# Rail-road transport as a means of economic-social region development

**Zuzana Gocálová, Juraj Mužík, Iveta Šnauková, Andrej Villim, Martina Paliderová**

Department of Railway Engineering and Track Management, Geotetechnics and Geodesy
University of Žilina, Faculty of Civil Engineering, Department of Ecomomics, University of Žilina, Faculty of Operation and Economics of Transport and Communications
e-mail: zuzana.gocalova@fstav.uniza.sk , muzik@fstav.uniza.sk, iveta.snaukova@fstav.uniza.sk, martina.paliderova@fpedas.uniza.sk

## 1 Introduction

In the context of projects „Transportowe studium przedolimpijskie – Zakopane 2008" and „Tatrzański system komunikacyjny a ochrona przyrody", there was birth of the study for renovation of the railroad track Trstená – Suchá Hora, which belongs to the obsolete reailroad connection with Poland, Trstená – Nowy Targ.

The study objective is to connect Orava region with Cracow region and to widen economical relations between regions and states. This objective requires modernization of the existing traffic structures. The study assumes the load movement from truck traffic to railroad, which is more economical, energetically safe and its with less influence on the living environment.

Other advantage is to thin the traffic on the road communications in the favour of personal transport, which is more effective in the context of traffic safety and road maintenance. Reactivation of the historical railroad, which integrates from the beginning of the 20th century the regions on the both sides of the High Tatras, will create the connection between regions with rich cultural and historical values. There will be the development of conditions to intensify tourist traffic and the economical and social development of the regions.

## 2 Nature of the railroad space Trstená - Suchá Hora

Crossstation railroad space Trstená – Suchá Hora was, as a part of Oravian local railroad 3rd section, opened on 21.12.1899. To the Poland the track was extended during year 1904 (track Nowy Targ – Podczerwone – Suchá Hora).

This rail track was running until 1975, when the traffic deputy cancelled the service on this railroad. The railtrack upper structure was destroyed during the eighties, but the earth structure was kept in original conditions.

The track is connected to existing rail station Trstená in km 56,930 and it goes to km 70,406 where the track ends on the border with Poland near Suchá Hora village.

The proposal of the new track is using the existing directional conditions of the cancelled track and existing earth structure. Uppon this conditions the maximal speed was stated to 80km/h, and this value was used to derive other base rail structure parameters. Maximal uphill on the track do not exceed original uphill conditions e.g. 21,803‰. Proposed maximal uphill was determined according to standard TNŽ 736301 „Design all-state tracks with normal gauge" article 31 „for design speed V = 80 km/h and less, the slope could not be more than 20‰." Minimal radius is r = 320 m, maximal uphill in the track arc pdl = 150 mm. Continual transition between straight track and arc is designed using cubic parabola spiral curve. Objects on the track are fully functional, and during potential renovation they should be cleaned and modified to meet the service conditions. Some bridges were removed and renewal of the service requires creation of the new bridges. The track is designed as monotrack with one level crossing with local communications. Design of the earth structure is based on the theoretical knowledges and visual findings. After geotechnical survey the structure character might change which may lead to lowering costs. Subsurface layer is designed from the gravelous sand with minimal grain diameter 300mm. Designed upper parth of the railroad embankment is the S49 type using concrete crossties SB8. The track is designed as monotrack with total length13,364 955 km, number of railway bridges – 4, crossings – 15, floodgates with pipe – 9, slab floodgates – 6, vault floodgates – 2, viaducts – 2 and designed traction – motor.

## 3 The characteristic design of railway stations

Railway station Suchá Hora is positioned on km 69,869 340, station begins on km 69,468 854 with rail switch object no. 7 and ends on km 70,240 339 with rail switch object no. 1. The total station length is 771,485 m. In dispatcher building there is waiting room, entrance hall and cash-desk. Through entrance there is possibility to exit and enter platform, for continual access between platforms the slab subway is designed. The station building reconstruction.

The railway station Suchá Hora is designed for track speed 80km/h on main track and track speed 50km/h on side tracks. Station has 4 tracks. Axial distance between track no.4 and no. 2 as well as between track no.1 and no.3 is 5m, axial distance between track no.1 and track no.2 is 10 m.

Railway tracks are designed using following rules. Track no.1 of the new state is identified with track no.1 of the old state. This track is main entrance and exit track for all trains and its effective length is length $l_{uz}$ = 550 m. Track no.3 is side entrance and exit track for all trains and its effective length is $l_{uz}$ = 518 m.

Service handling track, track no.4 with effective length $l_{uz}$ = 566 m an track no.2 with effective length length $l_{uz}$ = 566 m, are used mainly for loading and unloading or as a store tracks. Designed rail superstructure type S49 with gravel bed of the thickness min. $h_k$ = 300 mm on the wooden crossties 1A types.

Rail switches no.1,2,3,4,5,6,7 was designed as ratio switches of the S49 type on the wooden crossties. South track head was designed as arc head to radius of r = 600 m, to keep effective track length $l_{uz}$ = 550 m. Rail switches no.7, 5 is transformed to the arc with speed of 50 km/h, the switch no.6 is transformed outside of the arc with speed also 50km/h. To level superelevation on track no.3 the arc

was designed with r = 429,723 m with spiral curve, on the track no.4 the arc is designed, with r = 645,801. On the northern rail head the arcs with radius r = 200 m and r = 500 m are designed.

On the rail station Trstená, by the reason of using modern rules with goods transfer and using higher standards of the traffic services, the study was counting on combinated traffic. Using combinated traffic requires reconstruction of the railway station Trstená with creation of the combined traffic terminal.

## 4 Conclusions

Considering the suggested resolution of monorail Trstená – Suchá Hora (state border with Poland) with maximum speed of 80 km/hour and length of 13,365 km the total costs were estimated as 28 672 811 €, which presents 2 145 366 € per 1 km.

Suggested railway connection creates good conditions for economical-commercial trade and social growth of the regions. It gives the opportunity to make closer connection and attraction of the regions as Orava, Spiš, Liptov and Pieniny. These are the areas with huge potential for tourism with architectural, cultural and natural national heritage. Construction of mentioned monorail requires coordinated management of this project. Possible solution is an extensive cooperation with Polish side where both parties will participate on the management. This management would consists of full project management, plus financial studies impact, commercial and financial affectivity, full preparation stage including the application for sponsorship from European funds and all planning and executive steps. Project realization could play the key role in strategic forming of the regions as well as subject related to these and their successful presentation within international competitors.

### Acknowledgements

The article was written with the support OPVaV-2010/ 2.2/ 06 - SORO ITMS 26220220156 NUMBER OF THE CONTRACT: 152/ 2011/ 2.2/ OPaV Broker centre of the air traffic for the transfer of technologies and skills into the traffic and traffic infrastructure. The project was co-financed from the EU sources.


„We support the research activities in Slovakia".

### References

[1] MALÍČEK, I.,. a kol. : Projektovanie, stavba a rekonštrukcia tratí, VŠDS Žilina,1993

[2] KOŤKA, V.,: Digitálne mapy s AutoCADom - 1. diel AutoCAD, CD verzia, 2006, strán 340, ISBN 80-8070-482-1

[3] IŽVOLTOVÁ, J., KOŤKA, V.,: Kartografická interpretácia niektorých atribútov databázových štruktúr, 17. kartografická konferencia, Bratislava 6. 7.9.2007, ISBN 987-80-89060-11-5

[4] MASAROVIČOVÁ, S. - SITÁNYIOVÁ, D.: GIS aplication for solution of the problems of public transportation system in Žilina, Communications - scientific letters of the University of Žilina. ISSN 1335-4205. - Vol. 6, Nr. 3 (2004), pp. 47-50.

[5] HODAS, S. - ŠESTAKOVÁ, J.: Railway track modeling in 3D system. In.: XX Polish - Russian - Slovak Seminar Theoretical Foundation of Civil Engineering Warszava and Wroclaw, Poland, 5.-9.9.2011, p. 355-360. - ISBN 978-80-970248-6-4

[6] MOČKOVÁ, M.: Indexy hodnotiace konkurencieschopnosť krajín In: POSTPOINT 2007 : VII. medzinárodná konferencia zástupcov poštových správ a univerzít : 12.-14. september 2007, Žilina. - V Žiline: Žilinská univerzita, 2007. - ISBN 978-80-8070-729-3. - S. 183-190.

[7] MUŽÍK, J.: Použitie GIS pre určovanie stability svahov. In: Sborník studentské konference GISáček 2005 : Ostrava, 2.5.-3.5. 2005. - Ostrava: VŠB - TU, 2005.

[8] MUŽÍK, J. - SITÁNYIOVÁ, D.: Aplikácie GIS v geotechnickom prieskume zosuvných území. In: Geotechnika v urbanizovanom prostredí = Geotechnics in urban areas : zborník 7. Medzinárodnej geotechnickej konferencie, Bratislava 27. a 28. júna 2005. - V Bratislave: Slovenská technická univerzita, 2005. - ISBN 80-227-2225-1. - S. 117-122.