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Current Issues of Transport Infrastructure in Samarkand

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Abstract— The article analyzes in detail the unresolved urban planning problems of the new general plan of Samarkand. A master plan for the city of Samarkand until 2030 is currently being developed. The concept of the general plan takes into account the integrated use of three options for the territorial development of the city: option “A”, development of the city to the south; option “B” - development in a western direction towards Charkhin and adjacent agricultural lands. In the northwestern and southern parts of the city, the nature of the designed housing stock will change significantly. In the northwestern and southern parts of the city, the nature of the designed housing stock will change significantly. The proposed number of floors for the new city are multi-storey (16-25 floors) and elevated (30 floors) residential buildings (proposals from a Turkish company). The territory adjacent to the southern subcenter on the eastern side - up to 30 storey residential buildings (let's call it "Samarkand City"), taking into account engineering, climatic, hydrological, and seismological conditions.

The practice of reconstructing the central streets of Mirzo Ulugbek, Registanskaya, Penjikentskaya in Samarkand shows that the concept of reconstruction is associated mainly with the expansion of the roadway of the streets and an increase in their capacity as a result of modernization.

Specific measures are proposed to improve the general plan and ways to solve the city's transport problems.

Keywords: mountain terrain, the master plan, the road network, intercepts parking activities.

INTRODUCTION

In terms of population and gross industrial output, the Samarkand economic-geographical region occupies one of the leading places in the country. Geographically located in the middle part of the Zarafshan Valley and surrounded on three sides by the mountains of the Nurata , Turkestan and Zarafshan ranges[1]. The mountains dampen the cold air currents coming from the north. There is a lot of precipitation (250-800 mm). The location of the city in a mountain basin (on three sides of the mountain) determines the average annual wind speed within 1.0 m/ s . with a repeatability of about 65%, which significantly affects the transport and environmental condition of the city[2].

A master plan for the city of Samarkand until 2030 is currently being developed. The concept of the general plan takes into account the integrated use of three options for the territorial development of the city: option “A”, development of the city to the south; option “B” - development in the northwestern and western direction towards Charkhin and adjacent agricultural lands[3].

In the northwestern and southern parts of the city, the nature of the designed housing stock will change significantly. The proposed number of floors for the new city is multi-storey (16-25 floors) and elevated (30 floors) residential buildings (proposals from a Turkish company). The territory adjacent to the southern subcenter on the eastern side - up to 30 storey residential buildings (let's call it "Samarkand City"), taking into account engineering, climatic, hydrological, and seismological conditions[4].

Methods.

Samarkand is the center of a group system of populated areas of the valley (has zones of near and far influence), which is intertwined with the problem of labor migration . A large number of small and large settlements are closely adjacent to the city, merging and forming a whole system of settlements along the main transport roads. In 2022, part of the territory of the Akdarya region along the Zeravshan River came under the jurisdiction of Samarkand, and the process of “equipping” the million-plus city by annexing territories to it continues. The master plan of the city of Samarkand also covers the development of transport and highway networks of the city. The main points of development and prospects for transport are a 2-fold increase in the population (up to 1.1 million people), an increase in motorization of the population by 3-4 times, up to 240-300 passenger cars per 1 thousand inhabitants (now 89), an increase in transport mobility inhabitants by 1.5-2 times, significant territorial growth of the city in the north-west direction towards the river to Zarafshan- Karasuv massif with a population of 120 thousand people[5, 6].

Following the developing process of motorization in the country and the rapidly growing mobility of society, we note that the processes observed in developed Western European countries are beginning to manifest themselves in our country. Therefore, these processes should be managed in such a way as to not only avoid critical situations, but also accordingly direct efforts towards the formation of a modern city center[7].

The practice of reconstructing the central streets of Mirzo Ulugbek, Registanskaya, Penjikentskaya in Samarkand shows that the concept of reconstruction is associated mainly with the expansion of the roadway of the streets and an increase in their capacity as a result of modernization. An attempt to solve the problem through various measures also manifests itself with the expansion of the roadway due to the elimination of greenery, cutting down hundred-year-old trees, as a result of which the environmental situation is aggravated, which leads to disruption and rise of groundwater, which seriously affects the condition of historical monuments, and yet the landscape areas of historical zones, the same natural part of the historical and cultural heritage, the reduction of sidewalks, the restructuring of nodes, the demolition of valuable buildings, the expansion of the streets themselves, the strengthening of new functions in the city center. These measures improve the transport situation for a short time. The result of these actions is that these streets turn into transit highways of inter-district importance and begin to serve the population of the adjacent agglomeration. A large flow of traffic leads to disruption of the functional purpose of the public and business center, as a result, transport here is paralyzed.

Transport flow of the agglomeration from south to north and from west to east. For example, from the Urgut direction it passes through the security zone of the historical center of the medieval city along the street. Registan , and through the security zone along the streets of Amir Timur, Mirzo Ulugbek connects with the Bukhara direction[8].

It has been theoretically and practically proven that the radial network of highways has an inherent flaw - it inevitably draws traffic flows to the city center, which leads to congestion, traffic jams and a decrease in traffic speed. Radial schemes are unable to organize the mobility that large cities require. The speed and scale of movement in the central part destroys its usual order. The high density of traffic flow in the city center creates an extremely unfavorable traffic regime on highways, in which the emission of exhaust gases is maximum. A conflict situation is created between pedestrians and transport, and a threat to people's health appears. By creating noise, emitting exhaust fumes, causing nervous tension, dividing space and visually intruding on pedestrians, it has a negative impact on the physical and mental health of people. As a result of the development of motorization, the traffic intensity in the city center by 2020 compared to 2000 increased 5-6 times or more, which gave rise to many problems. This is a disadvantage of the radial and radial-ring structure of the city, in which transport moves towards the center. An unreasonable decision also leads to a distortion of the artistic appearance of historical cities[9].

The text **of the International Charter for the Protection of Historic Cities** defines the principles and objectives, methods and methods of activity inherent in the protection of historical cities. Paragraph 13 of the Charter states: " **The network of main transport roads provided for the improvement of the territory should not penetrate into historical cities, but only improve traffic in the vicinity of these cities, thereby facilitating access to them."**

Many experts believe that city growth itself is causing disruption to normal life and that if growth is curbed, the situation will be corrected. However, it is impossible to curtail this urban growth - this would be an attempt to change an objectively determined historical trend.

The dynamics of the development of the city territory from 1926 to 2020 shows that the population has increased 11 times, and the territory has increased almost 7 times, acquiring a linear development along the main transport roads. An analysis of the transport scheme of the master plan proposed by the Aga Khan Cultural Foundation's Historic Cities Support Program showed that the existing transport scheme of the historical core has remained virtually unchanged; a new loop has appeared with parking in front of Registan Street . This transport scheme does not relieve the transit traffic flow passing through the center of the historical core, it only strengthens it by performing the function of inter-district transit value, serving the adjacent agglomeration from the Urgut direction.

Registanskaya Street in the past transformed the structure of the historical part, dividing it into two parts. As a result, entire neighborhoods and house-museums were demolished , the visual perception of the historical environment was disrupted, wide transport roads that were not typical for the medieval historical environment disrupted the panorama and exterior of the streets, and the ecological environment was disturbed. Squares, mosques and other public buildings of the Middle Ages had the scale of human masses, which were commensurate with the masses of people gathered in city squares and streets. Now huge highways carrying high - speed traffic are encroaching on the old system. They demonstrate a super-human scale, which in no way can be brought into harmony with the architecture of the past[10].

Discussions .

We are not saying that there is no need to build roads at all, but if they start to reshape the city for the sake of cars and strive to transfer all residents to them, and this is exactly what our auto industry has been doing for a long time, then sooner or later a real disaster will result.

Currently, many Samarkand " highways " have reached the end of their service life, which is why there are 2 scenarios:

1. reconstruction of old streets;
2. demolition.

Today, instead of expanding the highway network, the government should be prepared to spend considerable money on demolishing highways, against the idea of " turning highways into boulevards."

It should be noted, but the construction of roads could not rid America of traffic jams, and the high capacity of city streets did not make them comfortable for life. After all, road expansion projects that were implemented in America 50-70 years ago are being implemented in our country now.

Moreover, maintaining high capacity on city highways often has only a minor impact on the time spent by city residents on the road, but at the same time significantly worsens their quality of life. Wide city highways mean noise, exhaust fumes and disgusting streets where it is impossible to walk comfortably. And over the past few decades, they have been getting rid of them all over the world, and the United States is no exception, but now this process has accelerated somewhat[11].

In Boston, where a city highway was built in the last century, and half a century later the roads were removed into a tunnel to create a park on the ground (Fig. 1).

https://www.tripadvisor.com/Attractions-g60745-Activities-Boston_Massachusetts.html

Figure 1. View of the main street of Boston: a) before; b) currently

Previously, there was a transport area here.

The designed main road network for the estimated period is designed to solve the following problems:

-relieving the residential area and city center from transit and freight traffic, creating duplicate highways to relieve congestion on the main city streets;

- building new main streets to ensure the passage of the expected fleet of passenger cars;

priority use of public transport, reduction in the use of personal transport;

-organization of parking for passenger cars in multi-level parking lots.

It is also planned to build transport interchanges on two levels at the intersections of Samarkand's transport routes.

But, there are some urban planning problems that are not fully taken into account in the new master plan. There are basically three of them: 1. the problem of labor migration by private cars from the adjacent territory of the city; 2. the issue of temporary storage of cars and 3-seismicity of the region and hot dry climate.

Samarkand has already faced the problem of an increasing number of cars. Overloaded transport routes, traffic jams and sidewalks, roadsides and even green areas in courtyards densely packed with cars are becoming a common occurrence. The difficult legacy of the urban planning situation of the Soviet era, when they simply did not count on a large number of private cars, is taking its toll. But even if Samarkand residents are accustomed to "shove" their favorite horse into a free space near their office or home and have learned not to be indignant at this, they would like to see convenient parking in front of shopping centers.

Therefore, to improve transport services for the population, it is proposed to build a high-speed tram - a lightweight ground or elevated metro. The zone of influence of light rail stations as a zone of mass transport accessibility should be about 3 kilometers.

The proposed high-speed tram route, 15 kilometers long, in the form of a ring connecting centers of population attraction and places of employment, covers 80% of the city's residential area.

A store or bazaar is a place where customers are invited, where they are expected and ready to provide them with all sorts of conveniences and joys in exchange for the money spent. "No parking - no trade" - it's hard to disagree with this statement today. You can't skimp on parking and rely on the fact that "no one in our city has it," or that visitors will look for spaces along the roadway. Buyers don't want the parking problem to fall on their shoulders; they can simply turn around and drive to a more convenient location[12].

Need in the territory available in the city and on highways outside the city. It is especially large in the administrative center, the area of trade, cultural and educational institutions, as well as near transport hubs and large residential complexes. On highways there is a need for temporary parking, independent of the location of the listed objects of gravity, but associated with the need for drivers to rest, inspect vehicles, etc.

Foreign data show that in large cities with a high level of motorization, the overwhelming number of temporary parking spaces are provided through off-street parking.

A broad ban or restriction on temporary parking makes it extremely inconvenient and sometimes pointless; the use of personal cars in urban environments and at high levels of traffic is unacceptable. These vehicles are in motion no more than 10% of the day. Therefore, traffic organizers face the complex and, in many cases, contradictory task of optimally providing temporary parking on road roads, without which the overall efficiency of using cars cannot be achieved.

Temporary parking near highways is usually organized in open areas, since under these conditions there is usually no need to place a large number of cars in one place. At the same time, it is important to ensure sufficient frequency of parking spots[13].

Parking lots are divided according to operating mode: 1 – with unlimited operating hours; 2 – with a limitation on the duration of the vehicle's stay; 3 – with limited (during the day) operating time. Parking lots of the 2nd type are used in heavily trafficked areas and cramped conditions, which makes it possible to serve a larger number of car owners with a limited number of spaces. A typical example is the introduction in a number of Western countries of the so-called "blue zone" for street parking in a certain part of the city. The duration of stay in a parking lot in this zone should not exceed 1.5 hours. This practically eliminates the possibility of using street parking in these zones by people coming to work, i.e., it excludes work trips that require the longest stay of cars in temporary parking lots.

Type 3 parking regime is introduced on certain streets, the capacity of which during peak times is insufficient in the presence of parked cars. It can also be introduced at certain hours due to the need to perform special loading and unloading operations, cleaning streets or parking areas themselves. The same regime can be applied to off-street

parking areas (for example, located near administrative and cultural centers) to prevent them from becoming a place for permanent storage of personal cars.

Currently, based on the experience of urban planning and traffic management, taking into account the prospect of motorization, many countries have developed recommendations and standards for providing characteristic objects with places for temporary parking of vehicles.

For example, in the new edition of ShNK 2.07.01-03* "Planning the development and construction of territories of urban and rural settlements" contains standards intended for urban planning and can be used in the city to justify the organization of temporary parking.

In shopping centers and multifunctional complexes, an accurate calculation of the number of parking spaces is made by identifying functions and counting spaces for each of them. Thus, for catering establishments, the number of seats at tables is taken into account, and 1 parking space is for 6-12 seats. The required number of parking spaces for shops and shopping centers is determined at the rate of 1 parking space per 15-25 m2 shopping area.

The parking provision ratio shows what percentage of parking spaces of the required number for a given retail area is available. For example, a store has a sales area of 3500 m2 . The required number of parking spaces is 140 (i.e. 1 parking space per 25 m2 retail space).

In foreign practice, for example, in the USA and Canada, the parking index is used .

Parking index (parking index is the number of parking spaces for every 1000 square feet (1000 square feet -93 m2) of GLA (gross leasable area).

The value of this indicator depends on the size of the area and the type of shopping center. The following values are accepted in the USA:

- 4 - for shopping centers with a size of 2,325 - 37,200 m2 (GLA - from 25,000 to 400,000 sq. ft.);
- 4.5 - for shopping centers 37200 - 55800 m2 (GLA - 400,000 - 600,000 sq. ft.);
- 5 – with a size of 55,800 m 2 (with GLA sizes of more than 600,000 sq. ft.).

In Canada, an index of 3.9 is considered acceptable for a regional shopping center, and 5.5 for an interregional one. Thus, the larger the retail facility, the greater the number of parking spaces per 1000 m^2 . Obviously, the large size of a retail space attracts customers from a larger area, and they can travel a long distance to get to a store or shopping center.

When choosing a location for organized parking, you should also take into account the nature of local conditions (visibility, intensity of pedestrian and vehicle traffic, flow composition, etc.) and, if necessary, adjust their location.

Parking location. Parking can be on the ground, underground or adjacent to the building (multi-level built-in parking). Obviously, surface parking is more convenient for visitors and costs less for the owner. Its shape and configuration matters. When determining the placement of a building on a site and a parking location, the following must be taken into account:

1. how visible the parking lot is to visitors driving up to the store;
2. Is it easy to control and secure parking;
3. how long visitors will have to walk to the entrance from the most remote points in the parking lot.

The best option is a rectangular parking lot located in front of the building. English specialist in retail architecture Nadine Beddington advises placing parking in such a way that the distance from the most remote places to the main stores does not exceed 200 m.

The permissible slope of surface parking according to American standards is 8%, which is very important for the topography of Samarkand. With a greater slope, parking is made in the form of terraces separated by retaining walls, which should be perpendicular to the facade of the store. For the climatic conditions of Samarkand, an effective technique is to decorate the dividing walls with greenery. The parking lot takes on a more picturesque

appearance, it is more pleasant for customers to walk from their car to the store, and in the summer, cars do not overheat, remaining in the shade of trees.

Particular attention must be paid to the choice of the location of entrances and exits for off-street parking in those places where significant interference with the main flow can be created by cars waiting on the roadway for the opportunity to enter the parking lot. To prevent delays and ensure traffic safety, it is advisable to use separate - entrances and exits and not to locate them in places of limited visibility, on the inner lane of a curved plan, near intersections or pedestrian crossings. It is necessary to find the possibility of organizing entry and exit to temporary parking areas from secondary driveways and streets, so as not to create conflict spots on highways.

The next problem of Samarkand. The greatest traffic load on the city's street and road network falls on the morning and evening "rush" hours, when the number of vehicles on the city's roads is maximum. Every morning a huge number of labor workers come to the city and leave the suburbs in the evening by private cars.

In order for car owners to use public transport more often than private ones, it is necessary to provide them with parking lots where they can leave the car during the working day[14].

Results.

Here, the most acceptable solution to the problem is "intercept parking", which should be located at four entrances (north, south, west and east) to the city and, if necessary, additionally within the city.

First, let's look at the concept of "intercept parking" in order to further understand what we are talking about.

Intercept parking. One of the possible ways to solve the problem of traffic jams is the construction of intercepting parking lots in hot spots of exacerbation of the transport problem, offering everyone the opportunity to rent parking spaces for an arbitrarily short period of time.

Parking is also a car parking lot located near a bus station or other public transport stop and is intended for drivers who want to leave their car and continue to their destination by public transport .

The transport system must have powerful multimodal transfer hubs linked to high-speed public transport stations. Such nodes should ideally include passenger bus stations (to process transfer passengers of ground public transport arriving from peripheral residential areas and nearby suburbs), as well as parking lots with a capacity of many thousands (to implement Park&Ride technology).

For such nodes throughout the world, something like a "safe-conduct" applies: there should not be any development facilities here that generate additional traffic load not directly related to servicing transit passenger traffic.

Naturally, not all drivers share this idea. Many are not ready to give up comfortable personal transport in favor of overloaded public transport, and therefore it is imperative to **make the storage of cars in "intercept" parking lots free of charge.**

Currently at the Department of "Urban Planning" under the guidance of the author of the article defended master's thesis Fazilova Sh. R. on the topic "Scientific basis for the use of overstaffed parking lots for the city of Samarkand"[15].

Recommendations. 5 solutions transport problem of Samarkand :

-1. type of measures - for the development of the road network, i.e. increasing its density to regulatory requirements -2.8 -4.5 km/km2 - in the city center (in Europe, UDS occupies 20-25% of the city area, and in the USA 30-35%), introduction of new ring and radial highways , transport interchanges, the formation of chord directions, the creation of a system of redundant highways, an increase in the volume of construction of new roads of various categories;

-2.type of measures is aimed at improving the quality of the road network. This group includes the development of transport infrastructure and reconstruction of existing highways, transport facilities and roads,

regular local measures to improve traffic conditions, the development of an automated traffic control system, measures to organize priority public transport, the introduction of an intelligent transport system - ITS, etc. d.;

-3.type of measures - administrative measures in order to streamline the movement of transport, including: tightening traffic rules, restrictions on the movement of freight transport, banning spontaneous parking and many others. It is necessary to build new bridges, interchanges, and lay roads through previously closed industrial areas.

-4.type of measures widely used in Europe, but not yet implemented in Samarkand, - the use of "intercept" parking systems at four entrances to the city (north, south, west and east) and, if necessary, additionally within the city;

-5.type of measures includes two network structures: the first circuit is passages and streets with direct access from the development site, the second is city highways designed for high-speed continuous movement (i.e., it builds high-speed transport lines in an underground version). Highways should be routed along chords (or ring fragments) in order to "throw" traffic out of the city at its two ends, and not drive it into the center. They must be laid along track structures separate from the building (overpasses, bridges, tunnels) and, accordingly, isolated from pedestrian flows. Highways form an independent high-speed network, each joint of which is a precisely calculated engineering structure that eliminates the occurrence of turbulence points at the junctions. This high-speed network must be technologically connected to the "grassroots" road network of the city. The global trend is the development of an integrated rail system, when a passenger can travel on commuter and city trains, then transfer to a tram. Another relevant question is the introduction of cycling not as a recreational activity, but as a means of transport. Naturally, with the formation of a comfortable infrastructure for it and the abandonment of environmentally hazardous cars with engines of a class below Euro 2. We must also think about the bicycle as a serious form of urban transport. It is necessary to actively promote cycling and build separate paths for them[16].

Conclusions.

Of course, it will be great if the strength of buildings is never tested in practice, but one way or another, today safety in the construction of skyscrapers has been elevated to unprecedented heights. Therefore, the implementation of the city master plan concept requires maximum effect, i.e., to act comprehensively - both to predict and to build well.

In conclusion, we can formulate **5 main reasons for** the transport problem in Samarkand:

1. the existing development of the city center with a high concentration of administrative, office, retail and other buildings;
2. lack of justification for decisions made based on scientific forecasts and especially the lack of microseismic data ;
3. lack of developed transport infrastructure;
4. incompleteness of the radial-ring structure of the city and chord highways, creating additional transport tension;
5. an urgent and major revision of the legal regulatory framework of urban planning on all positions in one way or another related to urban traffic and the presence of mass cars in the city.

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