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## ROUTE TOURIST RAILWAY BANOVIĆI – ZLAČA

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### SUMMARY

This paper shows the possibility that a part of the existing narrow track of Banovići mines 760 mm wide and with the design and part of the new track Banovići - Zlača is used for the tourist track. The project solution is planning a two-phase tourist track, phase I of Banovići-Mačkovac phase II, Mačkovac-Zlača, with a total length of 10,601 m.

The fact that there is a significant fundraising of mining and railway rarity and the noteworthy world tendency for them to create a perspective for the development of railway tourism is the motive for the ever-present history of mining and railroads in these areas, even after the need for transporting trench coals. Realization of this project opens up the possibility of recruiting a new number of employees and utilizing the capacity of the Zlača Hotel or the tourist-catering complex, which is considered one of the most attractive tourist destinations in the canton and in the country. Starting from a series of comparative advantages, such as the existence of a complete railway track infrastructure, with parochial locomotives that are world rarity and unity, and which should be particularly emphasized, are still in function.

Keywords: *railway, tourism, phase, project*

### INTRODUCTION

The longest period of about 60 years of the normal and narrow track railway, with the use of steam locomotives in the area of Banovici, has become a symbol of this area. Namely, a large number of coals and jams are transported on a daily basis, and this is a rare track in the former Yugoslavia and Europe used in this world. The existence of such a line is also the reason for the great interest of tourists visiting Banovici, the mines traversed by mines and the steam locomotives.

Bearing in mind that the conveyor belts in the world represent a tourist attraction, the idea was to design and construct a new 760 mm wide track, Banovići - Mačkovac, and in the second phase Mačkovac - Zlača, using the existing mining line in the first phase [1]. Given that there are certain comparative advantages, the existing railway infrastructure along a narrow track in a certain part, with the steam locomotives unique and rare, as well as the existing tourist facilities, the construction of these two phases would open the possibility of extending the other tourist capacity. [2]

The 760-mm-long roadblock project from Banovići to Zlače would work in two phases, with the construction of a section from Banovic to Mačkovac in the first phase, and in the second phase it would extend to Zlača.

The length of the strip Banovići - Mačkovac, phase I is  $L = 6.329,60$  m and the length of the track Mačkovac - Zlača, phase II is  $L = 3.784,54$  m. [1]

Elements of the route line:

- The total length of the strip from Banovići - Mačkovac - Zlača with the tunnel is  $L = 10.114,14$  m.
- The total length of Banovići - Mačkovac - Zlača line with a variant without a tunnel is
- $L = 10.601,00$  m.
- Banovići Station  $L = 217.63$  m
- Length of tunnel  $L = 198,00$  m
- Length of the bridge  $L = 18.00$  m
- The existing mining line used also as a tourist line  $L = 2,513.69$  m

## PROJECT SOLUTION

The first section starts from the plateau across the direction of the Banovići mining management building where there is also a starting station with a crossing for the mining track, a one-way pipeline, two deadlines, a cellar, a museum and other surrounding facilities and a cellar plateau.

The Banovići station, which is the entrance and exit point of the station, is connected to the number 3 with its existing mines. The cellular reception - the offshore track is parallel to the existing mining line and the same is at a distance of 4.0 m from the mining double-track railway.

The traffic from the receiving and the highway would continue to take place at the mine track, all the way to the Separation, where the tourist track turns into a tunnel. A part of the railway line that would allow transport of touristic equipment is currently in operation and it is carried out on two-way railroad traffic. For the Parallel Track, the upper and lower machine remover is currently in use, not in use or in operation. [1,3,4]

The upper machine of the existing mining borehole and track stations of Separation was constructed of S 49 type rail on wooden trunks with appropriate knitwear accessories in the curtain of tucanika. The prone prism is in poor condition and the thigh is improving. A number of thresholds are in bad condition, trully, deformed and damaged, and the overhaul of the overall upper machine in Separation is also planned. [3,4,5]

The double-beam mining line is laid on the ground and in the slope so that it is maximum adapted to the slope on which it is designed. This laid line has a serpentine shape with plenty of alternating curves. The minimum horizontal radius curve on the mining line is  $R_{min} = 75$  m. This is a satisfying horizontal curve halfway that was adopted for the tourist line. [1,2,3].

At the length  $L = 2731.59$  m from the starting station is the beginning of the separation of the tourist line from the existing one. The projected path with right curve  $R = 155$  m turns into the tunnel. The length of the tunnel is  $L = 198.00$  m. Exiting from the tunnel of the runway extends along the existing route Banovići - Zlača and is mostly in the shadow.

The terrain by which the track of the 760 mm congested track was laid was repeatedly surveyed and the engineering geological field prospecting was carried out with the aim of determining the geological-geomechanical data and the possibility of constructing the strip in the same. [6]

After detailed engineering and geological surveys, it can be concluded that the terrain on which the track of the 760 mm constricted track is laid is stable. [6]

The track is laid on a stable terrain that can accept the load of a somewhat larger embankment of track hulls, which are subject to a sloping tipping that is limited by regulations. [2]

Slopes in slats based on investigations is recommended to work in a 3:1 gradient.

The track route is largely in parallel with the existing route Banovići - Zlaća.

The route crosses the existing road traffic at the level of km 6 + 337,10 and in the part of km 6 + 750,00 along the route length 53,00 m.

In the station Mačkovac is planned the construction of a two-track railway station in phase I with a drawstring towards Zlaća, which would be used in the second phase for the railway track with the construction of a cellar and a peron.

In phase-out design, first and second phase, it is necessary to make one receiving-off line close to the existing track and re-connect with the existing track. [7,8]

Traffic from the pick-up track takes place along the existing track to the Separation station, from where it separates towards Zlaća according to variant solutions with or without a tunnel facility. Since the design of the tourist trails is done in two phases, to Mačkovac the first phase and the second phase of the radio from Mačkovac to Zlaće, this requires that in the first phase be done in the station Mačkovac and the other so called bypass. By building the second phase track to Zlaća this bypass could be dismantled [1,8].

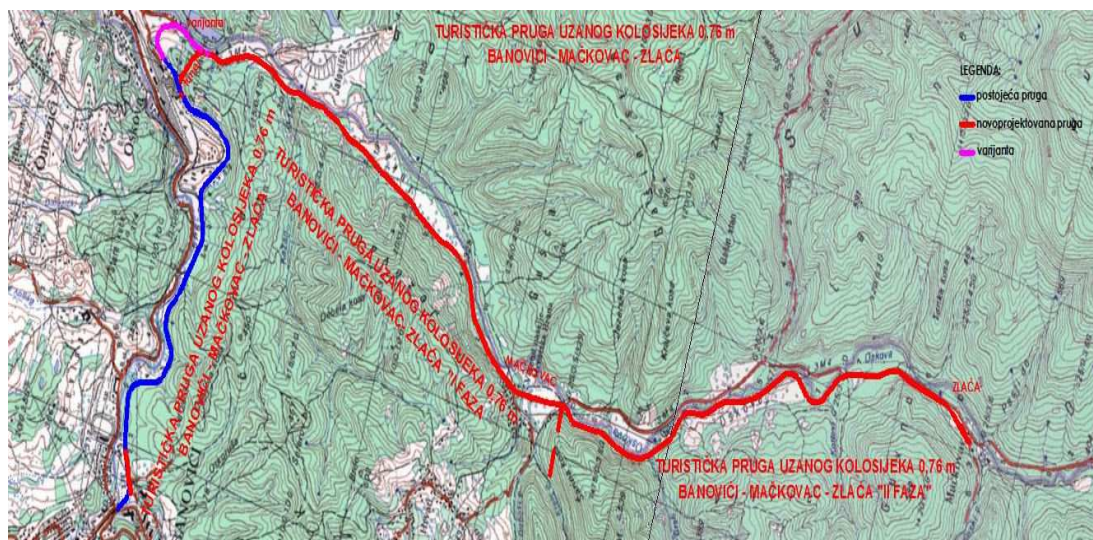


Figure 1. Shows the route map of the tourist railway

## SITUATION OF PHASE I

The number one is separated by the tourist track from the existing tracks and goes over to the reception-bank of the Banovići station, which is 4.00 m away from the existing railway line. Two blind and two are separated by two blind guides, one for the three-wheel and locomotive set, and the other blind for the exhibits of old locomotives and wagons. [2]

The reception-dispatcher has a useful length of  $KD = 70$  m. The end of this track is the number four on the existing Jug-Separation line. Further, the planned route of the tourist line coincides with the runway of the existing track until the seperage where the basic course turns to the left curve in the tunnel [1,4].

The tunnel has a length  $L = 198$  m which is at the entrance and exit in the horizontal curve. In this part of the projected tunnel there is also a variant solution without the tunnel km 2 + 731.59-3 + 645.51 (the end station variation on the tunnel route is 3 + 158.65).

The further stretch of the strip was designed next to the existing road to the Mačkovac settlement. In the village of Mačkovac, a station with two tracks and a drawstring was designed. The lengths of the track are:

- Receiving-conveyor belt KD = 70 m,
- Offshore track KD = 70 m,
- Blind track KD = 20 m.

## SITUATION OF PHASE II

In a second phase, the blind track extends to Zlača Stim for the bypass to be dismantled, and the dismantled upper machine (rails, thresholds, and chiselled equipment) can be used to build the track towards Zlača.

Behind the station Mačkovac is the road crossing at the level of km 6 + 337,10 and in the section km 6 + 750,00 along the route of the road in the length of 53,00 m.

The further stretch of track on the part of km 6 + 350.00 to km 6 + 710.00 is designed on the edge of the existing road. At this point the road is paved in the side and is projected by the width of road 4,00 m with the traffic on the road takes place two-way with one strip and the traffic on the line goes normal (road and rail traffic takes place undisturbed one from the other). The distance between the track and the track axis is 4.30 m which is the minimum permitted distance between the track and the way [1,4,8].

In the section km 6 + 750,00 the track was crossed by the ground and the existing route. Terrain conditions are very complex and difficult due to the construction of residential individual buildings and the supporting wall. This place can not be traversed and the line is adapted to the field conditions, provided that it does not anticipate the demolition of any dwelling. In order to provide access to the drum vehicles, the route of the track is planned midway and the layout of the track is planned as a crossing [6,8].

The track route was driven further along the river of the former narrow track, which had long been demolished, all the way to the plateau of Zlača station.

In the Zlača station, the following planes have been designed:

- Receipt-Dispatch KD = 70.00 m
- Offshore track KD = 70.00 m
- Blind track KD = 20.00 m

## LONGITUDINAL PROFILE

In the longitudinal sense, the joints are designed so that the height of the existing track is respected at the separation site, then at the receiving-dispatch point in the horizontal to return to the level of the existing track (cross-section 4).

The level of the existing tracks was fully respected from the crossroads number 4 (Banovići station) to the Separation (up to the tunnel) or further on the existing track (variant solution) until the turning towards the existing road and the cat. After the separation in the tunnel version of the joints is a 25% fall, which is the maximum permissible slope for the striped strips. This slope was necessary to be applied to fit the field along with existing road communication. It is important to emphasize that the projected joints are within the limits of the prescribed slopes, with the aim of designing the joints to be maximized to adapt to the existing terrain so that earthmoving works are as small as possible. [2,8,9,10,11,12]. Overlapping levels are rounded to vertical curves and are shaped in the spirit of valid regulations.

## CROSS SECTION LINE

The axle spacing of the receiving and conveyance track at Banovići station and the existing tracks is 4.00 m. The distance of the track in the cars of the swordsman is 4.00 m. The minimum distance between axle and track axis is  $a = 4.30\text{m}$ .

The width of the plan of the tourist track along the 76 cm track is 3.60 m, the planum is in a two-sided gradient and = 40.

Due to the lack of track type 22 rails, reclaimed S 49 type regenerated rails will be used with the appropriate "K" type flat track accessories with standing rail rails. The axle spacing is 80 cm. Thresholds are wooden impregnated dimensions of 15x25x160m. The prism of the standard buckwheat (granulation), the prism prism thickness is 30 cm. [1,3,7]

The project includes SP 49-50-60 switches on wooden impregnated concrete in the curtain of breakstone.

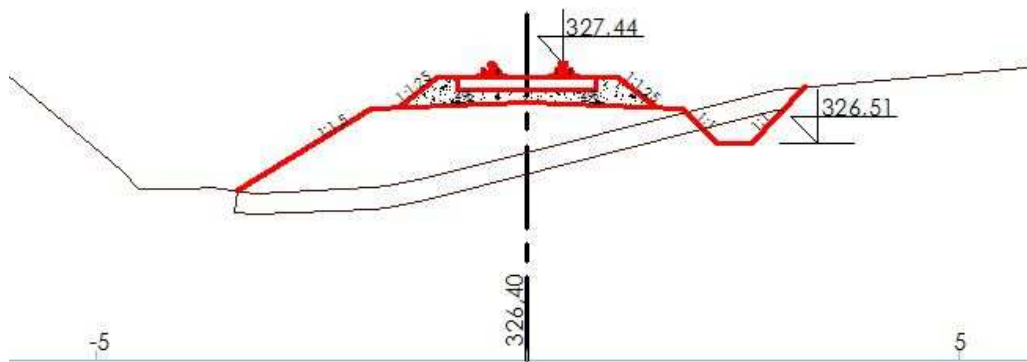


Figure 2. Cross section of existing track

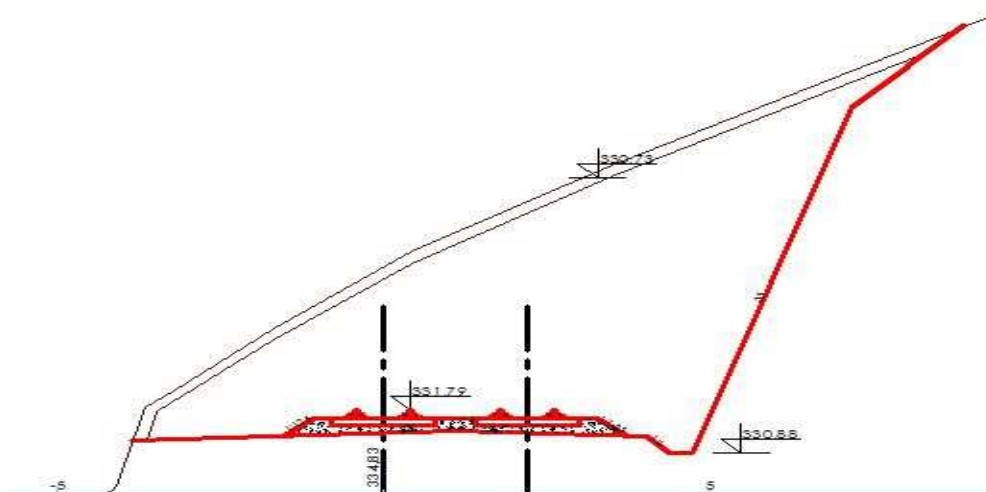


Figure 3. Cross section new projected track

## CONCLUSION

The paved tracks in the world represent a tourist attraction, and on this basis came the idea of using a new mining line in the first phase to design and build a new route along the narrow track Banovići-Mačkovac and in the second phase Mačkovac-Zlača.

Given that there is a significant fundraising of mining and railway rarity and the noteworthy world trend to create a perspective for the development of railway tourism, the motive is to have a history of mining and rail history in these areas, even after the need for transporting trenches.

The project is to plan a 760-mm rolling track from Banovići to Zlače, which would work in two phases, Banovići-Mačkovac phase L = 6.329,60 m, and the second phase Mačkovac-Zlača L = 3.784,54 m.

The route of the tourist line starts from the plateau across the direction of the Banovići mining administrative building, where there is a starting station with a crossing for the mining track, one drinkable-forwarding track, two blind tracks, a cellar, a cellar, a museum and other surrounding facilities and on a cellar plateau.

The project solution is planning to use existing mining trails of 2513.69 m long for the tourist track. A part of the mining line that would allow traffic congestion is currently in operation and there is a two-way traffic.

The field conditions and the ability to construct a narrow strip of tourist trails are very favorable, and are also acceptable from the point of view of the purpose of the future track.

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