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Decision Making When Justifying The Strengthening Of Uzbekistan Railways Under Conditions Of Uncertainty Of Background Information (By The Example Of Angren-Pap Railway Line)

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As part of the Great Silk Road transport strategy, Central Asia is seen as a link between China and South Asia. This fact gave impetus to the Central Asian republics for the development of their railways. In order to maintain the position of a leading player, the Republic of Uzbekistan needs to develop its railway system at a faster pace in order to provide the shortest path for economic cooperation between China and South Asia, while constant modernization and strengthening of the capacity of operated railways is required.

Finding the optimal way to strengthen the capacity of the railways of Uzbekistan in order to switch transit freight traffic volumes between China, Central and South Asia is a difficult task, which is due, on the one hand, to the uncertainty of the transit time of transit freight flows, and on the other, to the reliability of the initial information on the size of transit freight traffic volumes between China, Central and South Asia.

The prospect of developing the existing Angren-Pap line as a link between China and South Asia may not provide large transit freight traffic volumes between China, Central and South Asia, as there are bottlenecks on this railway line that significantly reduce throughput and freight capacity. This determines the need to strengthen the capacity of certain areas when switching transit freight flows between China, Central and South Asia. In this regard, an analysis of uncertainties and risks is required in justifying the capacity increase of the Angren-Pap railway line in order to switch transit freight flows between China, Central and South Asia, in particular when assessing the capacity gain of the 19-km Angren-Pap line tunnel. A correct risk assessment will make it possible to save construction and operating costs and increase the competitiveness of this railway direction with alternative modes of transport.

The results of tractional calculations showed [1] that the capacity of the Angren – Pap railway line implies the passage of freight trains in the amount of 21 pairs of

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trains per day and the maximum possible carrying capacity in the amount of 13.9 million tons (Table 1). In 2018, the cargo flow through the Kamchik pass amounted to 8.60 million tons. According to statistics, the volume of freight traffic between China and South Korea between Central and South Asia in 2018 amounted to 6.10 million tons. By 2020, when switching transit goods from China and South Korea to Central and South Asia via the Angren - Pap line, which will exceed the possible carrying capacity of the line in question. In this regard, already in 2020, the line will not correspond to the required carrying capacity. This gives rise to the need to strengthen the Angren-Pap line shortly after putting it into operation and to reconstruct it in the future, as traffic increases. Obviously, additional investment will soon be required.

Table 1 - Results of calculations of the throughput and freight capacity of the Angren - Pap line

Art. Angren - One. one	Time. 1 - Art. Sardala	Art. Sardala - One. 2	Time. 2 times. 3	Time. 3 - Art. Nightmare	Art. Nightmare - One. four	Time. 4 - Art. Dad
Possible throughput, pairs of trains per day.						
40	36	26	29th	28	33	32
The number of freight trains, pairs of trains per day.						
34	29th	21	23	23	27	26
Possible carrying capacity, million tons / year.						
23,2	20.5	13.9	15.9	15,2	18.5	17.9

The limiting railway hauls are “Art. Sardala - Section 2 "," Section 2 - Section 3 "and" Section 3 - station Nightmare . " On the stage "Art. Sardala - Section 2 ”is a 19 km long tunnel (Fig. 2) . Under the project, the construction of the tunnel is supposed to carry out freight traffic in the amount of 21 pairs of trains per day.

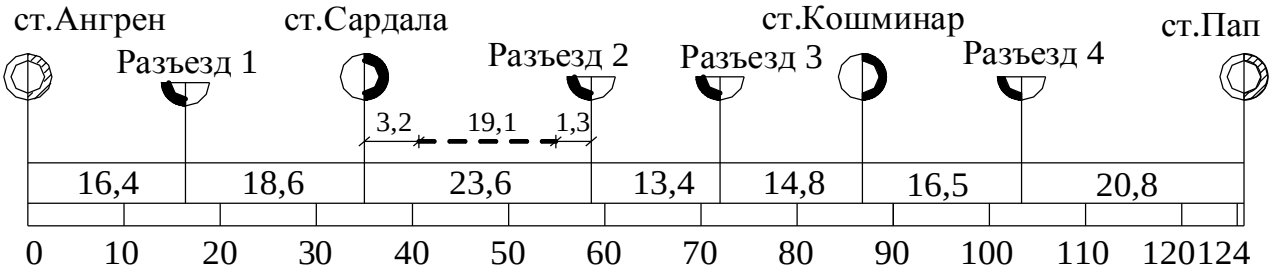


Figure 1 - Scheme of the railway line Angren - Pap

In more detail the above hauls are analyzed below:

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"***Art.Sardala-Razrezd2"-*** a 23.6 km-long haul stretch located on a complex profile has the outlines of a hump and large man-made structures (tunnel) (Fig. 3).

The construction of the tunnel was carried out in collaboration with the joint-stock company"O' zbekiston Temir Yo'llari" and the Chinese company "*China Railway Tunnel Group"*. The total cost of the tunnel amounted to 999.38 billionsoums.The tunnel in accordance with the project has a gable shape (+20; +10; +5.4; and -5.5 ‰). The tunnel begins at a distance of 3.2 km from the station. Sardala and has a maximum slope of 25 ‰ in this section. From the eastern portal to sec. 2 (1.3 km) maximum slope of 20 ‰ [2].

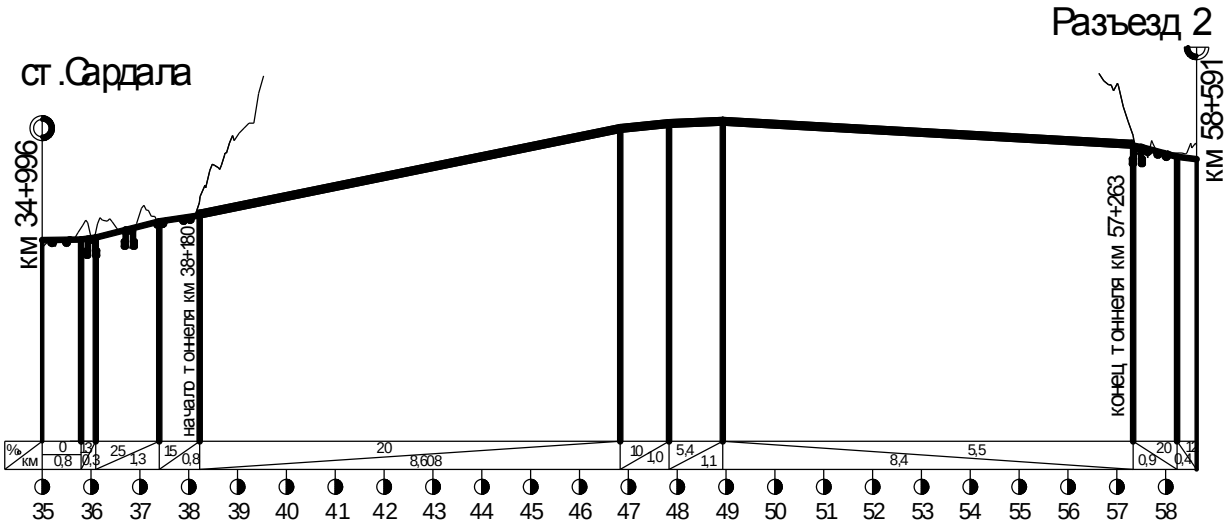


Figure 3 - Schematic longitudinal profile of the haul "Art. Sardala - Section 2 »

Under the project, the tunnel is supposed to carry out freight traffic in the amount of 21 pairs of trains per day. In the world ranking, in its complexity, a tunnel located in a mountainous area takes 8th place, and 13th in length. In addition, the tunnel is the most capital-intensive construction in the project (27% of the total construction cost) and the need for its early construction requires a more detailed analysis. Obviously, enhancing the power of the tunnel in the future is complex and requires the involvement of foreign specialists. The difficulties arising during the implementation of measures to enhance the power of the tunnel directly during its operation, as a rule, are associated with a large amount of various works, for example, the construction of a double-track insert, the introduction of self-locking or a second track in the tunnel. Therefore, with a reasonable approach, the capacity in the process of such events should be increased to the maximum extent possible so that the need for such events does not arise in the future.

" Section 2 - Section 3 " **and** ***" Section 3 - Art. Koshminar "*****- with a** length of 28.2 km, the hauls are located in difficult topographic conditions. Throughout the

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stretches, they are designed with heavy duty and 27% limiting grades. The part of the route has a radius of 300 m, and there are separate points with a longitudinal slope of 12 ‰ (Fig. 4).

The adopted project, in the plan of which there are curves with a radius of 300 m, can provide a reduction in the volume of work and a reduction in the cost of construction. But at the same time, the curves of small radii cause a deterioration in a number of operational ones. In addition, the intensive growth of transportation causes rapid deterioration of the main equipment of the power supply economy, which creates difficulties in the operational work on these stretches. It can also be noted that steep profile slopes limit the mass of the train.

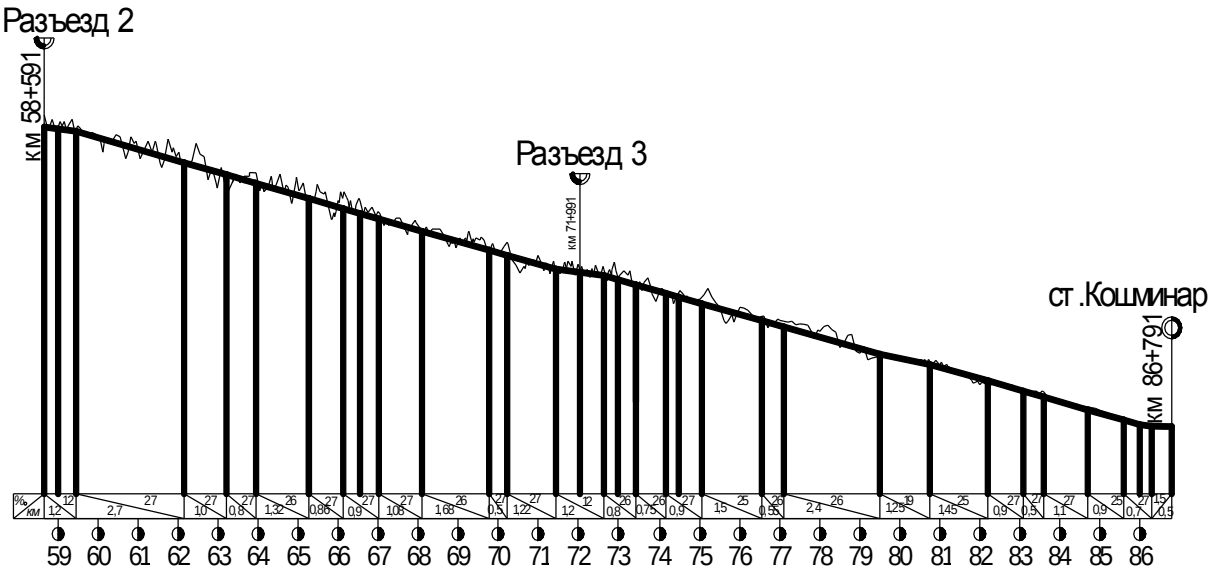


Figure 4 - Schematic longitudinal profile of the hauls “Run 2 - Run 3” and “Run 3 - Art. Nightmare »

In some cases, an increase in the power characteristics of structures and various devices and continuously using of the line can be carried out without a significant change in the facilities in operation. In particular, this applies, for example, to traveling, if sections are already provided for them.

The main parameters of the designed railway line, including the number of main tracks, useful length of receiving and sending tracks, layout schemes for separate points and sections of traction services, steering slope and type of traction, placement of traction substations, power supply of electrified lines, as well as its main direction, are necessary establish in accordance with paragraph 3.7 of the current STN TS-01-95 [3,5] according to the results of technical and economic

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calculations for the future, taking into account the saving of initial costs t and ensure further staged line reinforcement as traffic increases [3].

If it is necessary to strengthen the capacity of the structure within a given period of *t* years, it is advisable to build it immediately on increased power. If it is necessary to perform amplifications after more than *t* years, a more profitable option is to first build the structure in a smaller volume and further strengthen it during operation [3,4,5].

Analysis of the calculations allows us to conclude that the power characteristics of complex structures during construction should be maximum. In this case , it is necessary to take into account the possibility of development and operating conditions. This will avoid reconstruction until the 15th year of operation. To maximize the effectiveness of investments associated with such work, a project should be made taking into account the pace of road operation in the next few years. If we consider the Angren-Pap line as a model , namely the strengthening of the tunnel, then such events here should be focused on the long-term prospect.

Conclusion

1. The Angren-Pap railway line is of paramount importance in the transport system of the Republic of Uzbekistan, which plays an important role in the life of the whole Ferghana Valley: it serves the cargo - forming complexes of the Eastern landfill, provides significant volumes of cargo transportation to ensure the life of the region, including the supply of raw materials for industry, the export of finished goods products and raw materials, transportation of building industry goods, etc. For the Ferghana Valley, the project will provide a unique opportunity for direct export of agricultural governmental products, cotton, fertilizers, and cars in Russia, Kazakhstan, South Korea, Iran and Europe.

2. The design decisions made so far on the Angren-Pap line require clarification, since they do not fully take into account the possible prospects of the Kashgar- Torugart -Osh-Karasu route connecting China with the countries of Central and South Asia via the Angren - Dad. In favorable conditions, the development of events can lead to a significant increase in the size of traffic. To select the best options for enhancing the capacity of the Angren - Pap railway line in the face of uncertainty in the initial information, first of all, it is necessary to develop a forecast model for China's freight traffic between Central and South Asia, in particular, to evaluate the efficiency of the Angren - Pap line construction.

3. The existing approach to justifying the strengthening of the railway capacity in the face of uncertainty of the initial information is based on studies carried out more than 25 years ago in a planned economy. The problem, in our opinion, is that since the mid-90s of the last century, the rationale for enhancing the capacity of railways in the face of uncertainty in the source information when making decisions in the field of railway transport in Uzbekistan was not considered. Moreover, a number of critical issues related to the economic assessment and the method of

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processing the source information in the face of uncertainty have not yet been addressed.

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The article describes the reasons for the construction of a new electrified Angren-Pap line. The substantiation of technical solutions, the throughput and carrying capacity of the section, the description of the competitiveness of the railway line in comparison with alternative modes of transport in the plans of international transport and economic ties in the direction of China with the countries of Central and South Asia are given.

Keywords: *strengthening capacity, international corridor, China, Central and South Asia, line Angren-Pap, capacity, transportation capacity.*