International Journal of
Inclusive and Sustainable Education
ISSN: 2833-5414
Volume 1 | No 5 | Nov-2022

Issuing the Plan for the Development of the Automobile Road Network

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Abstract: In the current methods of design and development of the road network, the future speed of traffic and road transport costs for the studied area are taken as the main indicators. Such an approach is aimed at solving the issues of designing and developing the main road networks of economically developed regions. This article describes the development methodology of the remote districts of the region using socio-economic indicators for the development of highway networks.

Keywords: transport, logistics, availability, automobile, socio-economic, development, road scheme, optimal, criterion, cost, priority, correlation-regression, cargo flow.

Introduction

Accelerating the interaction of all sectors of the economy requires the transport sector to be continuously developed and updated.

According to the World Bank, the international transport market is valued at 2.2 trillion dollars, and its share in the world GDP is 6.8%, and in the Republic of Uzbekistan, the share of the transport and storage network in GDP is 5.5% (State Statistics Committee of the Republic of Uzbekistan data, 2021).

In the Republic of Uzbekistan today, about 98% of passengers and more than 88% of goods are transported by road transport (Sh.M. Mirziyoev., 2019).

The increase in the volume of cargo transportation, the expansion and densification of road networks of various vehicles, the increase in the speed of material flows in them, the expansion of cities, and similar factors make it necessary to determine the shortest length, low-cost road schemes connecting the destinations of products and goods in the region with the objects of consumer organizations, and to phase them. -puts the issue of stage development on the agenda. Because the flow of material delivered along the shortest road network is low and it increases the competitiveness of the manufactured product.

Literature Review

With the problems of increasing the efficiency of the transport network and their use, E.P. Nesterov, G.N. Kovshov, V.N. Livshits, Ya.V. Khomyak, A.K Birulya, B.A. Volkov, V.A. Parshikov, G.A. Polyakov, M.S. Zamakhaev, I.A. Romanenko, V.N. Bugromenko, S.M. Gribnikov, M.N. Kudryavtsev, G.A. Borodiansk, G. Sotiropulsom, D.K. Thenar, S.V. Meidj, E. Macioszek, M. Staniek, S. V. Kropivin, Yu.D. Kuznetsov, A.A. Zenkin, E.A. Pozamantir, B.A. Khojaev, K. Uldjabaev, Sh.A. Butaev, G.A. Samatov, S. Alikariev, A.Kh. Urokov, J.I. Sadikov and many other scientists were involved.

The highway is considered as a means of providing consumer demand, and the economic benefit from the investment in the construction of the highway and the improvement of its transport and operational condition is manifested in all sectors of the economy. This means the wide range of consumers who benefit from the improvement of road conditions (Botaev Sh.A., Sidiqnazarov Q.M., Murodov A.S., Koziev A.O'., 2012).

Costs associated with improving road conditions generally benefit companies that build highways and their infrastructure. In addition to the benefits that road construction brings to enterprises, there are direct socio-economic benefits for society. Today, there is no methodology that determines the efficiency except for road management (V.V. Koson, V.N. Livshchits, A.G. Shakhnazarova, 2002).

Highways and their artificial structures perform a delivery service for consumers and are an instrument for providing direct consumer demand. Consequently, the costs allocated to improving road conditions and maintaining them at the required level are reflected in increasing the efficiency of networks and improving socio-economic conditions (Highway Development, HDM-4, Washington DC: The World Bank, 2010., Kazemi, L., Shahabi, C. and Sharifzadeh, M., 2009).

The analysis of the literature devoted to the development of transport networks, planning of multimodal cargo transportation, it was shown that researchers use three main levels in their planning work, that is, strategic, tactical and operational levels, that the issues of the tactical level are widely studied, and the issues of the strategic and operational levels are in the next place (SteadieSeifi M., Dellaert N.P., Nuijten W., Van Woensel T., Raoufi R., 2014).

Research Methodology

The article analyzes the correlation-regression model of the influence of the level of transport provision on socio-economic indicators. The method of development of the transport network with low traffic speed is shown. Mathematical methods, generalization, statistical analysis, and comparative analysis methods were used in the article.

Analysis And Discussion Of Results

The road network development methodology consists of several stages. A block diagram of the algorithm of the methodology is given below (Fig. 1).

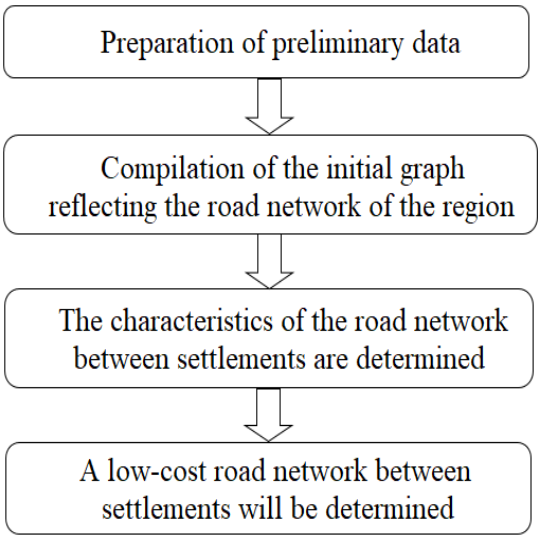

Figure 1. Block diagram of the regional road network development methodology.

Improvement of the local road network is carried out in the following order:

1) preparation of initial data:

- map of the studied district road network and settlements;
- traffic flow between the center of the region and settlements;
- the type of road surface for automobile road sections.

The distance between the settlements was taken according to the map of the studied area, as well as on the basis of the materials of the unitary enterprise of highways.

Taking into account the limited financial resources, it is envisaged that the development of local road networks will be carried out in stages at individual nodes. In this case, the improvement of the transport-operational characteristics of transport networks is carried out by transferring the low type of road pavement to the type of permeable pavement (Zhukov V.I., Kopylov S.V., 2015.).

1) an initial graph is constructed, showing the road network of the studied area (Fig. 2). The initial count was obtained on the basis of the analysis of the results obtained on the optimal distribution of future cargo flows of the Surkhondarya region in the transport multi-network and the development of the surface transport system (Kuziev A.U., Shermukhamedov A.A., 2020, Kuziev A.U., 2020).

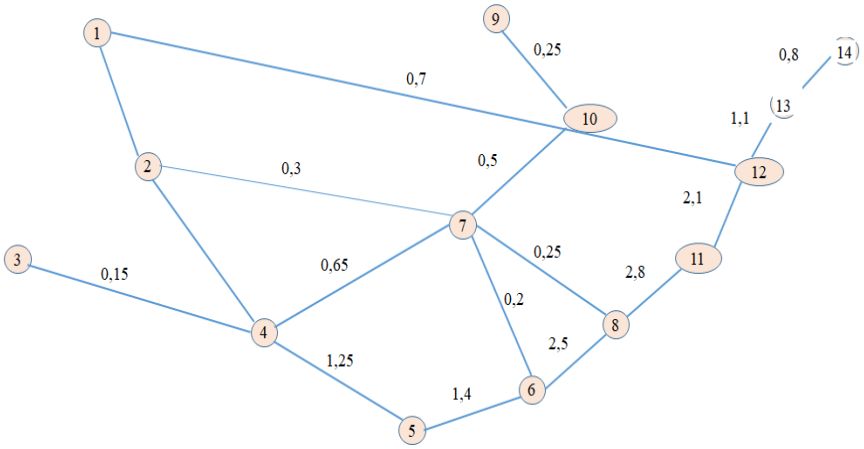

Figure 2. Road network of the region and location scheme of settlements.

All settlements are marked with numbers in the order of their distance from the center of the territory. Based on the results of the distribution, arcs with the least loaded transport connections are determined and selected. So, in the graph, traffic connections 3-4, 9-10, 2-7, 7-6, 10-7 had the least load. It was recommended to carry out surface treatment works on road sections 3-4, 2-7, 9-10 with a low load level, and to transfer road sections 10-7 and 7-6 from IV to III. It was determined that 225.2 billion soums and 1269.45 billion soums will be spent on these activities, respectively (Table 2). It is not enough to absorb the funds provided at the same time. Therefore, in the research work, plans for the step-by-step development of road sections were developed.

Table 2. Capital funds for road sections

	3-4	9-10	2-7	7-6	10-7
Road length, km	28,1	55,7	28,8	39,2	25,9
Total estimated costs, billion soums	56,2	111,4	57,6	764,4	505,05
Cost per 1 km, billion soums	2,0	2,0	2,0	19,5	19,5

It is necessary to select the least loaded transport links for improvement. The selected transport connections with the least load should be maximally compatible with the socio-economic development of the studied area (Kuziev A.U. Shermukhammedov A.A.).

Advantage of road network drawing. Transport networks 3-4, 9-10, 2-7, 7-6, 10-7 are not directly connected with the center of the region (Fig. 5.2). However, the 7-6 transport network connects the three districts with the regional center. 9-10, 3-4 transport connections do not connect any district with the center of the region. 7-6 and 3-4 are connected to the center of the study area by one transport, but the transport link 7-6 connects three districts to the center of the area. Therefore, it is given a preference of -1. Based on this, priority was assigned to 2-7 and 10-7 transport links -2 and 3-4 and 9-10 transport links -3 (Table 3).

Table 3. Priority on the drawing of the road network

Order of transport connections	Priority on the drawing of the road network
3-4	3
9-10	3
2-7	2
7-6	1
10-7	2

Population superiority is determined based on the number of people moving in the region of transport connections under study (Table 4).

Table 4. Population superiority

Order of transport connections	Population in settlements, thousand people	Population superiority
3-4	136	3
9-10	168,4	2
2-7	186	1
7-6	130,5	4
10-7	35	5

In order to calculate the priority in terms of socio-economic efficiency, all transport links under consideration are improved with load characteristics stratified. Including changing from a low road surface to a passing road surface. As a result of improving all transport links, the length and density of the improved paved road network will increase. After the improvement of the 3-4 transport connection in the region, the density of the paved road network is 2.13 km/1000 km^2, 9-10 transport connection-3.48 km/1000 km^2, 2-7 transport connection-12.8 km/1000 km^2, 7-6 transport links - 5.9 km/1000 km^2, and 10-7 transport links - 5.2 km/1000 km^2 (Table 5).

Table 5. Superiority in terms of socio-economic efficiency

Procedure for transport communication	Number of inhabitants in the district, thousand people	Transport communication distance with improved coating, km	Transport communication distance, km	Prospective density of paved road network, km/1000 sq.km
3-4	136	158	28,1	2,13
9-10	168,4	195	55,7	3,48
2-7	186	351	28,8	12,8
7-6	130,5	119	39,2	5,9
10-7	35	78	25,9	5,2

Regression equations for each indicator are presented based on the correlation-regression model performed above (Chernova T.V., 1999). To solve the problem, static data indicators of the area by years were used.

$y_1 = 4{,}0773x^2 + 1220{,}7x - 84552$, (1)

$y_2 = -11{,}191x^2 + 3516{,}3x + 247651$, (2)

$y_3 = 0{,}5695x^2 + 9{,}9079x - 7937{,}9$, (3)

$y_4 = -0{,}756x^2 + 201{,}41x - 11705$, (4)

$y_5 = -0{,}6778x^2 + 185{,}46x - 10079$. (5)

The values of the density of the road network with a solid surface (Table 5) obtained after the improvement of the specified road sections (transport connection) are put into the equations (1-4) above. The socio-economic performance results for each transport link are presented in Table 7 for all indicators.

Table 7 . Values obtained according to socio-economic indicators

Plot	K_1	K_2	K_3	K_4	K_5	Final assessment
3-4	-56701,16	317470,98	-67217,66	-7757,84	-6436,22	5
9-10	-37133,87	356465,54	-6903,34	-5610,93	-4445,84	4
2-7	**138500**	**514384,06**	**2660,99**	**1689,18**	**2553,93**	**1**
7-6	1662,38	416156,83	-5370,9	-2453,44	1496	2
10-7	-10050,59	400238,14	-5882,76	-3275,9	1316,22	3

According to the results of the calculation, 2-7 transport communication industry has good results in terms of volume of products, GDP indicator of Surkhandarya region, per capita investment in fixed capital, population employment indicators, 7-6 transport communication, 9-10 transport communication industry are in the next place. It has better indicators than 3-4 transportation network in terms of the volume of its products and the indicators of employment of the population.

It was revealed from the results of the calculation that 2-7 transport connections have the advantage in the assessment of socio-economic efficiency (Table 7).

The results obtained for the priority of the three indicators used to determine road sections for the development of the road network are presented in the table below (Table 8).

Table 8. Superior results in three metrics

Plot	Superiority			
	According to the diagram of the road network	By population	Socio-economic indicators	Total
3-4	3	3	5	11
9-10	3	2	4	9
2-7	2	1	1	4
7-6	1	4	2	7
10-7	2	5	3	10

From the results of the calculation (Table 8), it became clear that the sequence of development of highway sections can be implemented in the following order: 2-7 transport links (56.7 billion soums), 7-6 transport links (764.4 billion soums), 9-10 transport communication (111.4 billion soums), 10-7 transport communication (57.6 billion soums) and 3-4 transport communication (56.2 billion soums).

As a result of the improvement of the transport operational qualities of the road in the specified sections, the speed of motor vehicles will increase.

The delivery time criterion is especially important in the management of transportation of perishable goods, in the organization of transport work during the harvesting season of agricultural products. Because in such conditions, the reduction of the delivery period serves to ensure the quality of the products and not to reduce the harvest rate.

In addition, delivery time is an important indicator that determines the efficiency of intercity cargo transportation in cars and other vehicles. Reducing the mass of products in circulation in conditions that require large-scale transportation over long distances provides great economic efficiency for the national economy.

Conclusion

The effectiveness of this method is as follows:

allows to determine the plan of step-by-step development of the existing transport network for the safe transfer of traffic flows in the future;

as a result of the improvement of the traffic operational qualities of the road in the specified sections, the speed of motor vehicles increased from $v_1 = 65$ km/h to $v_2 = 79$ km/h, i.e. by 17.7%;

economic efficiency from increasing the speed of cars on a 1 km section of the road for one year was $S = 658350 сўм$.

Improving the state of the road network will increase the level of transport provision of the area and the quality of the existing road network, and will prevent the occurrence of a number of negative social consequences.

Thus, the improvement of the road network reduces the socio-economic tension of the region, helps

to increase the standard of living of the population due to the reduction of the cost of transportation of goods and services that provide daily needs.

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