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INVESTIGATION OF THE THROUGHPUT OF RAILWAY AND ROAD TRANSPORT OF ANGREN-POP THROUGH THE KAMCHIK PASS AND WAYS OF ITS FURTHER IMPROVEMENT

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ANNOTITION:

The article is devoted to the analysis of the current state of the capacity and carrying capacity of roads and railways passing through high mountain areas, its prospects, measures to be taken to further improve the existing performance. In the example of the Whip Pass.

Keywords: Angren-Pop line, railway, road transport, one-way line, high mountainous area, pass, Whip, permeability, traffic.

INTRODUCTION:

Railway transport in Uzbekistan is a sector that ensures the vitality of the national economy and provides important social services. Railways are a kind of mirror of the republic's economy, and its condition and development determine the development of other industries. After gaining independence, the country's transport system faced a number of important tasks to improve the provision of high-quality transport services to citizens and businesses, timely delivery of passengers and goods to their destination.

In his address to the Oliy Majlis Sh.M. Mirziyoyev called for the development of the transport and logistics sector in order to reduce the cost of delivering our products to the domestic and foreign markets, to separate passenger and freight traffic, operation and services in the railway sector. It was noted that the existing areas should be developed separately [1].

Uzbekiston Temir Yullari, as the most important link in trans-regional transport corridors, occupies a worthy place in the international railway system. Indeed, the main railway networks of our country have enormous potential to connect East and West, South and North. One of such strategically important projects is the Angren-Pop line across the Kamchik pass. Opened on June 22, 2016, the line was the next step in the creation of a national integrated rail system [2]. The electrified railway line Angren-Pop is one of the eight best in the world in terms of complexity and the first

13 in the length of the tunnel under construction.

1-table Within the framework of this construction project, the following indicators have been implemented

Height	2200 m
Priming	43 million cubic meters
Drilling and blasting works	16.3 million cubic meters
Artificial constructions	285
Railroad bridge	2.1/25/15
Overpass	6
Station	4
Crossings / railway stations	4/2
Residential buildings	10

Uzbekiston Temir Yullari and China Railway Tunnel Group have invested $ 455 million in the construction of the tunnel. More than 4,000 workers were involved in the construction work, and the construction work was carried out quickly and efficiently due to the effective use of 600 units of special equipment [3].

Features of the route passing through the Kamchik pass:

Before commenting on the improvement in the capacity and throughput of the Angren-Pop railway, it is advisable to take a look at the traffic passing through the Kamchik Pass. The capacity and capacity of the only road to and from the Fergana Valley by 2016 is directly related to the following factors:

• Road conditions (road width, visibility, slopes, etc.);
• Structure of traffic flow;
• Availability of coordination tools;
• Weather, climatic conditions;
• The ability of vehicles to maneuver along the width of the road;
• Psychophysiological characteristics of drivers;
• Automotive industry.

Changes in these factors have a significant impact on daily, monthly and annual results. As the traffic density increases, the distance between them decreases, the speed decreases, and the mental mode of the drivers becomes more complicated. This, in turn, leads to a number of complications. The highest traffic density is observed when vehicles stop ("congestion"). The traffic density is determined by the following formula:

$$\mathbf{q = \frac{N}{V} avt/km}$$

Where: N - the amount of traffic in one lane, car/hour; V - is the speed of the traffic flow, km/h.

When we talk about the capacity of a road, we mean the number of cars that can pass on a certain section of the road for a certain period of time (determined in cars per hour or per day).

• Maximum theoretical power;
• Practical possibility of transfer.

The maximum theoretical capacity is the number of light vehicles that can ideally be driven off a comfortable road, which is determined by the following formula:

$$\mathbf{P\frac{1000\ V}{L_d} avt/soat}$$

Here: V - speed of movement of cars on the tape, km/h; L_d - dynamic dimensions of vehicles, m.
The dynamic size is determined by the following formula:

$$\mathbf{L_d = l_a + l_t + S_t + l_x\ m}$$

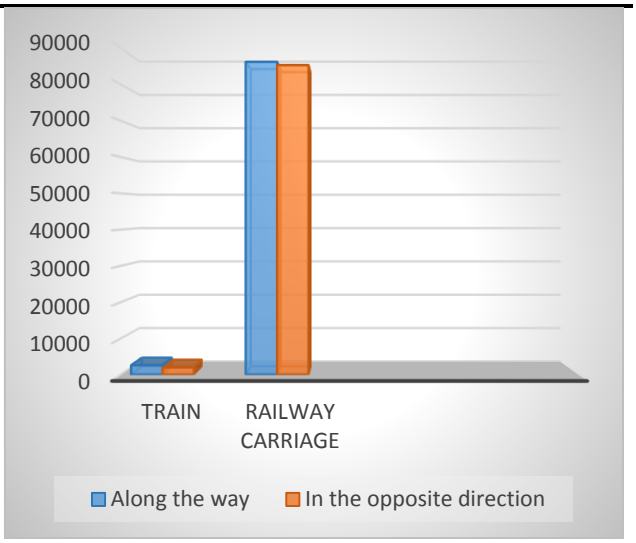
Here: L_a - static length of cars; lt - distance traveled by the driver during the reaction time; S_t - vehicle braking distance; l_{xm} - safe distance; d - safe range.
Carrying capacity is the main calculated indicator of the road, which depends on the condition of the road and the level of traffic organization. The road load can be estimated as follows:

$$\mathbf{Z = \frac{N}{P}}$$

Here: P - productivity, auto/hour; N - number of movements, car/hour [4].

When carrying capacity is carried out as the maximum number of cars moving in one or both directions for a certain unit of time, experts recommend taking into account climatic conditions when calculating these indicators [6]. This is especially important for the Kamchik Pass. Since the throughput of the Kamchik Pass is mountainous, it is very sensitive to climate change. Especially on rainy, snowy, icy, foggy days in late autumn and winter, the permeability decreases sharply. As a result, the speed decreases, the traffic intervals are lengthened, the number of congestions and forced stops increases. When analyzing roads in mountainous areas, they can be conditionally divided into flat, foothill and mountainous according to the relief elements. Although climatic conditions strongly affect traffic flow, the importance of rail transport in such conditions will continue to grow.

With a good understanding of the local and international importance of the railway through the Kamchik Pass, since 2017 the government has paid special attention to the Angren-Pop line. According to the Resolution of the Cabinet of Ministers of the Republic of Uzbekistan dated April 11, 2017 "On measures for the efficient use of the A-373 highway passing through the Kamchik pass", from July 1, 2017 - bullet loads of more than 11.5 tons, not allowed [7]. The decree also provides for the construction of high-tech checkpoints on the A-373 highway - 185 km from the Tashkent region "Chinor" and 273 km "Sherabad" in the Namangan region until July 1, 2017.



1 – diagram Receiving trains and wagons from Angren station to Kokand railway junction and in the opposite direction in 2020

Weight and volumetric indicators, as well as their bullet loads. The main cargoes transported by road with the specified indicators are transported by the Uzbek Railways OJSC on the Angren-Pop railway, which passes through the Kamchik pass. For us, this is an important aspect of the solution. This decision will significantly increase the capacity and capacity of the Angren-Pop railway [8]. Innovative reforms carried out by the State Joint Stock Company “Uzbekiston Temir Yullari” serve to further increase the capacity of the railway line passing through the Kamchik pass.

Possibility of transferring to parallel graphic type:

In a parallel graphical type, the maximum capacity of freight trains or train pairs on the tracks is determined. This type of timetable is characterized by a daily calculation, according to which the time occupied by the passage of alternating groups of trains is called a graphical period. To determine the throughput of the lines on this type of graph, we will divide the daily period, that is, 1440 minutes, by the graph period and multiply the result by the number of trains for the period. This account looks like this in general:

$$N_m = \frac{\alpha_m (1440 - t_{texn}) K}{T_{dav}},$$

Here: a_m - coefficient of strength of technical means equipped with a platform; T_{texn} - the duration of the technological "window", minutes; K - the number of trains or pairs of trains in the graphical period; T_{dav} - chart period, minutes. It can be seen from this expression that the bandwidth is inversely proportional to the period of the graph, that is, the shorter the period of the graph, the greater the bandwidth.

One-sided two-batch graphics is equal to:

$$T_{davr} = t' + t'' + \tau_a + \tau_b + t_{t.s.},$$

Здесь: t', t'' – travel time of one- and two-digit trains on the route (excluding the time spent on acceleration and deceleration associated with a stop), minutes; τ_a, τ_b – intervals between stations at separation points a and b, minutes; $t_{t.s.}$ – total acceleration and deceleration time of one train, minutes.

Conductivity of two-way transportation in the form of a parallel graph:

The throughput of double-sided constrictions is determined separately for each direction. In two lane sections that are not equipped with automatic blocking, the batch type is used. The calculation of the passability of the limiting samples in a given direction is determined by the general formula:

$$N_m = \frac{\alpha_m (1440 - t_{texn})}{T_{dav}}$$

In the graphical type, the period of the graphical image is the sum of the travel time t and the successive intervals of movement tkk of trains along the route. The bandwidth of the packet graph type is determined by the following formula:

$$N = \frac{\alpha_m (1440 - t_{texn})}{t + t_{kk}}$$

The movement of trains on sections with two-way traffic, equipped with systems of dispatch centering, automatic blocking, semi-automatic blocking, can be organized according to the type of batch schedule. The permeability of each direction of travel can be determined using the following formula:

$$N = \frac{\alpha_m (1440 - t_{texn})}{I}$$

Here, I is the interval between trains in a package, minutes [5].

2-table Information on the results of the activities of JSC "Uzbek Railways" in the 1st quarter of 2021

№	Main factors	Years		Difference, %
		2020 г. 1 quarter	2021 г. 1 quarter	
1	Dispatched cargo, thousand tons	16991,5	17483,8	102,9
2	Freight turnover, million ton / km	5479,2	5523,5	100,8
3	Carried cargo, thousand tons	23388,9	24146,8	103.2
4	Passenger turnover, mln pass-km	836,6	702,1	83,9
5	Passengers dispatched, thousand passes	4045,9	1846,7	45,6
6	Passengers, thousand passes	4112,9	1850,5	45,0
7	Total number of employees, thousand people	87464	84417	96,5
8	New workplaces	310	0	0
9	Revenue, billion soums	2238,87	2379,40	106,3
10	Operational length of the railway, km	4735,1	4732,7	101,6
11	Including electrification route, km	1830,6	1830,3	163,5

Increasing and improving the capacity of the Angren-Pop railway line requires an integrated approach, and the success of the measures taken and implemented in this regard depends on many factors. In particular, the

capacity of this line depends on steep descents, turning radii, type of traction, location of dividing points, condition of roads at stations in the area. In this regard, regardless of whether the line is a long-term development program, it is necessary to focus on increasing the capacity of individual sections. However, there are several ways to increase the throughput of a single-track line, and data on the expected load current in the future is incomplete. For example, during the preparation of the article, we searched for statistics on the volume and type of cargo transported by road and rail through the Kamchik pass. We contacted the State Statistics Committee of Uzbekistan, the Ministry of Transport of the Republic of Uzbekistan, the Agency for Rivers and Transport. It turned out that these organizations collect data by region, and not by individual road and rail sections [9-10]. In the logistics centers Angren and Pop, only the volume of cargo passing through these organizations is taken into account. Without the use of their services, there is no information about the goods transported by their own or rented personal vehicles, their volume, quantity [11]. According to the Goskomstat representative, there are no overestimated requirements for individuals and legal entities transporting goods by road, therefore there is no clear statistical database on the volume and type of goods transported through the Kamchik pass. To accurately calculate the volume of cargo passing through the "whip", it is necessary to open checkpoints with special weights at the checkpoint. Of course, in order not to incur excessive costs, the state can delegate this task to the private sector, based on the experience of developed foreign countries. In the system of railway transport, little attention is paid to this issue. For example, the official website "Uzbekiston Temir Yullari" also presents general indicators in the table of results for the first quarter of 2021. Separate railway lines, including the Angren-Pop section, are absent (2-table).

The task of the Uzbek railway workers was to increase the throughput and throughput of the railway line, which was started in 1929 by the scientist L.G. Begam and proposed from the first attempts to increase the capacity of single-track paths. The most promising methods that serve are to present all ideas, including organizational and technical measures, in a positive and critical manner. It should not be forgotten that the Angren-Pop railway is a major project not only locally, but also internationally. According to international experts, middle-income developing countries should devote 2-4% of their GDP to the development of the transport system. Because the refusal to invest in this area in the future will cost the state dearly. The amount of daily work that needs to be done, but not done, will increase and become a burden on the state. According to the Asian Development Bank, by 2030 railways will become the main means of transport in Central Asia. This will require investment in the rail system, including the Angren-Pop line. These attachments:

→ Elimination of deficiencies in the network;
→ Further improvement and modernization of the existing railway infrastructure; →
modernization of the existing staff;
→ Introduction of advanced information technologies.

If the collection of statistical data on roads and railways, which are the main transport networks of Uzbekistan, is not organized in separate sections, along the lines, the accuracy and efficiency of work on the development of these networks will be reduced. It may not be possible to cover all railway routes at once and collect statistics on them (this requires additional funding, personnel, organizational measures), but you can start with road and rail lines passing through high mountain areas. Although their number in our

country is small, strengthening the throughput and throughput of single-track railways passing through highland regions is a difficult task from the point of view of its technical and economic indicators and requires consideration of many possibilities [12].

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