EUROPEAN-STANDARD RAILWAY LINE BETWEEN VILNIUS AND KAUNAS

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Abstract. The article studies the possibilities for the enhancement of railway communication between Lithuania’s two largest cities – Vilnius and Kaunas. Reviewing the political reasons and economic arguments behind the improvement of the transportation, it presents the theory of transport axle in the Vilnius-Kaunas dipole. Authors lay down arguments explaining why the transport axle should include a European-standard railway line like that of the Rail Baltica project. Two versions of building the European-standard railway line between Vilnius and Kaunas are proposed. Possibilities are discussed to modernize the existing railway line and adapt it to facilitate speeds for passenger train traffic up to 160 km/h. The article provides traction calculations, plans modernization works and calculates the investments required.

Keywords: European-standard railway line, Vilnius and Kaunas dipole, transportation infrastructure, passenger transport railway, Rail Baltica, investments.

1. Introduction

After reaching population of half a million, cities, according to practices around the globe, start sharing the agglomeration – a complex accretion of urbanized territories, meshing around the old core in a dynamic and almost unstoppable process. If regulated in a rational way, it usually directs territorial development along the intensive traffic of transport, in most cases along main railway lines. Similar master plans have been developed in Stockholm, Copenhagen, Washington D.C. and many other cities similar to Vilnius in size. Our neighboring Poland, Belarus and Germany propose connecting largest cities by „axles“, which are to become urban „skeleton“, directing and regulating the oncoming expansion of city territories under the so-called theory of gravitational urban development. Territorial arrangement and urban framework of entire Europe and Lithuania – under the approved General Plan of the Republic of Lithuania – is based on the principle of „axles“ and „spines“ [1]. One of the key tasks of territory planning in this aspect is to render active the development of infrastructures that integrate the country into the European Union. Lithuania’s strategic importance in the Baltic Sea region lies within the international transport corridors crossing its territory.

Lithuania’s urban framework provides for top-level – interstate (European) and national – centers of Lithuania: multifunctional cities of Vilnius and Kaunas, which meet requirements for agglomerated metropolitan centers. Together they have enough potential, however, separately they lack and will continue to lack potential (especially demographic) for gaining recognition as centers on the European scale (Euro City). Such centers are important for the country’s integration into the EU. The general plan stipulates forming a European-level center as an urban dipole of Vilnius and Kaunas, connecting the existing potentials of the two metropolitan centers. The status as Euro City guarantees far bigger EU support to the city and serves as a powerful magnet to attract foreign business and investments.

Consequently, absence of a Euro City-level metropolitan center would rank Lithuania among second-rate countries in the region, which would serve as a major obstacle for taking a due market position in the region and Europe. On the other hand, Lithuania is unlikely to acquire the status without a universally-accepted center with a population of at least a million people and a cluster of production, businesses, communications, international trade, banking, foreign tourism and a point of attraction of international relations [2].

A stretch with distinguishing parameters has been forming along the axle of the Vilnius-Kaunas dipole for many years. Firstly, 1.53 million people (38 % of the country’s overall population) reside in the territory of 30 kilometers on both sides of the axle connecting geographic centers of Vilnius and Kaunas, the density of population is 131.6 persons per km². The indicator is higher by a factor of 1.1 than the European Union’s statistics (116.4 persons per km²). The indicator puts the Lithuanian dipole region between Denmark
(124/3 persons per km²) and Luxembourg (170.9 persons per km²) [3]. Studies of transport flows have shown that the majority of railway passengers leaving Vilnius in six directions from Vilnius on business days head towards Kaunas. A fourth of them reach Kaunas. Without doubt, the situation regarding railway passenger flows from Kaunas is similar.

The first priority, the first and mandatory condition for establishing a dipole is to create an actual potential of the two cities and, later, an urban link — a fast and convenient corridor of transportation.

The dipole will function in a lively and forceful way if a trip by rail between Vilnius and Kaunas takes 30-35 minutes at most. For this purpose, selection of locations for final passenger stops is of utmost importance – the locations should ensure fast and convenient communication with city public transportation; Rail Baltica stations and centers of both cities. In Vilnius, the final station should be located in consideration of the final stop of the planned high-speed tram route. Similar high-efficiency public transportation should be planned for Kaunas in the future [4].

Coordination of the region’s economic development is a key factor in dipole economic growth, closely related with improvement of the transport system between Vilnius and Kaunas, as well as along the stretch between the two cities. This also involves encouragement of direct contacts, broad inclusion of business figures into the solution of dipole economic development matters and establishment of organizational structures to coordinate such actions [5, 6].

Practical observations suggest that an automobile highway is not suitable in this case because the speed limit tends to be reduced in small towns it crosses. The perfect axle for a dipole is high-speed railway or a combination of automobile highway, regular railway and high-speed railway. The route also connects two international airports and logistic centers.

Kaunas is located in the intersection of Lithuania’s key roads of transportation: automobile roads of IX and I corridors, Moscow-Kaliningrad and Warsaw-Riga-Tallinn railways (see fig. 1). These facts serve as preconditions for Kaunas to become a logistic and transport center [6].

Global practice shows that a modern public transportation system is the main factor in urban development [7]. The prepared scheme for Vilnius modern tram allows introduction of the progressive type of transport, thus building tough competition for cars and reducing environmental effects. The approved tram scheme provides for two new lines: „Stotis-Santariškės“ and „Justiniškės-Centras-Lazdynai“ [4, 8]. The main goal for developing communications, as stipulated in the Strategic Plan, is to improve conditions for international cargo and passenger transport. The following tasks are set out for achieving the goal:

- Modernization and development of international corridors to increase their capacity. Main instruments are as follows: prioritizing railway transport; building a European-track part of Corridor I from the Lithuanian-Polish border to Kaunas; modernizing the Vilnius-Kaunas section of IX B railway corridor; modernizing automobile roads, which are a part of the trans-European network; building lacking road connections in the cities of Vilnius and Kaunas; improving the infrastructure of international interior water roads.

- Creation of favorable conditions for expansion of international transport connections. Main instruments are as follows: modernizing Vilnius and Kaunas airports; designing and building logistics centers for intermodal logistics in Kaunas and Vilnius; modernizing existing railway stations for cargo and passengers; harmonize network of routes of all means of transportation and traffic schedules in the region [4, 6, 7].

In the effort to properly organize passenger transport via railways, it is highly important to determine the demand for railways as a transport system in the society. Results of a survey carried out by J. Butkevičius show that merely two aspects of railway journeys have been identified as satisfactory by passengers – the possibility to reach the point of destination without transfer and low ticket prices. Merely (9–13) % of passengers appreciate other advantages of railways, i.e., sufficient train speed, comfort, convenient schedules, safety and other. Without doubt, railway transportation has shortcomings. Biggest shortcomings include low transport speed and lack comfort [9, 10].

An analysis is provided of two possibilities to improve passenger communication between Vilnius and Kaunas: construction of a European-standard railway line and renovation of existing railways to increase speeds of passenger trains to 160 km/h.

2. European-standard railway line Vilnius – Kaunas

Under the Rail Baltica project, the railway trunk-line should make a western bypass of Kaunas (Version I) or cross Kaunas suburbs in the east (Versions II and III) [11, 12]. Considering that the international line does not reach the Lithuanian capital, the shortcoming may be compensated by the building of a European-standard railway blind pass to Vilnius. Proper connection of the railway line with the Vilnius’ modern tram would create a unique transport axle between the Vilnius and Kaunas dipole.

The European-standard railway line would start outside the Kaunas railway station where the existing railway forks in the Vilnius direction – close to the Palemonas station [7,12]. Further on, route should continue on the common track formation all the way to Kaišiadorys where a platform for high-speed trains would have to be constructed. From the Kaišiadorys station to Rytantai, the new railway line should run close to the existing double-track railway or a combination track formation would be built on the common formation. From Rytantai, the line would go to the proposed modern European-standard railway station in Pilaitė where the final stop of the high-speed tram is also projected (see fig. 2).
The railway station would facilitate easy transfer to the tram or other means of transportation. From Pilaitė, there would be direct routes to the student campus in Saulėtekis, Santariskės, the central railway station and the international airport (with one transfer). To sum up the version, we see that the new European-standard railway line’s 66.02 km (80% of the overall length) would run on the common formation all the way to Rykantai, with lines separated in sections where it is technically impossible (train separation points and low-radius curves). From Rykantai to Pilaitė (the final tram stop), the 12 km line would run on the new routes. Routing conditions are rather complex (the Paneriai forest) because of the nature reserve (Pit Geomorphologic Reserve) and the need to cross the Neris River valley.

As an alternative to the version, we can consider the possibility of routing to the Vilnius central railway station (as stipulated in the General Plan). The 27.76 km stretch from Rykantai to the Vilnius railway station is highly complicated due to the abundance of low-radius curves and the well-developed infrastructure of existing railway stations (Lentvaris, Paneriai). This causes extensive difficulties because the new railway line has to be placed in the existing track formation, while there is too little space due to dense territories and other railway equipment. Train speeds would be limited in the stretch, and construction costs of a new railway would be very high. This version is complicated in the technical and economic sense. Every kilometer of the European-standard railway line on a new track costs approximately 12 million litas. Every kilometer of the European-standard railway line on a combination track costs 9 million litas, while a kilometer of the European-standard railway line on an overhead track costs 15 million litas. More precise calculations would be made considering specific project characteristics. Additional assessment should be made of management and utilization costs [13]. A more precise economic and financial analysis requires calculation of income as well, with the majority of money coming from the infrastructure usage fee.

Fig. 1 The possible options of Rail Baltica

Fig 2. Versions of European-standard Railway lines (version I to Pilaitė and version II to existing station)
Table 1. Summary of analysis of versions of train time results on the railway line Vilnius – Kaunas

<table>
<thead>
<tr>
<th>Version No.</th>
<th>Locomotive, train</th>
<th>Number of stops</th>
<th>Stops</th>
<th>Duration of travel from Vilnius to Kaunas (hours, minutes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>TEP 70 (7 cars)</td>
<td>1</td>
<td>Kaišiadorys</td>
<td>0’37’</td>
</tr>
<tr>
<td>II</td>
<td>TEP 70 (4 cars)</td>
<td>1</td>
<td>Kaišiadorys</td>
<td>0’24’</td>
</tr>
<tr>
<td>III</td>
<td>TEP 70 (4 cars)</td>
<td>3</td>
<td>Lentvaris, Kaišiadorys, Pravieniškės</td>
<td>1’03’</td>
</tr>
<tr>
<td>IV</td>
<td>Electric train</td>
<td>1</td>
<td>Kaišiadorys</td>
<td>0’34’</td>
</tr>
<tr>
<td>V</td>
<td>Electric train</td>
<td>3</td>
<td>Lentvaris, Kaišiadorys, Pravieniškės</td>
<td>0’58’</td>
</tr>
<tr>
<td>VI</td>
<td>Pendolino</td>
<td>1</td>
<td>Kaišiadorys</td>
<td>0’31’</td>
</tr>
</tbody>
</table>

3. Research of possibilities to modernize the existing railway line infrastructure

The double-track stretch on the existing railway line Vilnius – Kaunas measures 103.3 km.

Overhaul repairs of the Vilnius – Kaunas railway line carried out in 2005 has enabled passenger trains to reach speeds of 100 – 120 km/h. Currently, a trip between Vilnius and Kaunas on an electric train ER-9 M takes 1 hour and 12 minutes (with 3 stops).

A study by VGTU scientists calculated the speed limit at 160 km/h, therefore, the analyzed calculation versions are based on a locomotive TEP 70 with 4 and 7 passenger cars and gives an approximate simulation of possible electric trains version and special-construction rolling-stock Pendolino [14-16]. Summary of analysis of versions of train time results on the railway line Vilnius – Kaunas is provided in Table 1.

An analysis of results of the traction calculation, we may conclude that a trip from Vilnius to Kaunas on a locomotive TEP 70 will take 52 minutes (with a stop in Kaišiadorys only) when the locomotive traction force is used to the maximum and there are no speed limits on the route.

As compared with the current fastest trip from Vilnius to Kaunas (trains now take a minimum of 1 hour 12 minutes), this means economy of 20 minutes.

Summary of investments needed for renovation of the railway line Vilnius – Kaunas to increase the speed limit to 160 km/h until 2010 is provided in Fig 3.

4. Conclusions

The Vilnius-Kaunas dipole is a new-quality phenomenon in the development of the city network in Lithuania, which meets the most modern global urban tendencies and is an unavoidable process.

The core of the Vilnius-Kaunas dipole – the railway connection – should shaped as an organic part of the Rail Baltica network to not only serve the individual cities of Kaunas and Vilnius but also two of them as a unit treated as an integral urban arrangement. A modern high-speed railway should be the core of the dipole. The railway should be given priority, as the practice is in most European countries. Passengers value railways as a cheap, safe and comfortable way of reaching final destinations.
It is necessary to achieve that the trip between the final stations of the dipole took 30-35 minutes at most. This is the primary and most important condition for efficient functioning of the dipole as an organic connection between Vilnius and Kaunas. Location of the dipole’s final stations should be in agreement with high-speed transport routes within Vilnius and Kaunas.

The European-standard railway line, as a branch of the Rail Baltica railway from Palemonas to Rykantai should be built in a single track formation, except for stretches of low-radius curves or train separation points. The railway line should go on a new route and cross the Neris River valley in the section between Rykantai and Pilaitė – the final passenger station of the railway and the high-speed tram.

Modernization of the existing railway line between Vilnius and Kaunas should be granted investments, which are necessary for elimination of main reasons that keep passenger train speeds under 160 km/h to ensure safe and high-speed communication. On a modernized railway line, a passenger train should make the trip from Vilnius to Kaunas with a single stop in Kaisiadorys in 52 minutes.

References