TRANSGRANICZNY MODEL TRANSPORTOWY MIĘDZY AUSTRIĄ I WĘGRAMI[1]

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Streszczenie. *W artykule przedstawiono Austriacko-Węgierski Model Transportu Przygranicznego wykonywany w ramach Programu Austriacko-Węgierskiej Współpracy Przygranicznej w latach 2007-2013.*

Słowa kluczowe: *modelowanie transportu, Austria, Węgry*

1. Introduction

Globalization procedures are attended by the decrease in the importance of State borders concerning transportation through the borders. These borders became actually formal after Hungary joined the EU and the Schengen area. However, transportation models for assessment transportation development projects are completed usually on a national level.

In order to solve this contradiction, the Technical University Vienna initiated the creation of an Austrian-Slovakian, and then, in 2011, an Austrian-Hungarian transportation model. The aim of the project was to prepare a multimodal transportation model which covers the Centrope region. Considering that the project's aim was to set up a strategic planning tool, the model was built on a macroscopic level. The system of the PTV AG VISUM is in common use in this field, so the project used this software-package, too.

1 Wkład autorów w publikację: Horváth B. 20%, Horváth R. 20%, Juhász M. 20%, Koren C. 20%, Miletics D. 20%

2. Steps of the model construction

In the followings the sometimes unsmooth way to the model is introduced. The building of a transportation system-model can be started basically in two ways: the network is either built manually or an existing geoinformatical- or other map is imported into the software. Considering that the Hungarian part of the project (see Fig. 1.) area consists of the road and public transport network of three counties (Győr-Moson-Sopron, Vas, Zala), the manual building of the model-network seemed unrealistic. On the other hand, some network versions prepared by other national projects were available, and these networks provided a good basic for the preparation of the model. These sources were expected to ensure the road network, the public transport network and the zoning system of the area.

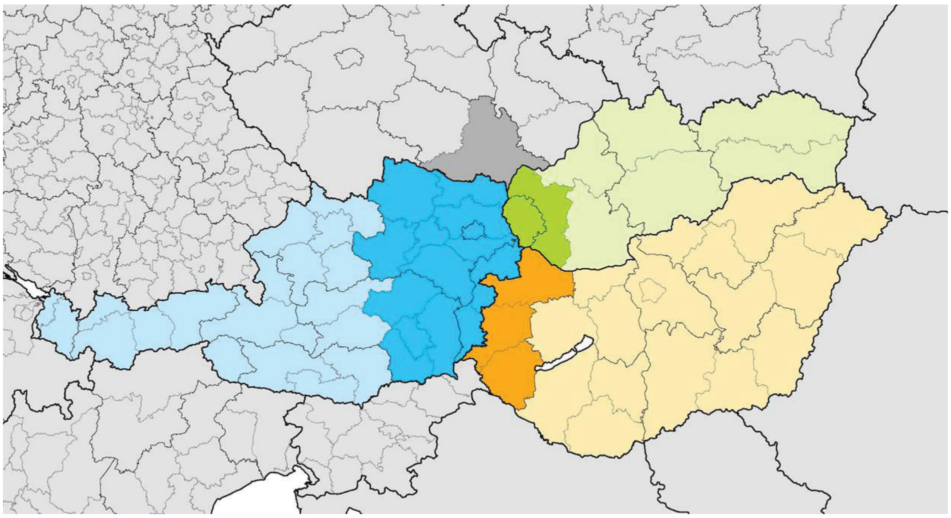

Fig. 1. The project area

After studying the previous models, it was found that one of them is too detailed, while the other one is too rough (tab. 1).

Tab. 1. Received and planned model-characteristics

	Nodes	*Links*	*Zones*
Model 1	9,459	22,178	688
Model 2	2,500	5,800	123
Target value	9,000	20,000	265

After the evaluation of the received data (models), the research group decided to adopt and revise the more detailed model as a starting point.

Considering that the Hungarian part of the model had to be merged to the Austrian model-part, the choice of the proper coordinate system was important. In regard to the international aspect of the project, the WGS84 coordinate system was chosen, so the existing data had to be converted into this system. As a result of this conversion, a raw basic model came into being, which consisted of the following data:

– nodes,
– links,
– zones,
– connectors,
– public transport stops,
– public transport lines.

The national part of the model is just done at first sight, but two main problems had to be solved in this phase of the project. First, the resolution of the basic model and the target value were far away from each other. Secondly, the attributes of the certain elements were not filled in properly in several cases.

The problem of the resolution was solved easily with the aggregation of the elements (particularly the zones), as shown in Fig. 2., so the model became as detailed as expected.

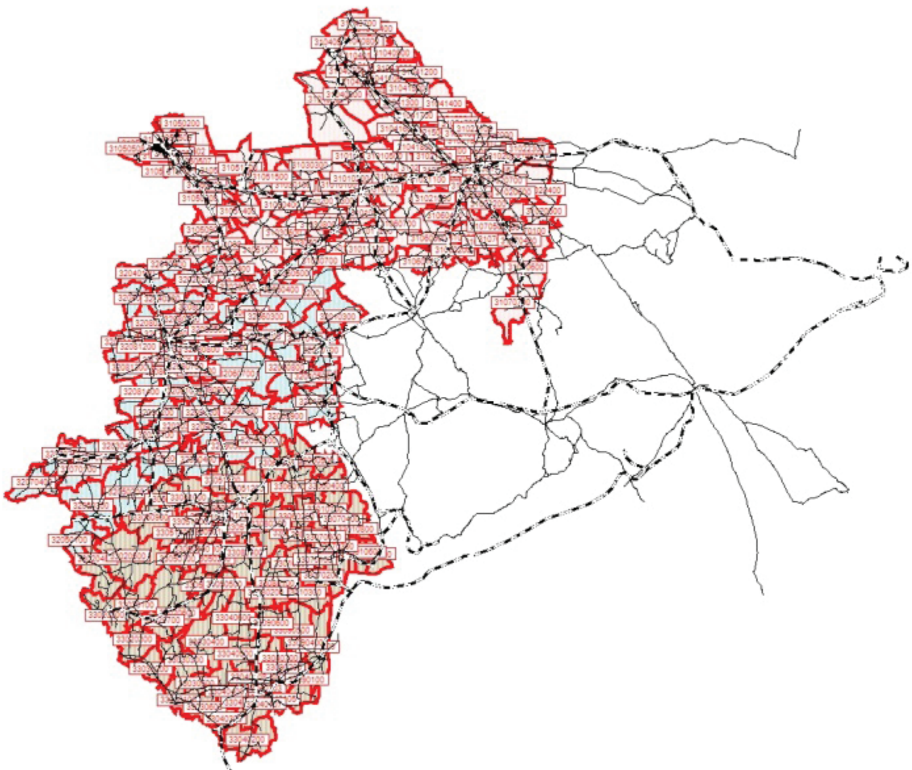

Fig. 2. The basic model after solving the problem of resolution

The problem of the missing attributes was treated in a multiple-stage procedure. This correction had two well-isolable parts:

– road network,
– public transport system.

In regard to the road network the characteristics of the links (speed and capacity) had to be assigned to the respective link types, as these attributes are the base of the route choice. In addition, as requested by the partners, the type of control of the nodes had to be corrected. This task needed intense efforts, as the model consisted of around 9,000 junctions. The nodes were divided into two groups. The first group could be treated automatically, as the nodes in this group were typical priority junctions of major/minor roads. The rest of the nodes, however, had to be corrected manually. It was impossible to tour the whole model area, so the control type of the junction in the second group was corrected based on the information obtained from Google StreetView (as it turned out later, about one hundred of junctions were corrected false in that way)

After fulfilling these tasks an acceptable basic model was available regarding the road network.

The public transport system, however, was mostly missing from the model. As the first step, the stops were corrected or complemented based on several data sources. All the 2,736 stops got on their right place that way. These stops had to be connected into the system through the railway- or bus network. The railway lines were amendable manually due to the relatively large headways in the timetable. Treating the diverging and merging trains was a conceptual difficulty at this point (Budapest-Győr-Sopron-Celldömölk-Szombathely).

Treating the bus network needed more efforts, so it was a longer procedure. The main problem of the bus network was that there are many cul-de-sac settlements in both Vas- and Zala County, and these small settlements are not called by all of the bus lines. Therefore the route of the buses changes line by line. Furthermore, a conceptual problem with the bus lines leaving and later returning the model area had to be solved. If these lines were considered on their whole route, the number of stops were unnecessary large. On the other hand if these lines only pass through the "external" area, an uncertain amount of passengers remain on the buses.

The project partners organized senior meetings in order to clarify the above mentioned questions. The model resulting from these meetings is shown in Fig. 3.

3. Introduction of the model

The national part of the Austrian-Hungarian transportation model is considered as settled. It consists of Győr-Moson-Sopron, Vas and Zala Counties, and the neighbouring areas to such a necessary extent.

The characteristics of the national model fit to the level of resolution set out in advance:

- nodes: 9,010 pcs,
- links: 20,454 pcs,
- zones: 265 pcs,
- stops: 2,736 pcs,
- connections: 301 pcs (connection routes: 4,169 pcs),
- lines: 4,680 pcs.

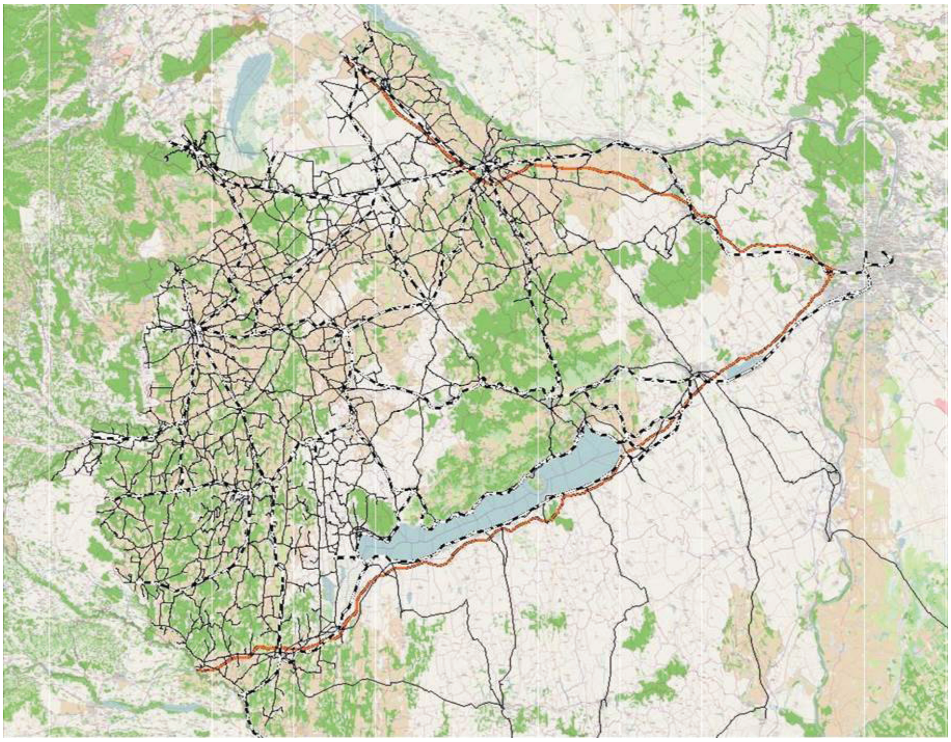

Fig. 3. Hungarian part of the model

The final model is going to be set up by merging of the Hungarian and the Austrian part-models. This step had to be considered from the starting point of the work, so a special coding system had to be introduced.

The number of the zones is an 8-digit code, which consists of the following:

– 1. digit: code of the country: 1 AT, 2 SK, 3 HU, 4 CZ,
– 2. digit: code of the NUT1 (counties): 1 GyMS, 2 Vas, 3 Zala,
– 3-4. digit: code of the NUT2 (district),
– 5-6. digit: sequential number,
– 7-8. digit: further sequential number if a zone is divided (e.g.: large cities - Győr).

The numbers of the links and nodes are similarly formed.

The model contains the road network and the timetables of the public transport lines running, starting and ending in the project area. All these elements were built into the model based on the data from autumn 2013.

The model is dealing not only with the supply, but also with the demand side, therefore it contains a demand-model as well. After many discussions the Hungarian part-model contains a conventional EVA model based on a four-step model. The structural data required to run the model were uploaded step by step, parallel with the correction of the basic model.

4. First runs of the model

Although the model is not fully completed yet, the research team carried out a few tests in order to find out whether the model fits to the expectations. For the first test the model of the planned M9 motorway was prepared.

The first step in such an analysis is the check of the current state (calibration). The calibration in this case was been fulfilled only roughly. The result is shown in Fig. 4.

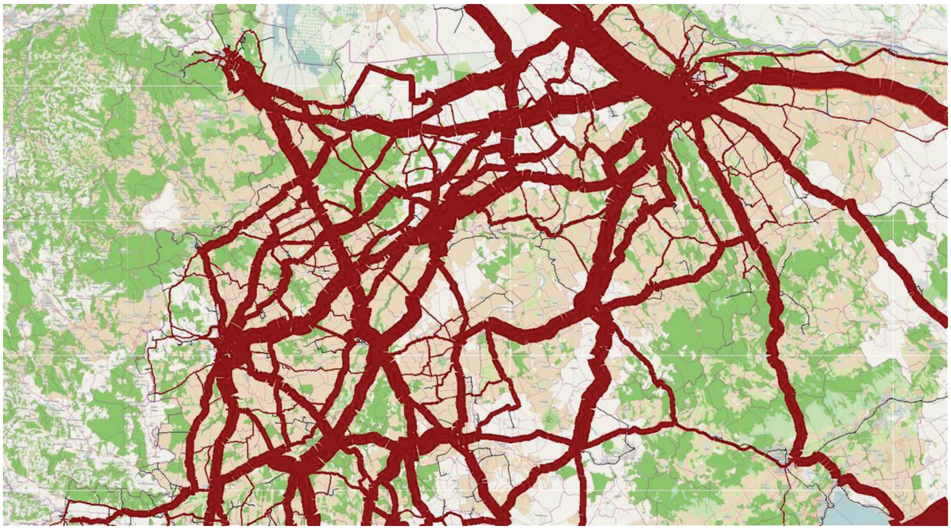

Fig. 4. Traffic volumes on the current road network

After the calibration the M9 motorway was imported into the model. This road supplies a missing connection in the network and it improves the accessibility of the region. A significant difference was found after running the traffic assignment with the original demands but with the new network. The traffic volume of the new road will be quite high according to this test-run (Fig. 5.)

It is remarkable that the new road "pulls" the traffic even from distant road sections. For a more detailed analysis of this pulling effect, a difference figure was prepared, showing the differences between the traffic volumes on the present and the planned roads (see Fig. 6.)

Studying Fig. 6, it is surprising that the new road would have an impact even on the traffic volume of the M7 motorway. On the other hand, it is interesting that the traffic volume of certain roads near by Csorna and Kapuvár would increase, presumably because drivers would take a first short detour in order to reach the new road, thereafter they would travel on the new road to the south. It is important to emphasize that these are the results of a test-run of the model. The detailed analysis of this development project has not been fulfilled yet.

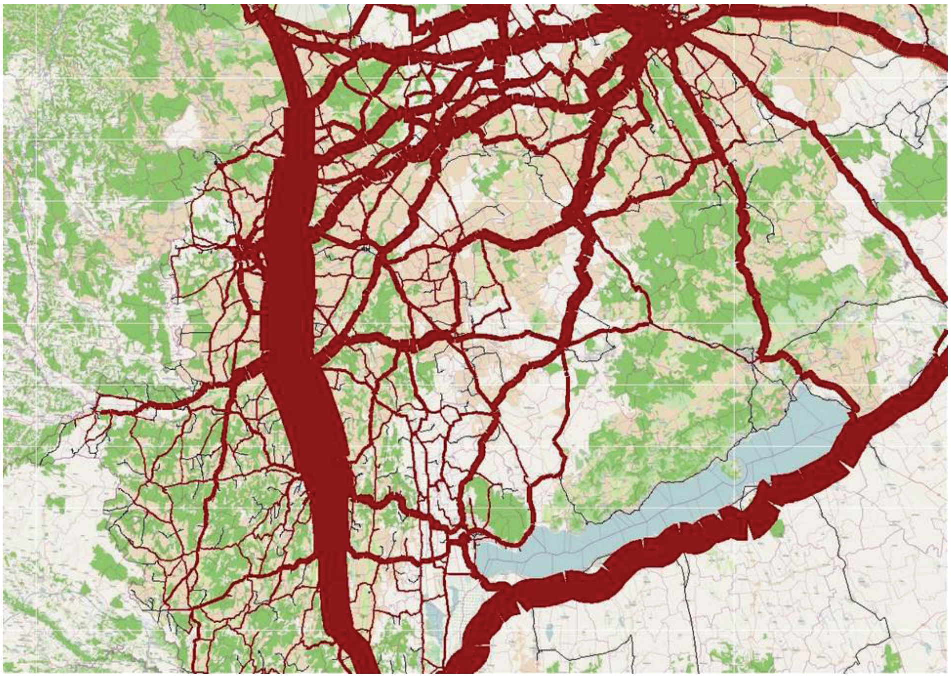

Fig. 5. Traffic volumes with the new road in the network

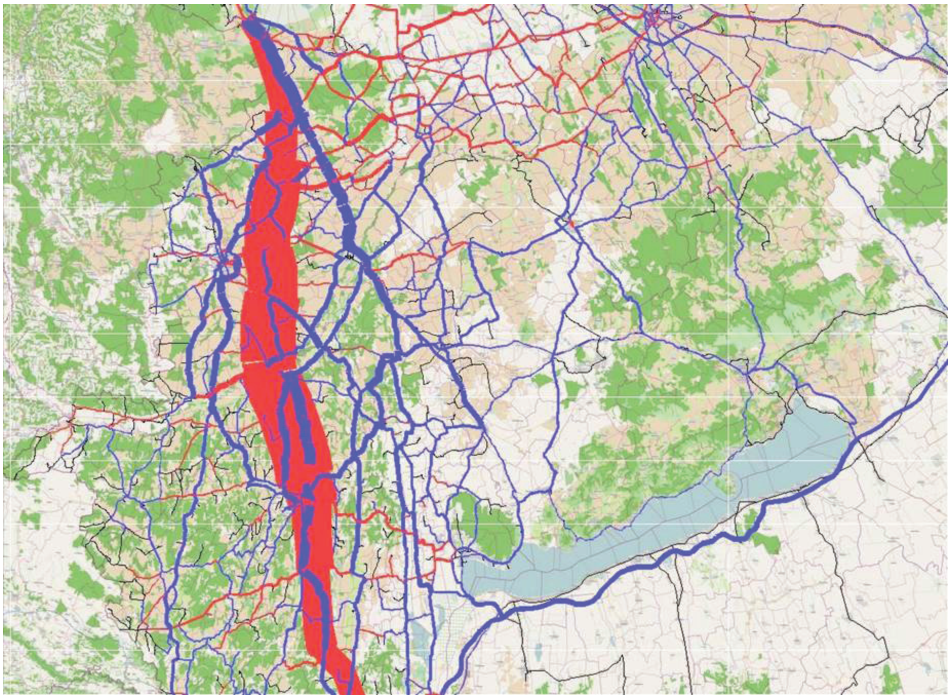

Fig. 6. Difference case of the test scenario - M9 motorway (red- increase, blue-decrease in traffic volumes)

The results of this test, however, prompted the research team to analyse other, realistic scenarios after the model is completed and the Austrian traffic and its impacts can be taken into account.

5. Analysis of transport developments

Basically the aim of the project was to develop a cross-border transport model. Some development projects were analysed in order to try the model in practise and to demonstrate its potential.

5.1. Selected development alternatives

An overview of the relevant transport planning strategies was carried out in an attempt to find those projects, which can really demonstrate the above mentioned potential. The following development scenarios were selected for deeper analysis:

- (1): new 2x2 lanes motorway between Győr and Eisenstadt (M85-A3, Győr – Sopron – Eisenstadt),
- (3): new 2x2 lanes motorway between Rajka and Fürstenfeld (M15-M86--S7, Rajka – Mosonmagyaróvár – Szombathely – Körmend - Fürstenfeld),
- (5): Development of border-crossings roads (a pack of small-scale road projects, mostly upgraded and new links),
- (6b): double-track-upgrade of the Győr-Sopron-Ebenfurt railway line,
- (8): new rail connection between Oberpullendorf and Kőszeg (replacement of an old rail link and a new line route: Oberpullendorf – Kőszeg – Szombathely – Zalaszentiván).

The basic modelling approach in the project was to model each scenario independently, in order to better understanding of their pure effect without the synergies. That was done with the assessment of the difference between the „do-something" and the „do-nothing" cases. The „do-nothing" case was the modelled current (2013) traffic situation as a reference.

5.2. Preliminary results

Two of the road scenarios (3 and 5) were chosen to show what kind of effects these projects can have. However, the whole project has still some issues with the calibration of the demand model, so the following ones should be considered as preliminary results.

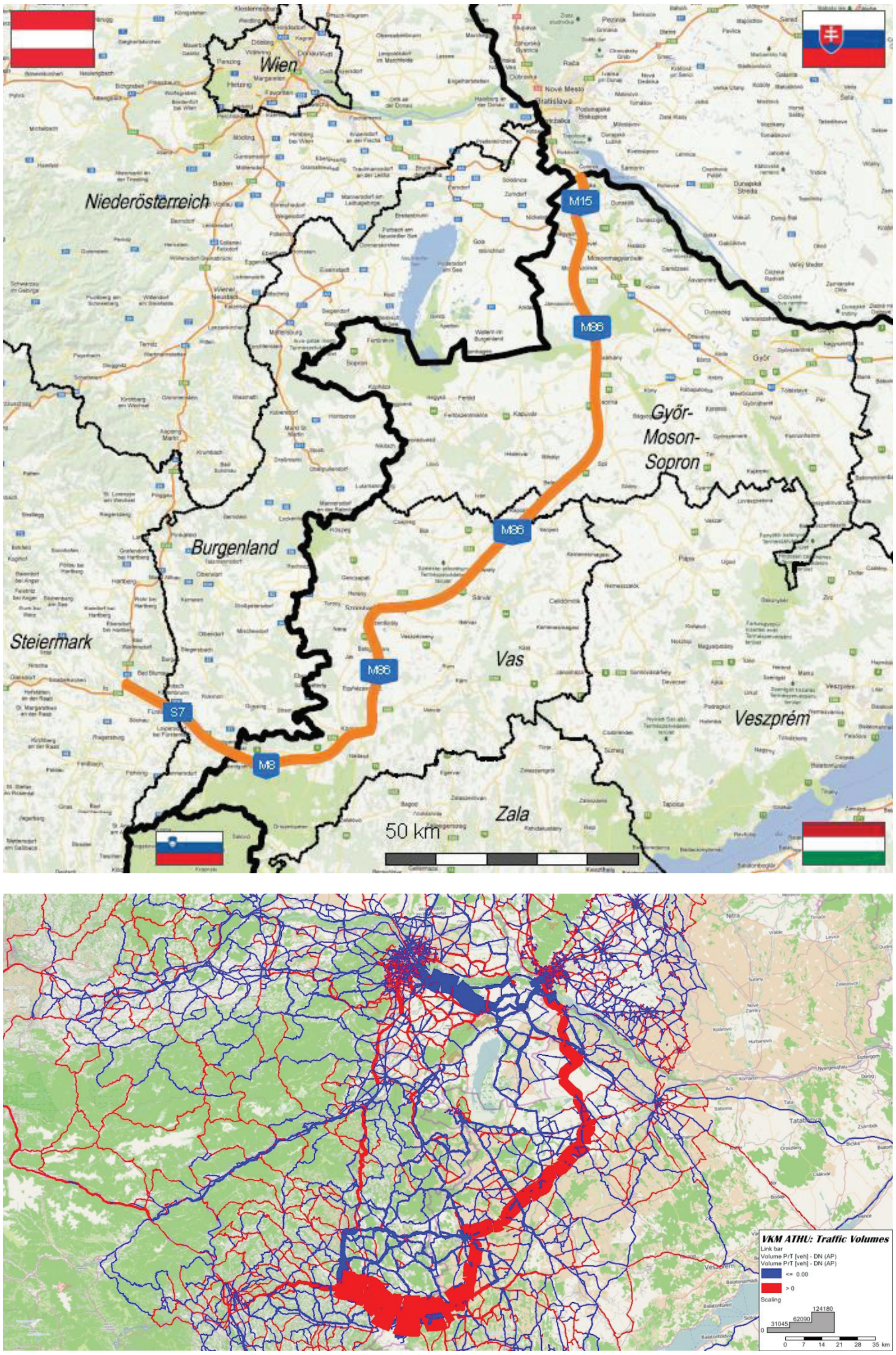

Fig. 7. Overview and difference case of scenario 3 – M15, M86, M8, S7 (red- increase, blue-decrease in traffic volumes)

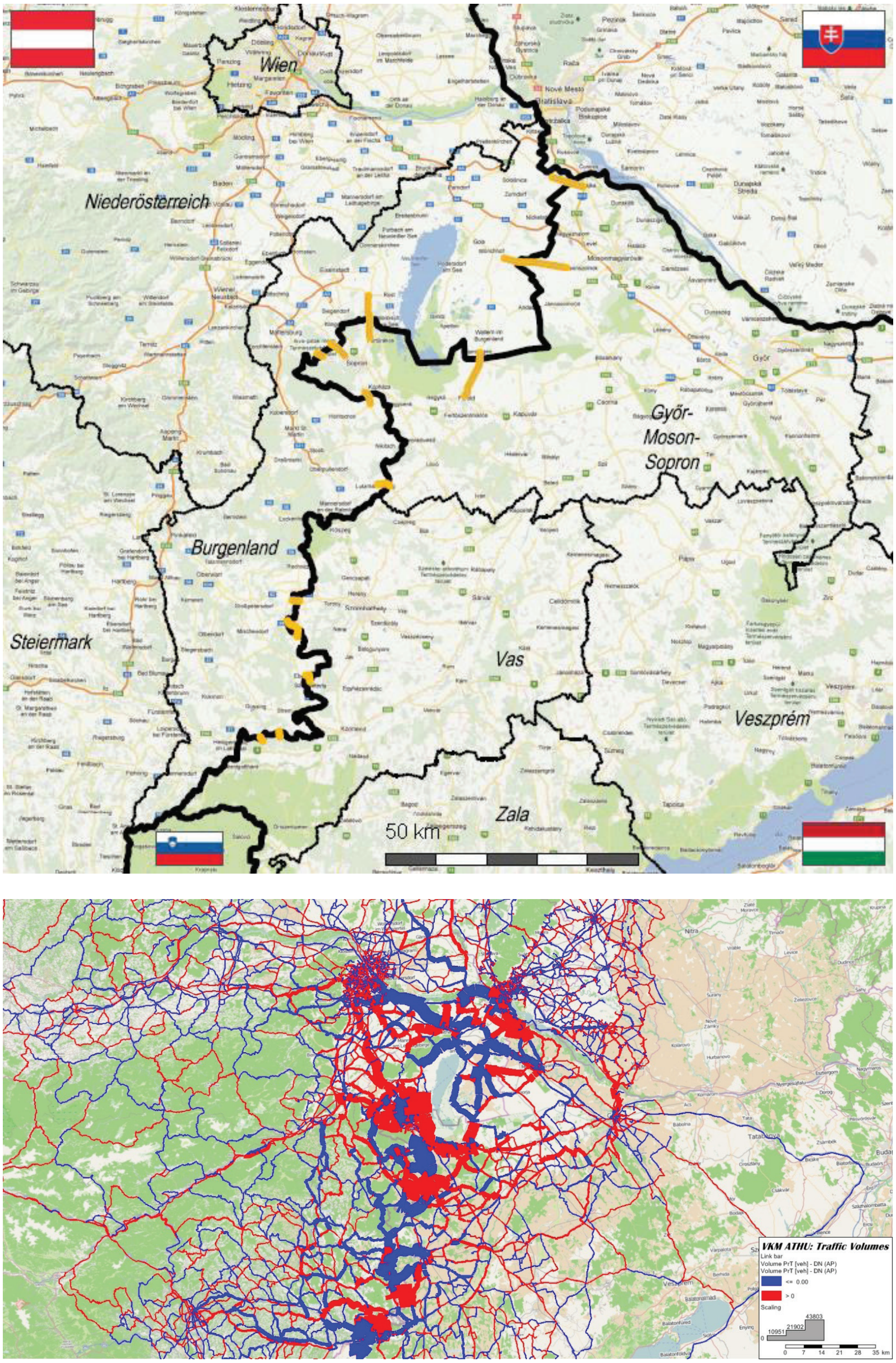

Fig. 8. Overview and difference case of scenario 5 – small roads (red- increase, blue-decrease in traffic volumes)

6. Conclusion

The project introduced in this paper ended in March 2014. The goals set two years ago were achieved by the end of the project: a calibrated, multimodal, strategic transport model was developed, which covers the whole area of East Austria, West Slovakia and West Hungary. These days the model covering the whole Centrope Region is being completed, which gives a basis for the preliminary analysis of development projects in the field of transportation.

Acknowledgement

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