SURAMI TUNNEL: PENETRATING POWER OF OIL

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ABSTRACT

Surami railway tunnel is located on mountain crossing section Zestafoni – Khashuri of Georgian Railway. It was built in 1886–1890 years under the guidance of the engineer F. D. Rydzevsky. Tunnel length is 4 km. It is double-track, electrified, DC network. Daily more than 50 pairs of passenger and freight trains pass through it. The article describes construction of a tunnel in difficult geophysical and production and technical conditions, and the project itself, which was unusual for those times.

Keywords: history, railway, Surami tunnel, construction project, excavation, engineering solutions.

Background. *The first railway in the territory of Georgia was opened in 1872. It connected Poti with Tiflis (Tbilisi).*

Later, in 1874, preparations began for construction of Tbilisi railway link with Baku, for which four project lines were offered. All options pursued the main goal – to facilitate access to the provinces of Turkey and Persia.

Objective. *The objective of the author is to tell the readers about construction of Surami tunnel in Georgia.*

Methods. *The author uses general scientific method, historical review, retrospective method, descriptive method.*

Results. *The desire to construct the railway coincided with a period of a feverish struggle for new sources of raw materials, sales markets for their products. It was a period of world repartition, accompanied by colonial wars. Russia, just recovered from the Crimean War, tried to take part in it. Another war with Turkey was planned. Persia and adjacent to a rich India, not captured Middle East provinces particularly attracted attention of the tsarist government. The decision to speed up the project of a railway from Tbilisi to Baku was natural and most reasonable in those circumstances.*

As a result of survey work and repeated discussions the experts identified the most rational direction of the track. In April 1883, three and a half years after receiving a permission for construction of a new section in the direction to Baku, it was finally accepted by the Commission. A month later (May, 8) train movement was opened on this section. Thus, in a relatively short period of time a railway line with a length of 550 km (with a branch to the commercial port in Baku) was laid and after some delay, put into operation.

Since beginning of movement on Tbilisi–Baku section the local Baku oil node became strongly linked to the Transcaucasian highway and thus entry of Caspian oil into the world market was provided. To this we must add that in the spring of 1883 train movement on the section of Samtredia – Batumi was opened, that is its operation through line from the Caspian to the Black Sea began. This caused a rapid growth of the city of Batumi, as a major commercial and industrial port that is relevant to the Mediterranean basin.

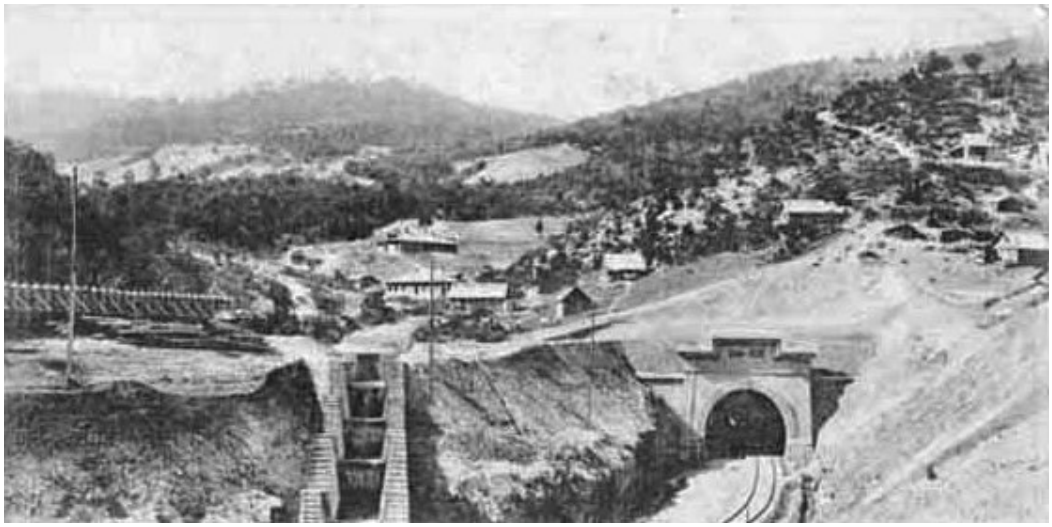
With the introduction of through traffic from Baku to Batumi volumes of goods presented for transportation began to grow with great rapidity. Meanwhile, the Transcaucasian railway, especially in its «bottleneck» on Surami Pass, could not count on such volumes. This led to the fact that on the section from Kvirili (present Zestafoni) to Mikhailov (now Khamuri) arose great traffic jams. A huge number of tanks and dry cargo wagons accumulated there. Terms of railway track profile – significant ascends and slopes, curves of small radii – created additional technical problems that did not exist on other roads. Depending on the nature of the track trains sent from Baku and back, had to be rearranged at a number of stations, there appeared queues to pass through the mountain pass. The urgent task was to construct a bypass road section with arrangement of a tunnel through Surami range.

Extensive research on reconstruction of Surami mountain crossing section had been made already in 1874 by the engineer Mishenkov under the supervision of an engineer of Poti–Tbilisi railway Staykovsky. So soon the project of a bypass line and a tunnel was approved, being in terms of the plan for 1886. The engineer F. D. Rydzevsky, tunnel builder on Lozovo–Sevastopol railway was appointed a chief of construction process.

Work on tunneling began in late 1886 without sufficient technical means. From both sides of the range towards each other underground passages were carved. Tsey Gorge on the west side and the area near the village Begleti on the east side turned into crowded settlements.

First excavation was carried out manually, just at this stage on both sides of the tunnel 277 linear meters were completed. Then drilling began: in the west since June 6, 1887, in the east – since January 15, 1888. On the west side it was necessary to drill 3058 meters, and on the east – 930 meters. Drilling was produced by machines of Brandt, and with such a success that on October 12, 1888 at 7 a.m., tunnel punching was completed. The axes of moving towards runs were separated vertically by 4,3 cm, horizontally – by 12,8 cm, which was considered a very good result. When punching the lower guide stroke average performance of machines was on the west side of 6,2 m, on the east – 4,05 m, and these figures were significantly superior to the contract provided the average daily rate of 2,84 m.

According to the contract signed with contractors, sole stroke of the tunnel had to be



2,67 m in height and the same in width, but much smaller gallery was developed with machine drilling. Therefore, after completion of drilling team of miners began their work, which expanded space to the project size manually. For removal of soil from the tunnel and transportation of building materials a special track was built. Inside the tunnel cars with soil and building materials were transported by horses, and beyond – by several locomotives. Up to 500 cars were involved.

The work from the very beginning was very difficult and dangerous. Soil bulged often and there were landslides, which sometimes led to victims. Nevertheless, thanks to patient and persevering labor of workers all the process was looking much better than it was provided by the project. Drilling rate of shaft tunnel reached 10 meters per day. While in practice of such construction in Europe and America, this speed did not exceed 8 meters.

Then the builders started masonry work and lining of the tunnel. To build the foundation was used stone of solid rock – solid granite or sandstone, limestone use was not allowed. The side wall had a height of 3,84 meters from the top surface of rails to ceiling. The lining of the tunnel was performed by separate rings in length from 6,4 to 8,5 meters (possibly – in a circle). In weak rocks, where shift of side walls from soil pressure is likely, as well as buckling of the sole of the tunnel, the so-called reverse vaults were built between foundations.

In total the construction of the tunnel required about 145682 m^3 of stone, roughly 39358 m^3 of cement (then measured the amount of bulk material, not weight), nearly 163,8 tons of dynamite, about 38848 m^3 of sand. More than 19820 m^3 of timber were spent for manufacturing of supports, and at least 388485 m3 of soil were exported from the jobsite. All this taken together makes a huge figure of approximately 1310392 tons.

In total, about 2000 people were involved in tunnel construction. At that time, not only in the Caucasus but also in general in Russia specialists were absent, who were able to carry out tunneling work: miners, operators of drilling rigs, and as a

result this was done by employees who came from Germany and Italy. Even the first team of bricklayers had to be invited from there. Later the rest of artisans and workers – plumbers, carpenters, bricklayers, stonemasons, including laborers, due to the lack of local personnel were gathered from interior provinces of Russia, Persia, Turkey, Greece and Italy. This mixture of working people of different nationalities who spoke different languages, caused great inconvenience.

For telegraph communication in the tunnel a 11-cord cable was laid, six cords were designed for the needs of Transcaucasian railway, and the remaining five were handed over to the Post and Telegraph District.

On September 13, 1888 in the presence of the Minister of Railways and many invitees the connection of two tunnel runs took place. The participants moved on trolleys in a tunnel, illuminated with colored lights. In the end of it a dynamite cartidge was laid. The Minister lit the wick, and explosion formed a through hole. There was an enthusiastic «Hurrah». Tunnel axes, as already noted, came together with amazing accuracy. The hole was cleared, all passed through it on trolleys and went out of the tunnel, encountered by cheering workers.

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Conclusion. *The history has not preserved all the names of heroes of this gigantic construction site. It left a report of the acceptance committee, expressing gratitude to the head of construction F. D. Rydzevsky. In 1888, Tsar Alexander III visited the site and assessed ongoing work. His stay was marked by obelisk erected at the west portal of the tunnel.*

On October 10, 1890 head of the railway A. U. Fride signed an order to start operating Surami tunnel. The opening ceremony was attended by the Minister of Railways of the Russian Empire, State Secretary A. Ya. Gyubbenet and supreme commander of the civil unit of the Caucasus, the Adjutant General S. A. Sheremetiev. This event was called the «festival of victory of mind and technology over the forces of nature». The total length of the tunnel was 3998,3 meters. Due to successful implementation of the project Trans-Caucasian Railway has become, in fact, the oil artery.

One of the major specialists in tunnel construction, honored worker of science and technology, professor M. N. Danderov later wrote that the builders of Surami tunnel managed to overcome enormous difficulties (sometimes had to work up to the chest in water) and to carry out an ambitious project at the highest level of engineering art. ●

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