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28–30 April 2014, Split, Croatia

Road and Rail Infrastructure III

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INTEGRATED PERIODIC TIMETABLE BASED CONCEPTS IN HUNGARIAN NATIONAL TRANSPORT STRATEGY

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1 VPE, Hungary
2 MÁV-Start, Hungary

Abstract

This paper is about the methodology of defining projects for the National Railway Development Concept, which is an essential part of the Hungarian National Transport Strategy referring to the time perspective of EU White Book planning for medium (2020), long (2030) and strategic framework term (2050). The concept and the methodology are based on service concepts and integrated periodic timetables. The goal of the strategy is to improve performances of the transport network, to achieve a higher modal split ratio for public transport, by increasing the competitiveness of railways and of the entire public transport system.
The first part of the paper is about the passenger demands. It analyses competitiveness of the current railway network, and it points out the bottlenecks of the network – where the capacity is not enough, and the parts, where the competitiveness is poor. It defines two kinds of necessary interventions: increasing competitiveness and eliminating bottlenecks. The second part is about the current integrated periodic timetable and its development concepts which are able to increase the competitiveness in short, medium and long term. The timetable development concepts can show, where and what the real bottlenecks of the network are. By these concepts we can define the exact infrastructure development projects which are necessary to achieve the main goal of our strategy. European and Hungarian taxpayers could also benefit from using this methodology, by making it possible to avoid inefficient investments. The last part of the paper gives a detailed overview of the proposed projects embedded in the strategic aims. The proposals could ensure an efficient use of the EU sources in the budget period 2014–2020, by increasing the competitiveness of railways.

Keywords: integrated periodic timetables, transport strategy, public transport system

1 Introduction

First we have to know what our aim is. The aim has to be based on passenger demands. For knowing what the passengers want, we analysed the competitiveness of the current railway network, which indicates the bottlenecks of the network – where the capacity is not enough, and the parts, where the competitiveness is poor. It defines two kinds of necessary interventions: increasing competitiveness and eliminating bottlenecks.

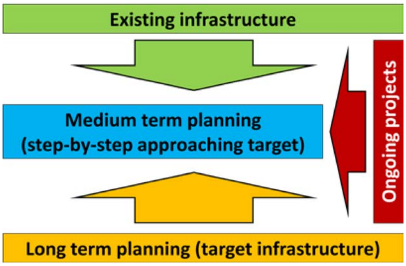

Figure 1 Flow chart of the process

2 Analysing the market and competitiveness

2.1 The size of the market

Before getting to the network, we analyse how many railway passengers we have in each relations, and most importantly, the total number of passengers travelling between our destinations, including passengers using other modes of transport. From this data, we can estimate how many new railway passengers could be the maximum target of the development. For estimating it we are using data from the Hungarian Central Statistical Office about numbers of journeys in total between major Hungarian cities and Budapest.

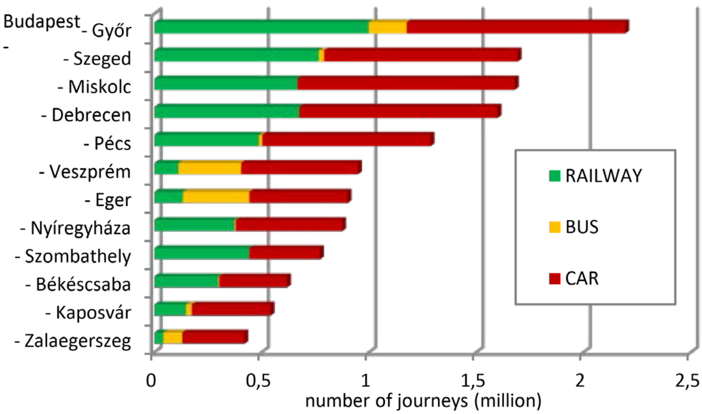

Chart 1 Journeys between Budapest and the major cities[1]

2.2 The number of railway passengers

The diagram above shows the total number of the passengers. To have a more detailed view, we used the data from MÁV-START (passenger railway company) ticketing statistics, to see how many railway passenger we have. To estimate the railway's competitveness between the major cities and Budapest, we've looked at how often an average citizen travels between their cities and Budapest (total yearly number of journeys divided by the city's population). The current railway services are more successful where from there are more railway passengers to Budapest. The differences between the major cities are huge.

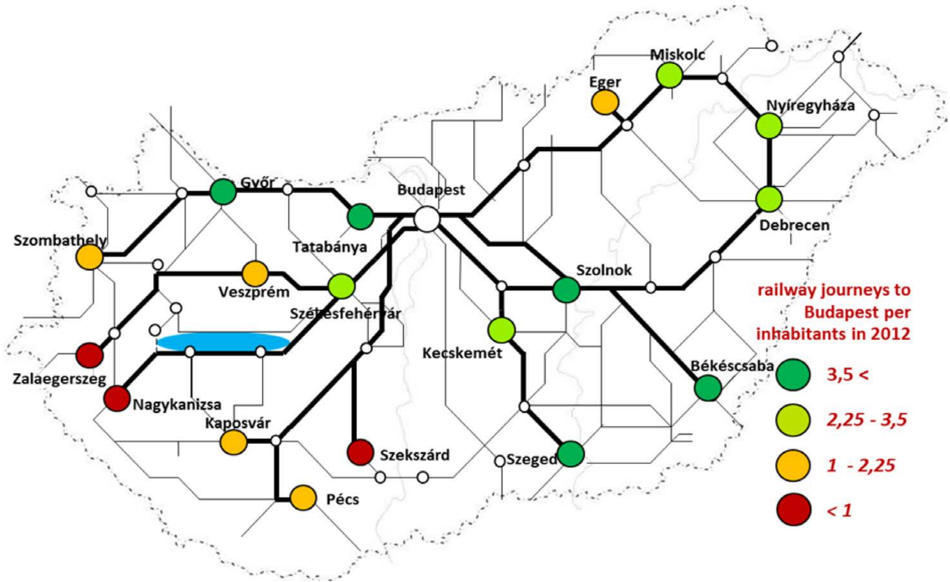

Figure 2 Railway journeys to Budapest per inhabitants [1] [2]

2.3 Parameters of the railway services

To see the reason for these huge differences, we checked the parameters of each connection. We've compared the journey time and the frequency of the service to the travel time by car. As a result, we got a variable which combines the frequencies and the journey time, and named it 'average travel time'; this is the variable which is comparable with the journey time by car. We calculated the average travel time by adding the journey time and the average waiting time which is the half of the frequency.

2.4 Correlation between competitiveness and numbers of passangers

It is suspected that there is a correlation between the competitiveness and the success of the railway services, therefore, we checked how strong it is. Comparing the railway's average travel time to Budapest with the percentage of travel time by car, and the railway journeys to Budapest per one inhabitant in a year, the correlation coefficient is -0.84 which shows a very strong correlation between the two variables. The diagram below shows the correlation in two dimensions, it's visible that all the points are pretty close to the line.
There is one more correlation visible on the diagram: the cities closer to Budapest have more journeys per inhabitants. This fact makes even stronger correlation between the competitiveness of the journey times and the success of the railway services. The only exception is Szeged, but the railway services between Szeged and Budapest are traditionally very good. This fact shows that travel time and frequency are very important, and there is a strong correlation between this, and the number of passengers, but this is not the only factor.
From that point it's clear that the target of infrastructure developments should be to decrease travel time, and to increase frequency. The chart also shows the directions, where competitiveness is poor.

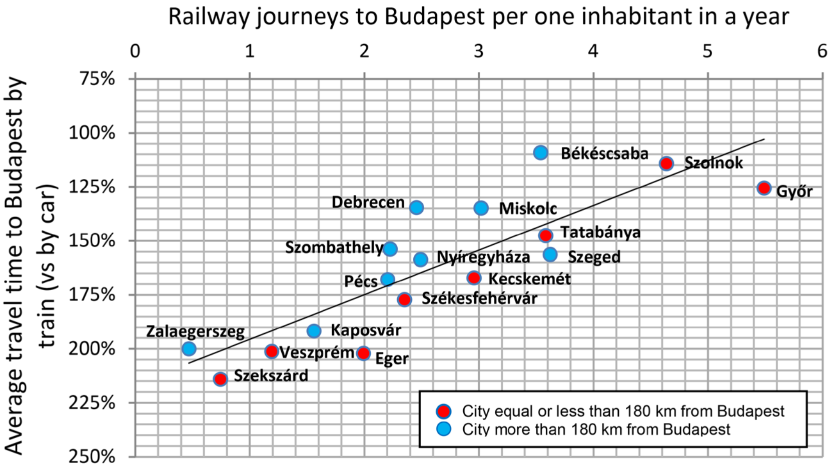

Figure 3 Correlation between travel times and number of passengers [1] [3]

3 Target infrastructure

Now, we know our target from the passenger's point of view. Our next task is to elaborate our target railway timetable structure, as a backbone of an attractive transport system. Our aim is to create such a railway network, where public transport is competitive with driving, and not only with a capital city as destination. ITF was designed to reach desired travel times in a cost-effective manner. If applied correctly (at least hourly), on a network with good connections, integrated periodic timetables require minimal infrastructural developments [4].

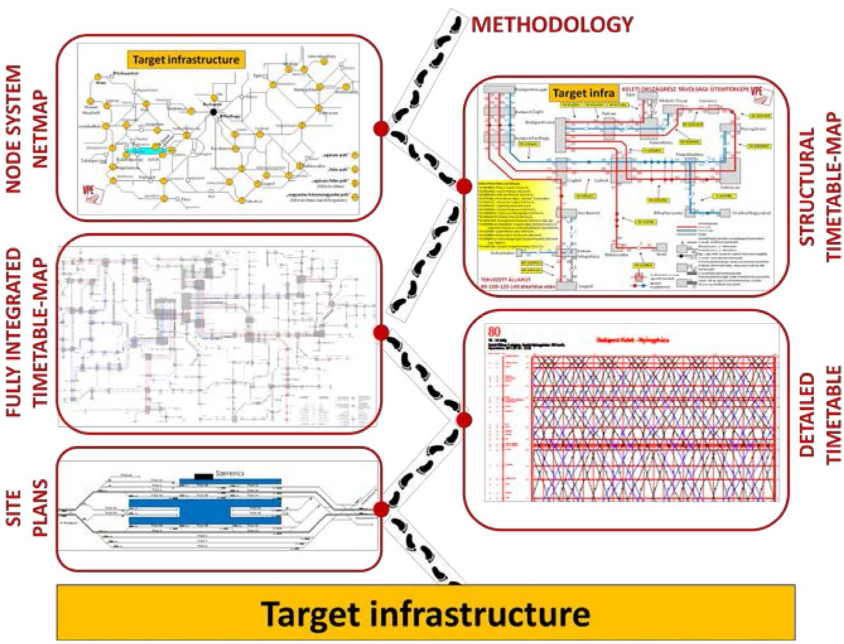

Figure 4 Methodology of developing an efficient transport system

3.1 Methodology

Fig. 4 shows the steps necessary to find out the requirements for such an infrastructure. Firstly, we need to define the types of timetable hubs (60, 30, 15 minutes), according to the physical position of the transport nodes (bigger cities) and to the target travel times between them. In this stage, structural problems of current infrastructure may appear, highlighting the need to replace current junctions to different, more suitable places.
Secondly, we need to define long-distance traffic in details to the previously designed system. The output is the long-distance periodic map (Fig. 5), which shows the necessary infrastructural developments needed to reach the target travel times.

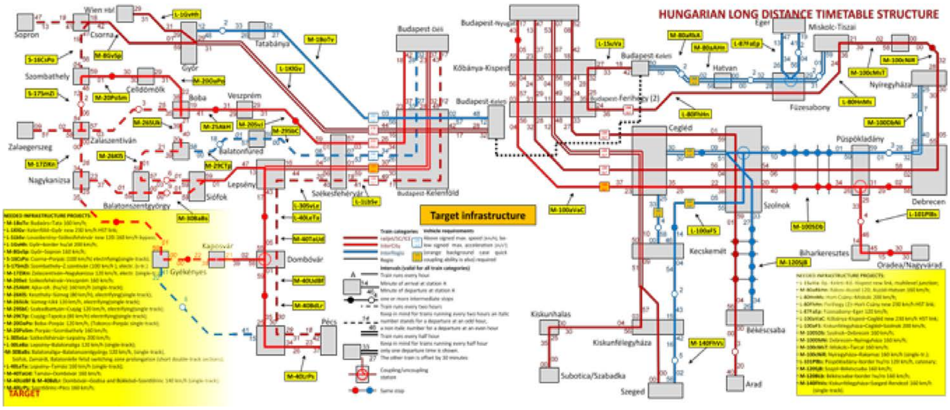

Figure 5 Structural timetable-map for target infrastructure

Based on this long-distance periodic map, we can construct a detailed map, showing our transport network as a whole, including the relevant bus lines that support our system. With the help of this fully integrated periodic map, the detailed timetable can be constructed, showing the required improvements in details (track speed increase, railroad switches, and railway platform designs for transfers).
If we go through the steps above, we get such an infrastructure (needed infrastructure connections and track speeds can be seen on the right side of Fig. 6.), which enable us to design a competitive public transport system (existing and target running times of fastest trains could be seen on left side of Fig. 6.), but does not contain such expensive elements, where capacity utilization is not effective.

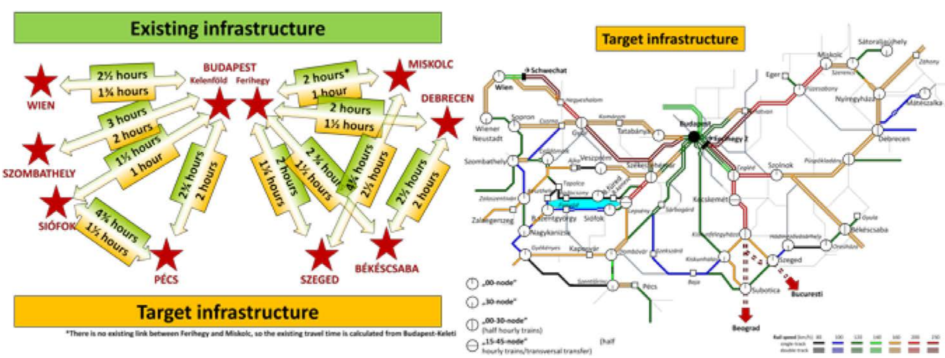

Figure 6 An efficient target infrastructure for the Hungarian transport system in our suggestion

4 Reasonable infrastructure development projects for the Hungarian railway system in the 2014-2020 financial period

Knowing the target infrastructure helps us to create a list of current development projects that are directed to one specific goal, and their individual results amplify each other instead of weakening the return indicator. The order of implementation may vary among the projects, but certain priorities need to be set, so that the ones with most benefits would be completed first. As part of our work, we've compiled a development package, based on the sources available in the financial period of 2014-20. This package does not only comply with the requirements of EU subsidies, but also contains coherent elements, that help reaching quality improvements for the most possible passengers.

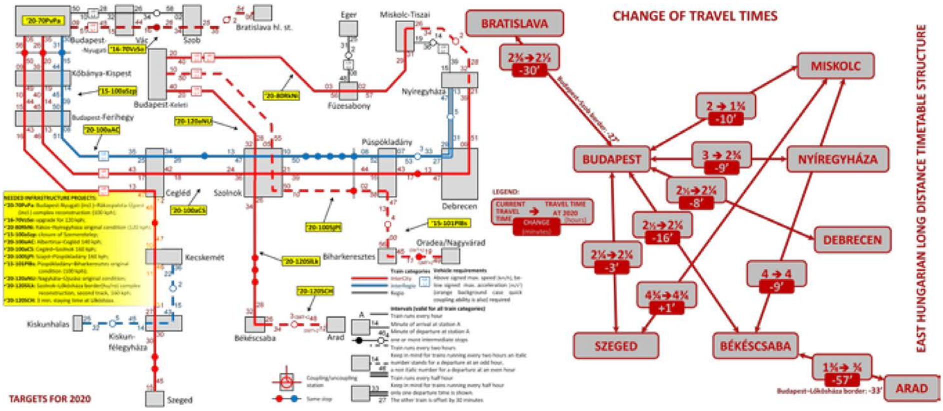

Figure 7 Timetable structure in Eastern Hungary for 2020

4.1 Eastern Hungary – Eliminating bottlenecks

In Eastern Hungary, railway traffic is already on the border of competitiveness, with an infrastructure that is rather worn out. Due to its competitiveness, most of our revenue from passenger rail is generated in this region; therefore, preserving the schedule structure from possible negative effects of infrastructure deterioration is top priority. Instead of recent, detailed, but very fragmented modernisation projects, we've proposed an implementation of a more comprehensive development package, containing only the most essential works needed on Eastern Hungary's main lines. MÁV is already working on the detailed plans.

4.2 Transdanubia – Increasing competitiveness

In Transdanubia (the western part of the country) railway services are much less competitive, with significantly less passengers in general (figure 2). The main target in this region is to increase competitiveness. To reach this goal, developments are necessary in the following directions, starting from Budapest: to Veszprém, to Zalaegerszeg, to Pécs, to Kaposvár and to Szombathely. Infrastructure developments are recommended on lines between Budapest and Pécs, Székesfehérvár and Veszprém, implementing ETCS on lines between Boba and Zalaegerszeg, and between Budapest and Székesfehérvár. These projects should be focusing only the parts which are necessary to reach our goals; this is the most efficient way of using our resources.

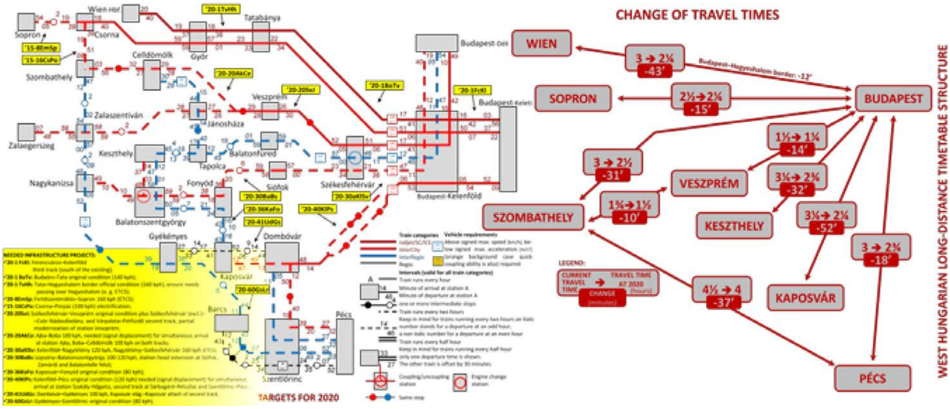

Figure 8 Timetable structure in Transdanubia for 2020

5 Conclusion

Among few other projects, all our major recommended projects got accepted, and they are all in the National Transport Strategy. That means our sources for infrastructure developments will be used in an efficient way in the following EU budget periods.

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