



CETRA²⁰¹²

2nd International Conference on Road and Rail Infrastructure
7–9 May 2012, Dubrovnik, Croatia

Road and Rail Infrastructure II

Stjepan Lakušić – EDITOR



Organizer
University of Zagreb
Faculty of Civil Engineering
Department of Transportation



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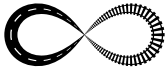
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TECHNICAL AND TECHNOLOGICAL PRECONDITIONS FOR IMPLEMENTATION OF INTEGRATED TIMETABLE IN REGIONAL PASSENGER TRANSPORT WITH THE REPUBLIC OF SLOVENIA

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Abstract

The technical and technological aspects of introducing regional passenger transport refer primarily to the introduction and improvement of integrated timetable. In the Republic of Croatia and its immediate surroundings this problem has been tackled primarily in the host countries. The goal of this work is to indicate the possibility of regional passenger transport on the territory of the Republic of Slovenia and the Republic of Croatia. In order to use these possibilities it is necessary to determine all the technical and technological parameters of rail transport, based on which such a concept would be implemented in a proper way.

Keywords: regional passenger transport, integrated timetable, rail transport

1 Introduction

Since the Republic of Croatia is about to join the European Union, this means formal disappearance of the borders between Croatia and the permanent EU member countries. In order to use the advantage of this political integration, it is necessary to organize transport in a smarter way and to improve the cooperation between the neighbouring railway administrations. The Republic of Croatia, as well as the Republic of Slovenia can become more efficient and more accessible to all the interested transport users by reorganizing rail passenger transport. The integrated passenger transport as a concept is very rewarding for the implementation and adaptation on the existing railway networks and conditions of transport organization on them. The integration means organization of the parts which act harmoniously in achieving joint objectives, i.e. such harmony acting as a system. To make the concept successfully operational, some pre-conditions have to be met, and the most important of these are the harmonization of the timetables (in arrival and departure). Also, the usage of a unique ticket simplifies the entire technological process of transport and transparent control of revenues and costs. However, in order for this transport concept to come to life it is necessary to research in detail the transport demand and the habits and needs of the target group of users.

In order to apply the concept of integrated transport, this paper has studied the possibilities of providing such services in regional transport between the Republic of Croatia and the Republic of Slovenia. The proposed concept has been developed for the network of the existing lines between the two countries which includes:

- 1 railway stations Savski Marof – Dobova;
- 2 network sections in Croatia around railway station Čakovec as start-terminal hub station;
- 3 sections of railway network in Slovenia around railway station Ormož as start-terminal hub station.

The implementation of such concept would thus encompass the existing railway lines, and they would be used to organize the traffic based on interoperability, achieving maximum shortening of passenger composition turnaround time and maximum usage of its capacities. The technical preconditions for such a concept on the two mentioned railway networks have been maximally satisfied.

2 Research of transport demand

When considering regional passenger transport on the HŽ lines network in railway traffic the average transport route ranged from 32km in 2001 to 48.2km in 2010. It is also interesting to note the range of the average transport route in interurban traffic for the same period of time, from 47km to 55km. This may lead to the conclusion that the total average transport route in the system of the Croatian Railways is extremely low, regardless whether it refers to internal both interurban, and urban–suburban and international transport of passengers. Obviously, this level of service can be seen in the number of carried passengers in regional transport on the network of railway lines of the Croatian Railways system (Table 1).

Table 1 Realization of transport and revenues in regional transport of the Croatian Railways system (in 000)
– Estimate of regional traffic excluding distance traffic

YEAR	2005	2006	2007	2008	2009	2010
PASSENGERS	14,362	14,485	14,351	14,176	14,690	14,537
PKM	619,000	629,000	603,000	675,000	690,000	657,000
REVENUE	157,300	167,000	174,400	186,100	178,100	175,000

The reasons for such a low level of service in regional passenger transport on the network of HŽ railway lines, i.e. obvious stagnation in the total number of carried passengers lie in the following facts:

- 1 insufficient (or better to say technologically inefficient) investments in rail infrastructure which is in the segment of passenger transport service in the function of target network;
- 2 insufficient investments in repair and modernisation of the rolling stock for the passenger transport requirements (which is owned by HŽ – Passenger Transport Ltd. Company), and
- 3 poor and technologically unsustainable model of the organization of passenger transport service provider within the HŽ Holding structure which requires radical structural changes and a good program of reorganization and restructuring.

Should the necessary reforms and good investment cycle in this sector of passenger transport in the coming period fail to take place, one may expect a certain growing trend in the number of carried passengers, but with a very low rate of growth. The part of regional transport that refers to the topic of this paper is related to the railway stations Varaždin and Zabok for which the traffic forecast is presented in Table 2.

Table 2 Forecast of regional transport per railway stations

RAILWAY STATIONS	2006	2010	2015	2020	2025	2028
Varaždin	453,214	571,043	711,623	824,967	1,052,890	1,117,335
Zabok	468,888	723,276	901,333	1,044,893	1,333,577	1,415,203
TOTAL	922,102	1,294,319	1,612,957	1,869,859	2,386,467	2,532,538

3 Vehicles for integrated public passenger transport between Slovenia and Croatia

In order to respond to modern transport user requirements and transport demand which is generated on these sections, it is necessary to use adequate transport means to serve the respective region. Since regarding the electrification of the considered section of the network there is a case of two supply systems, and certain sections that have not been electrified, the use of Diesel multiple units (hereinafter DMU) is proposed for this service of integrated passenger transport.

One of the possible solutions is a low-floor Diesel multiple unit developed by the Gredelj Company, which satisfies the advanced requirements and conditions of transport required of them. The train of 7022 series for regional traffic is low-floor, with floor height of only 570/600/875 mm and with 209 seats and 201 standing places and with maximum velocity of 160km/h. Such vehicle is both regarding design and performances adapted to target organization of passenger transport, and its advantages in the proposed organization of traffic will have multiple effects. Because of technical compatibility of the observed networks the vehicle can be used for this type of transport without any special modifications. Naturally, it is necessary to insure adequate education of the train staff that would serve such a technological transport process.

Also, according to another proposed variant of integrating passenger transport on this part of network, the possibility of using electric multiple units can be also taken into consideration. One of the possible solutions is the low-floor electric multiple unit developed by the Končar Company, which satisfies the advanced requirements and conditions of transport required of them. The train of series 6112 for regional transport is low-floor, with floor height of only 600mm and with 212 seats and 220 standing places, and with maximum velocity of 160km/h. Such a vehicle is regarding design and performances adapted to target organization of passenger transport and its advantages will have multiple effects in the proposed organization of traffic.

4 Analysis of technical and technological parameters of the proposed section of rail network for the implementation of integrated timetable

Since the Croatian Railways have determined in their strategic and operative plans the development concept of the urban-suburban transport and regional transport on their part of the network (Figure 1) the proposed organization of crossborder integrated passenger transport has to recognize the proposed approach. In this concrete case it would be the integration of urban-suburban transport of the city of Zagreb and the regional transport on relation Zidani Most-state border-Savski Marof-Zagreb-Dugo Selo.

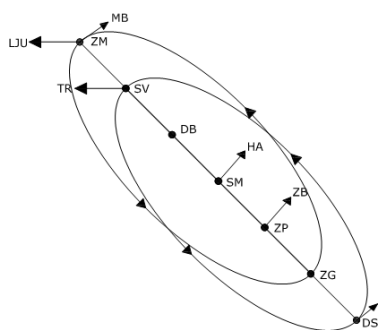


Figure 1 Schematic presentation of observed Zagreb ring sections

Two concepts are proposed on the considered section, i.e. two variants of transport organization. These variants have been determined based on the length of the considered relation, transportation conditions on the respective relation and determination of the turnaround stations that would be the start–terminal travel points of the used passenger compositions.

4.1 Proposal of passenger transport integration on Zagreb (Dugo Selo)–Dobova–Zidani Most (Sevnica) relation

In the first variant the idea is that the travel section is Zagreb – Zidani Most with stopping in Zaprešić, Savski Marof and Dobova. It is namely at the stations Zaprešić and Savski Marof that the railway lines fork towards other important railway stations on the network, and as such represent important points in further integration of rail transport (at the railway station Dobova which is currently a border station the exchange of the train staff may take place). According to current conditions of the usage level of infrastructure the travel time from the station Zagreb Main Railway Station to the railway station Zidani most is 83 minutes, which means that the turnaround of one composition in one direction would be approximately one hour and 30 minutes. Since it is a double track section between terminal stations there are no special technological restrictions for such traffic organization. Figure 2 shows the schematic presentation of the composition turnaround and individual travel times i.e. stopping times at certain traffic places of work.

The second variant refers to Dugo Selo–Sevnica relation. On this relation the railway station Dugo Selo is at the same time the terminal railway station of the urban–suburban transport of Zagreb, and from the railway station Sevnica the railway line forks towards Zidani Most (Maribor, i.e. Ljubljana). According to the current conditions of the usage level of the infrastructure the travel time on this relation is 83 minutes, and the turnaround in one direction would amount to ca. one hour and 30 minutes. The proposed organization of traffic is presented by a scheme in Figure 3.

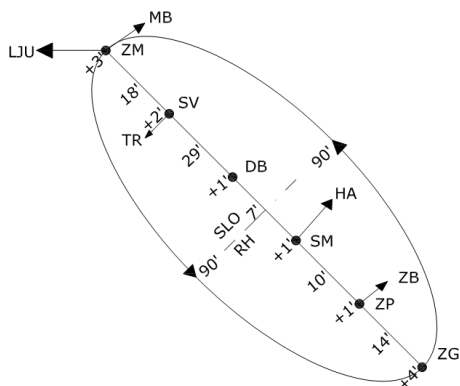


Figure 2 Schematic presentation of section Zagreb – Zidani most with individual times

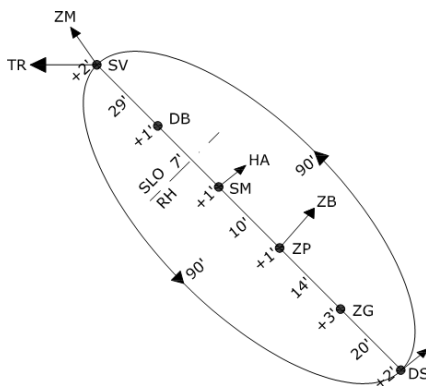


Figure 3 Schematic presentation of Dugo Selo–Sevnica section with individual times

As possible sub–variant of transport organization on the current relation in case electric multiple units (EMU) were used for passenger transport the following solution is proposed. From railway station Dugo Selo via Zagreb to Dobova the EMU would be used for 25kV AC system, and in Dobova the passengers would change to EMU with 3kV DC system.

The change of passengers from one train to another would be organized at the same platform at the railway station Dobova, so that the passengers could change safely and fast from one train to another. Such approach requires adaptation of the overhead contact line from both

sides of the platform. In that case the travel time of the railway station Zagreb and Dobova would be 34 minutes, and with stopping times at turnaround stations the turnaround would take 45 minutes (Figure 4).

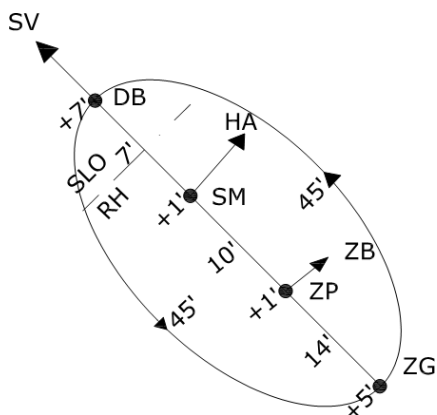


Figure 5 Schematic presentation of Zagreb–Dobova section with individual times

In case a clock–face timetable were used with an interval of 60 minutes as planned, for the first two cases in order to maintain the interval three trains would be necessary, whereas in the third case (change of train at the railway station of the traction system change two trains would be necessary).

4.2 Čakovec – Ormož section

If such a concept were implemented on the Čakovec – Ormož section, the travel times and the turnaround of compositions have been established as well. The reason is because the railway stations Čakovec and Ormož are hub stations from which the railway lines fork into several different directions and these stations are suitable as points of integration. Figure 5 shows the organisation of traffic of the planned DMU compositions between these two hub stations.

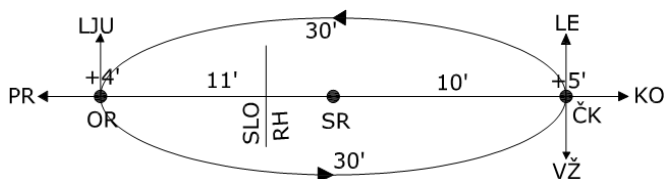


Figure 6 Schematic presentation of Čakovec – Ormož section with individual times

An interval of 60 minutes would also be used in this concept, and to maintain this interval only one diesel multiple unit would be necessary, which would operate between Čakovec and Ormož.

5 Conclusion

Since the Republic of Croatia is soon to become an EU member country, the logical and foreseeable further step is the connection of the neighbouring border regions, which are already well connected regarding traffic. This connection should be based on the concept of integrated public passenger transport, since in this way the technical and technological drawbacks of the classical transport organization are avoided.

The integrated passenger transport features many advantages, and the most important ones are fast, efficient and high-quality transport with great savings, first of all of time (since waiting is eliminated or reduced to a minimum), and at the same time the efficiency of all the transport means is increased, thus automatically reducing the costs.

Also, since the studied sections of the networks of HŽ and sŽ systems are to the greatest extent technically and technologically compatible, the use of a joint rolling stock is possible in providing this service.

The criteria according to which this integration of the passenger transport is proposed refer to the duration of the turnaround of the composition in regional passenger transport and the role and importance at the official places of work on the current network that would be in the function of providing this type of service.

This type of approach results in a series of positive effects, first of all the existing capacities of the railway infrastructure could be additionally used. The use of railcars for this purpose as well would substantially increase their productivity and efficiency. Finally, there would be additional promotion of such type of service of rail transport thus significantly increasing the competitiveness of rail system on the transport service market. Such integration on the market of transport services would create the preconditions to think about the foundation of joint operators in this market segment.

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