АГЕНТСТВОЭСДЖИЭМ» SUSTAINABLE GROWTH MANAGEMENT AGENCY, 2014 г. – 24 с.
11. Бычков, В.П. Экономика автотранспортного предприятия: учебник / В.П. Бычков - М.: ИНФРА-М, 2006.
- 12.Будрина Е. В. Транспортно-экспедиционная деятельность: учебник и практикум для среднего профессионального образования / Е. В. Будрина [и др.]; под редакцией Е. В. Будриной. — Москва: Издательство Юрайт, 2019. — 370 с.
- 13.Морозов, С. Ю. Транспортное право: учебник для среднего профессионального образования / С. Ю. Морозов. — 5-е изд., перераб. и доп. — Москва: Издательство Юрайт, 2019. — 305 с.