CENTRAL EUROPEAN CROSS BORDER TRANSPORT MODEL (CECBTM)

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ABSTRACT

The Vienna University of Technology in Austria (AT), together with Slovak University of Technology Bratislava (SK) and the University of Győr in Hungary (HU) are developing a transnational cross-border transport and demand model for the CENTROPE region, covering the regions of Vienna[1] (AT), Lower Austria (AT), Burgenland (AT), parts of Styria[2] (AT), Bratislava[3] (SK), Trnava[4] (SK), Győr-Moson-Sopron (HU), Vas (HU) and Zala[5] (HU). This is necessary because existing national models abruptly end at the borders of their territorial units and therefore are not able to depict consequences of close-to or cross-border infrastructure projects accordingly.
In times of scarce (financial as well as material) resources and of increasingly powerful lobbies, which do not always have public welfare in mind, it is of utmost importance to base expensive and long-lasting infrastructure decisions on reliable objective fundaments.

[1] Federal state and capital of Austria
[2] Federal states of Austria
[3] District and capital of Slovakia
[4] District and city in Western Slovakia
[5] Administrative counties in Western Hungary

In this paper we will introduce the background of the project, the targets and first outcomes as well as the challenges on the way and how we dealt with them. We harmonized and merged several demand and assignment models from different sources; we updated the model with the latest socio-demographic data and with the results of our own mobility survey; we compared two demand models (VISEM & VISEVA of the PTV VISUM package) concerning data requirements, modelling efforts and quality of the results; we calibrated our models with commuter statistics and traffic count data for these three different countries; we developed strategies to model cross border traffic constraints and their vanishing over time; we developed scenarios in order to show the potential impacts of cross border transport policy instruments; and – most importantly – we brought together transport modellers, planners and decision makers from these countries to sensitize them to the potential and the limits of 4-stage cross border transport models.

Keywords: cross border, transport model, demand model, Europe, Austria, Slovakia, Hungary, mobility

INTRODUCTION

The paper is arranged as follows: in the first chapter "Central Europe – The Region" we give a general overview of the history, the current situation and some socio demographic and socio economic data of Central Europe and the project region. In the main chapter "The Transport Model – CECBTM" we describe the objectives of the project, the used software, the development and design of the model. We end with an outlook and a conclusion summing up the project.

CENTRAL EUROPE – THE REGION

History

Over the last centuries until World War I, Austria, Hungary, the Czech Republic and Slovakia were all part of the Austro-Hungarian Empire without any physical borders. Even with the split-up of the former empire after World War I there were ambitions to build a follow up confederation (Donauföderation/Danube confederation). But after World War II all international relations were stopped when parts of Austria and Germany were occupied by the former Soviet Union and the construction of the Iron Curtain between Western and Eastern Europe began. 28 years later, when the Iron Curtain finally fell in 1989, borders were opened and people were free to travel again. The final step breaking up the physical borders happened in 2004 when Hungary, the Czech Republic and Slovakia joined the European Union and the Schengen Agreement[6].

[6] The Schengen Agreement is a treaty and was first signed in 1985 by the members of the European Economic Community at the time and was adopted for the EU members. Currently there are 26 European countries in the Schengen Area. Within the area it is permitted to travel without any border controls.

Current situation

Central Europe (see Figure 1) is characterized by the fusion of the long separated Western Europe and Eastern Europe. Since 1989, the year the Iron Curtain fell, a slow integration process has started which is growing ever since.

Figure 1: Central Europe region (Source: http://en.wikipedia.org/wiki/Central_Europe)

Even more than 20 years after the opening of the border, barriers still exist between the Eastern and Western European countries. To overcome these, the European Union is funding cross border projects within several programmes, such as the bilateral "creating the future"-programmes AT-HU (Austria-Hungary), AT-CZ (Austria-Czech Republic) and SK-AT (Slovakia-Austria) and the multilateral CENTRAL EUROPE programme[7]. Figure 2 shows the area covered by the programmes "creating the future" in Austria (blue), Slovakia (green) and Hungary (orange) with intense colours. The rest of each country is shown in less intense colours.

Bratislava and Vienna are forming together the "twin city region" – they are the two closest capitals in Europe (~60 km). The "twin city region" concept is pursued and exploited to further develop the region around the two cities. They are linked by two train routes, several bus lines, a motorway, a high-speed boat connection and a cycling path. There are also two airports in the region.

Austria´s public transport is organized in different transport associations. Public transport in rural areas is mainly conducted by buses and trains, flanked by trams in larger cities and the underground in Vienna. Hungary and Slovakia feature similar public transport systems.

[7] For further detailed information readers are recommended to refer to the websites of each programme; http://www.at-hu.net/, http://www.at-cz.eu/, http://www.sk-at.eu/ and http://www.central2013.eu/.

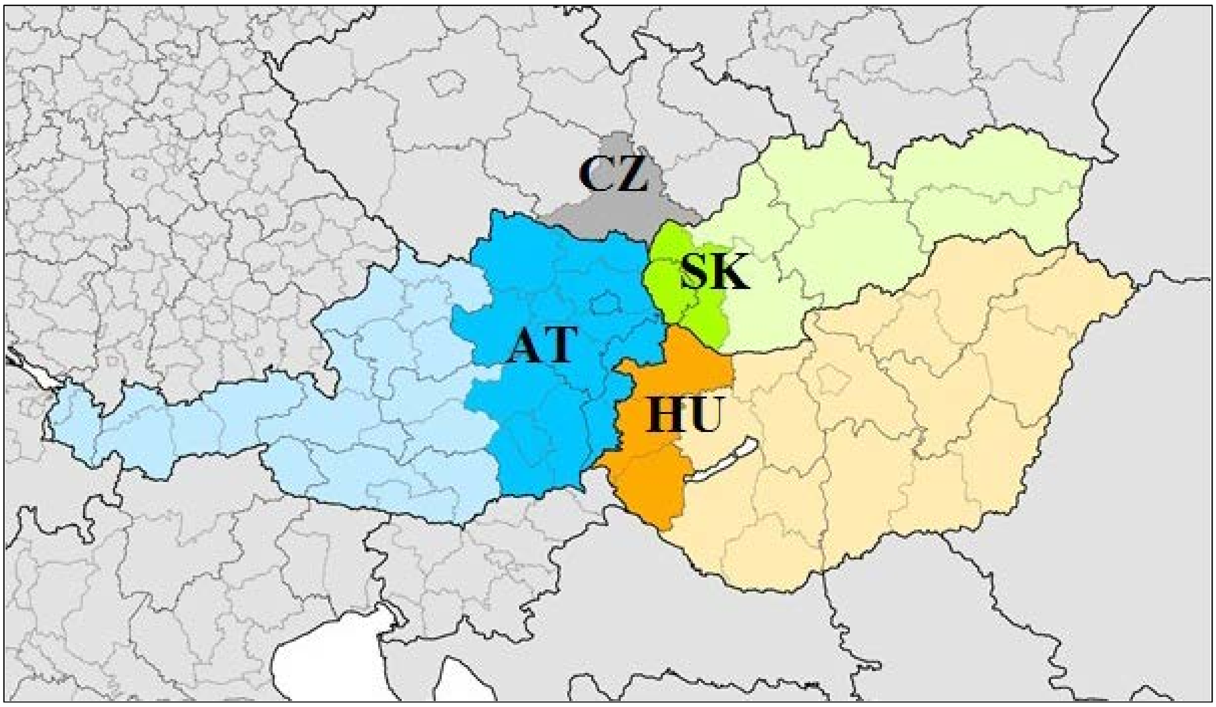

Figure 2: CENTROPE region

Technical data

Table 1 shows some statistical figures about the project areas in Austria (Statistik Austria, 2012), Slovakia (Štatistický úrad Slovenskej republiky, 2012) and Hungary (Központi Statisztikai Hivatal, 2012).

Table 1: Statistical data for the regions in the project area

	Austria	Slovakia	Hungary
Covered provinces	Vienna Lower Austria Burgenland Styria (parts)	Bratislava Trnava	Győr-Moson-Sopron Vas Zala
Inhabitants / Share of country [%]	4.638.316 55,2 %	1.191.767 21,9 %	994.698 10,0 %
Area [km²] Share of country [%]	33.636 40,1 %	6.211 12,7 %	11.209 12,0 %
GDP (2011) per person [€]	32.299	18.400	16.500
Car motorization per 1.000 inhabitants (nationwide)	540	307	299

Borders

Nowadays, most of the physical borders are gone (waiting times, customs), but some barriers such as few crossing points (also due to geographical conditions) and nationally centralised public transport systems, still exist. Even more, there are invisible borders such as different tax and legal systems, wage differentials, ideologies and prejudices which restrict cross border interactions.

One of the biggest challenges in the EU and the CENTROPE region is the barrier of languages. In the project area alone we are dealing with three different languages without any similarities[8]:

- Austria: German and some minorities (Croatian, Hungarian)
- Hungary: Hungarian and some minorities (Croatian, German, Slovakian)
- Slovakia: Slovakian and many minorities (Hungarian, Roma, Czech, German, Croatian, Ruthenian)

THE TRANSPORT MODEL – CECBTM (CENTRAL EUROPEAN CROSS BORDER TRANSPORT MODEL)

Objectives

Usually, common national transport models are just representing private and – sometimes – public transport within national borders due to administrative and financial reasons. Beyond the border the information value of common transport models is decreasing significantly. Therefore, the effects of the implementation of new road or railway constructions on one side of the border cannot be displayed on the other side with national transport models.

As a result of economic integration of Hungary and Slovakia in the EU, traffic volume is increasing drastically (ASFINAG, 2012). As national transport models are not able to represent the whole region it is necessary to develop a transnational transport model taking this fact into account.

As the project is meant to support politicians and other decision makers some objectives have to be met in order to provide these people with an appropriate and qualified tool.

Getting **realistic results** is the most important objective of this project. To reach this goal the CECBTM is provided with recently recorded mobility data and the latest census data of 2011. Decision makers need reliability concerning the results. Therefore, it is necessary to have an **outsourced quality management** led by an independent institution certificating the CECBTM. After all, the certified CECBTM will represent the base for further **prognosis.**

A major challenge in this project is the implementation of inner European borders within the model which are physically already broken up, but still exist e.g. in the form of language barriers. This **border crossing model** represents the first of this kind in central Europe.

Projects and partners

The CECBTM is a project initiated and coordinated by the Research Centre of Transport Planning and Traffic Engineering at the Vienna University of Technology. It consists of currently three projects – the Transport Model AT-SK (Leth and Emberger, 2011) within the "creating the future" programme SK-AT carried out in collaboration with the Department of

[8] Only the largest minority language groups are mentioned.

Transport Construction and Traffic of the Slovak University of Technology in Bratislava (10/2009-06/2013), the Transport Model AT-HU within the "creating the future" programme AT-HU carried out in collaboration with the Department of Transport Infrastructure and Municipal Engineering of the Széchenyi István University in Győr (10/2011-09/2013), and the Transport Model AT-CZ within the "European territorial co-operation" programme AT-CZ carried out in collaboration with CDV Brno (10/2012-03/2014).
The projects are accompanied by an Advisory Board consisting of experts from the countries' ministries for transport, representatives of federal states/districts/counties and bigger cities of the project area, transport associations, public transport operators as well as highway operators.

Software

These days PTV´s VISUM software package (PTV-AG, 2012a) is the most common software used in private and public offices on the European mainland. VISUM is a piece of software for designing transport models. As all existing models in Austria, the Czech Republic, Hungary and Slovakia are based on the PTV software, we also chose it to avoid compatibility problems. The VISUM package provides various modules for demand modelling. Two of them used in this research are VISEM and VISEVA. The modules allow for the setting up of a 4-step-model.
The main difference between VISEM and VISEVA is that VISEM is an activity chain based model that handles a set of trips like a "chain" (e.g. "Home-Work-Shopping-Home") while VISEVA is an activity pair based model that focuses on the combination of different activities connected by a trip as a "pair" (e.g. "Home-Work" or "Shopping-Home"). Therefore each module uses different data as input and as a consequence a different kind of calibration.

Strategy of designing a transport model

Transport modelling is an iterative process. In the setup process, the structure of the demand model has to be specified, e.g. the number and scope of person groups, the number and scope of structural properties (measurement of zone attractiveness) as well as the dependencies between them. This first setup might have to be changed during the ongoing modelling process, e.g. when data availability problems arise. These internal iterations together with modelling iterations in the wake of calibration result in a highly complex system. Additionally the number of zones, links and nodes, person groups, structural properties and countries increase the complexity, too.

Executed tasks, encountered problems and feasible solutions

In the following sections we present a step-by-step log of the executed tasks in order to get an integrated multi-modal cross-border transport model. On our way we encountered a number of challenges which are rarely dealt with in common modelling practice (e.g. border modelling):

List of issues

a) gathering and analysing existing transport models
b) defining the model structure
c) merging and unitizing existing models
d) homogenising zone sizes
e) estimating the background traffic
f) “border” modelling
g) demand modelling
h) calibration

Gather and analyse existing transport models

Previously to our project, four separate transport models covered the project area: the Austrian Federal Ministry for Transport, Innovation and Technology (BMVIT) had a multi-modal transport model for the whole of Austria on municipality level; the Municipal Authority of Vienna (MA 18) had a much more detailed model originating from the BMVIT model but manually disaggregated and refined for Eastern Austria; the City of Bratislava owns a transport model for the western part of Slovakia (Bratislava, Trnava); and KKK[9] owns a transport model of the western part of Hungary.
These existing models were analysed concerning their model structure, the level of detail, the base year of input data, their geographical context, etc.

Define common model structure (coordinate system; nomenclature of nodes, zones, links, etc.; behaviour homogenous groups; structural properties)

Based on the analysis of existing models, a common transport model structure had to be defined in order to merge them. A target coordinate system and projection was chosen, a common numeration and nomenclature of zones, nodes and links was specified – to prevent identical numeration and thus problems in the merging process.
E.g. for the numeration of zones an 8 digit code was used – starting with 1 digit for the country (1-Austria, 2-Slovakia, 3-Hungary), followed by a 5 digit national code (mostly based on municipality codes used by the national statistics offices) and by another 2 digits which are used to indicate if a zone is further disaggregated.

Unitize existing models

Once the common transport model structure was defined, the existing models were adapted to this new system and merged. To enable constant identification of the origin of each part of the transport model, all zones, nodes, links and connectors were attributed accordingly before being imported.

[9] KKK is the Hungarian Coordination Centre for Transport Development, which is an institution complementing and implementing the work of the Ministry of Transport, Telecommunication and Energy.

Links and connectors crossing the borders of the original transport models had to be restored manually as they were lost in the merging process. Also all transport model border crossing PT lines had to be manually edited and completed.

Disaggregate large zones

As the distribution of inhabitants and area of the zones turned out to be too inhomogeneous, we chose to disaggregate the largest zones in order to ensure a homogenous model structure. Zones with more than 10.000 inhabitants or larger than 150 km² were disaggregated.

Gather missing data and update old data (behaviour homogenous groups, structural properties)

Data concerning the behaviour homogenous groups (no. of children, no. of employed with or without car availability, etc.; mobility rates) and the structural properties (no. of work places, attractiveness of leisure facilities, etc.) were derived from the existing models and updated with statistical offices' data if necessary.
Also calibration data were collected such as traffic counts, trip length distributions and modal splits. All used sources are documented in the "Internal working paper AT-CZ-HU-SK" (Schumich, 2013).

Impute freight traffic as well as transit, origin and destination car traffic

As our CECB transport model has no freight traffic module and cannot calculate transit, origin and destination traffic from and to the model area, we use an imputed background traffic load. The background volumes were derived from traffic counts of the national highway authorities.
It is necessary to have this background traffic load before starting the demand modelling to estimate actual travel times on stressed roads.

Set up demand model

We set up a demand model with six behaviour homogenous groups (students, employed with car availability, employed without car availability, non-employed with car availability, non-employed without car availability, population) and five structural properties (school places, work places, leisure time attractions, shopping attractions, population). From a scientific point of view we were interested in the differences between the VISEM and VISEVA demand models so we set up both with identical input parameters (as far as possible).
In a first assignment, we received unrealistic high numbers of cross-border trips which we had to correct → issue of border modelling – see below.

Border Modelling

We have identified two approaches to model the border:

1) **Specific person groups and matching structural properties:** one option is to split up the person groups into national person groups. E.g. the person group “children” as well as the structural property “school places” exists in every country, so that the children of one country only attend schools in their country. The advantage of this approach is the ability to fully control cross border trips of each person group, the disadvantage is the increase of complexity and computing time with each additional country and the increase of person groups.
2) **Border matrix:** another approach is to multiply all impedance matrices by a weighted external matrix – as shown in Table 2 – which increases the impedance between two/three/four countries. When VISEM is used, this approach delivers a satisfactory solution. When using VISEVA, it is further necessary to balance the trip generation zone-wise, otherwise too many trips are generated over the whole project area.

Table 2: This external border matrix is weighted by the EVA function to decrease the cross-border traffic

	AT	SK	HU	CZ
AT	0	1	1	1
SK	1	0	1	1
HU	1	1	0	1
CZ	1	1	1	0

Both approaches have to be calibrated with cross-border traffic counts. This border calibration must be in the same iteration loop as the calibration of the whole transport model, because with each iteration results are changing.

Calibration process and evaluation

In order to get realistic traffic volumes it is inevitable to calibrate each step of the demand model (trip generation, trip distribution and mode choice).

VISEVA (trip pair approach)

First the following settings have to be done in **VISEVA** demand modelling process:

- Regional balancing: In order to limit trip length, regional balancing of attractions and productions is necessary to make short trips more attractive. To manage this, trip generation is calculated main zone by main zone (zones aggregated by districts) and balanced intra-zonally.

- Average number of trips: The average number of trips depends on the mobility rates. Calibration is done by adapting the mobility rates of the activity pair "others-others"[10] to model the observed average number of trips.

After a first assignment trip lengths and trip times are calibrated:

- With EVA function: EVA functions describe the weighting probabilities and are used to calibrate the distribution of trip length and trip time as well as the average trip length and time.
- The modelled traffic volumes are compared with empirical data of traffic counts and parameters of the EVA functions are varied until a sufficient fit is achieved ($r^2 > 0.9$).

In VISEVA the modal split is an input value and cannot be calibrated.
The calibration is an iterative process and very time-consuming due to the complexity of the system.

VISEM (trip chain approach)

The VISEM demand modelling approach needs a different calibration.

- Trip distribution: VISEM is equipped with a specific function to calibrate trip distributions. This LOGIT-function is used for each trip purpose. Changing the parameters of this function allows fitting the model values as close as possible to the empirical trip distribution.
- Modal split: The next step is the modal split calibration. The modelled modal split can be adapted by changing the parameters of the LOGIT-function or the utility function, which describes trip time, distance and costs or the combination of these.

No matter which demand model is used, the car assignment is calibrated with traffic count volumes in the end. For further information please see PTV VISUM User Manual, see p. 753 and following (PTV-AG, 2012b).

Model structure

Network

Currently the CECBTM network covers the Eastern part of Austria and the Western parts of Slovakia and Hungary. Current endeavours are in progress to extend the CECBTM to the southern part of the Czech Republic.
The implementation of the Hungarian model is still in progress. Coordinate system, zones, nodes, etc. are adapted to the existing CECBTM network at the moment. Figure 3 shows an overview about the current calibrated model covering eastern Austria and Western Slovakia. Demand modelling is continuously adjusted to integrate the latest knowledge in the CECBTM.

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[10] Trips neither starting at home nor ending at home – because all other activity pairs are calculated from empirical data. Those activities which are not separately modelled are summed up in "others" and used for calibration.

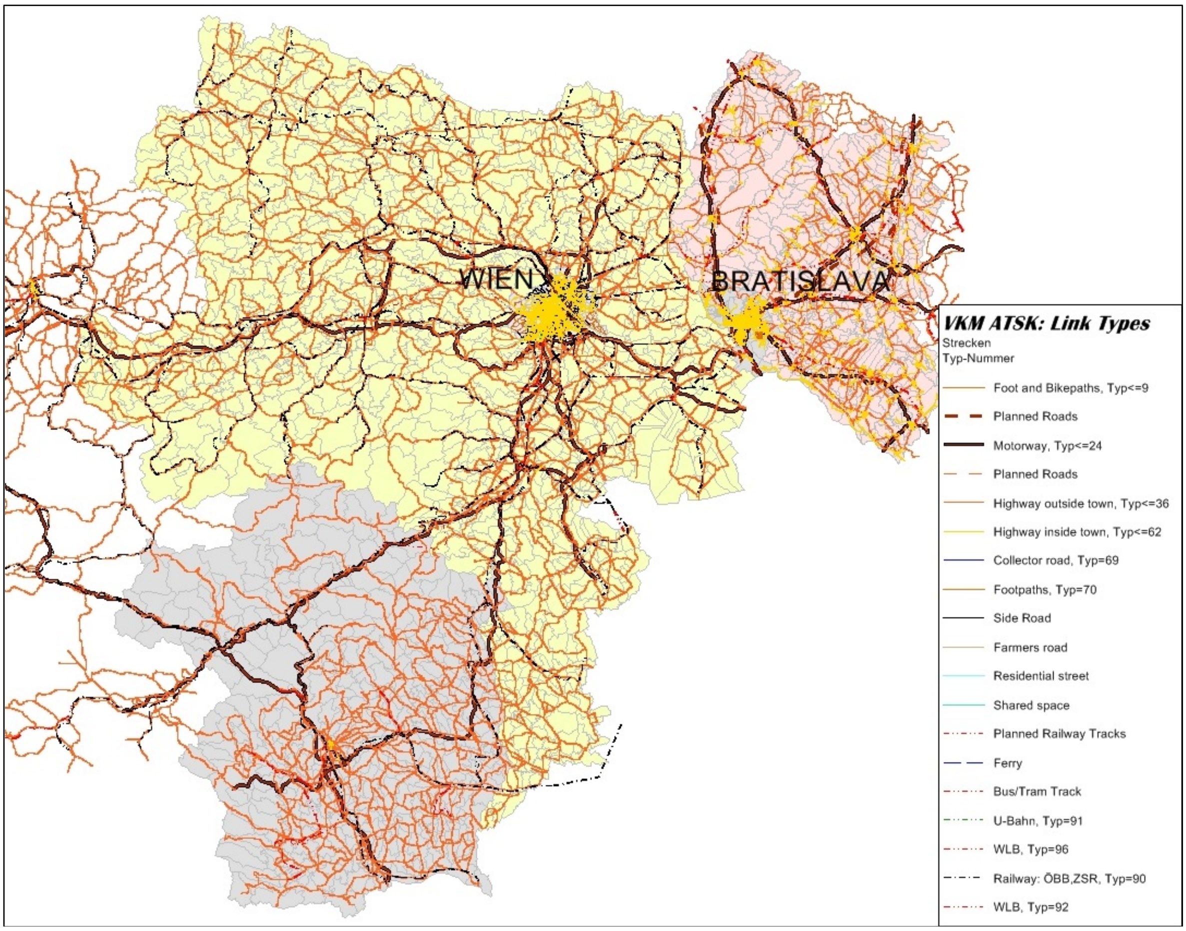

Figure 3: Overview CECBTM - links and zones

The transport model is designed to calculate four transport modes: pedestrians, cyclists, public transport and cars. Pedestrians, cyclists and car users are defined as individual transport.

Table 3 shows some numbers describing the CECBTM covering Austria and Slovakia. As the extension towards Hungary and the Czech Republic is still in progress it is just possible to estimate the number of zones for the following steps. Nodes, links, etc. are modelled at the moment.

Table 3: Numbers of CECBTM

Number of	AT-SK	+ HU	+ CZ	Total
Zones	1.892	+ appr. 265	+ appr. 500	appr. 2.660
Nodes	18.853			
Links	49.396			
Connectors	15.872			
Stops	8.171			

Input data/Calibration data

Structural data in the Austrian model are taken from the BMVIT model (data were extrapolated from the 2001 census on the basis of a population forecast in 2007 (Hanika, 2007)). The Viennese data are taken from the model of the Municipal Authority of Vienna and represent statistical data of 2001 and 2008. All data will be updated as soon as the analysis of the 2011 census is available.

Mobility rates are taken from Austrian (Herry et al., 2007) and German (Ahrens et al., 2009a) mobility analyses. To overcome the lack of behavioural data for the Slovak region, a very small mobility (1.052 households, 2.808 persons) survey was conducted within the project (Bezák and Hamaďaková, 2012). A questionnaire survey carried out in the two selected municipalities Malacky (Bratislava region) and Piestany (Trnava region) provides the CECBTM with further information. A summary can be found in (Schumich, 2013).

In parallel, a large-scale mobility survey for the Austrian-Slovakian border region is planned for the year 2013 - BRAWISIMO[11]. The results of this survey will be implemented in the CECBTM as soon as they are available.

Traffic data from the Austrian highway and road construction financing company (ASFINAG) is used to calibrate the model. Traffic data for calibration of the model on the Slovakian territory were gained from the Slovak Road Administration (SSC) collected in national surveys of road traffic as well as from the database of traffic surveys in the capital of Bratislava provided by the city of Bratislava. Further available data for the transport model on the territory of Slovakia were taken from several other sources, notably: the Slovak Statistical Office, the Slovak Road Administration, Police Directorate, National Health Information Centre, a specialized company for mapping[12], etc.

Because of the strict data reglementation of the Austrian Railways no passenger data are available. The same problem arises in Slovakia. Therefore the calibration of public transport in the CECBTM has to be estimated.

Demand model

The CECBTM has been set up as a 4-step transport model:

1. Trip generation
2. Trip distribution
3. Mode choice
4. Assignment

The first three steps are summarised under the term demand modelling.

VISEM is an activity chain based model. The three logical steps (steps 1 – 3) are not processed separately in succession by VISEM, but are interlocked. Especially the trip distribution and mode choice are carried out simultaneously in a single procedure. In all three work steps two important concepts have been implemented for VISEM: Calculation on the basis of groups with homogeneous behaviour, and activity chains ((PTV-AG, 2012a), p. 154, 155).

VISEVA was first developed by Lohse at the Dresden Technical University. Later PTV integrated this in its software package VISUM. The following two issues differ VISEVA from the Standard-4-Step Model:

[11] BRAWISIMO is a project for collecting and analysing mobility and transport data in the Twin-City region Vienna Bratislava

[12] MAPA Slovakia Plus, s.r.o.

- If trip generation and trip distribution are calculated separately, i.e. one after the other and above all separately for each activity pair as in the Standard-4-Step Model, it often happens that differences occur between the origin and destination traffic of the zones. The VISEVA model links generation and distribution by an explicit constraints step to make up for the differences ((PTV-AG, 2012a), p. 126)
- In the VISEVA model trip distribution and mode choice are performed simultaneously, i.e. by applying a one-stage discrete choice model to three-dimensional utility matrices indexed according to origin zone, destination zone and mode ((PTV-AG, 2012a) p. 126).

Data requirements: The following table lists necessary data needed for the demand model approaches VISEM and VISEVA. As shown in Table 4 mobility rates have to be prepared in different ways for VISEM and VISEVA.

Table 4: Input data requirements by person groups and size of settlements (village; small, medium and large cities)

VISEM	VISEVA
mobility rates for activity chains	mobility rates for activity pairs
mode choice by age structure	
distribution of trip length by transport mode and transport purpose	
distribution of trip time by transport mode and transport purpose	
average trip length by transport mode and transport purpose	
average trip time by transport mode and transport purpose	

Scenarios

The CECBTM is intended to support decision makers by demonstrating the effects of measures in the transport system. The following scenarios of realistic short term measures have been implemented in the CECBTM and their effects are calculated for each transport mode. We distinguish between two types of scenarios – infrastructure measures and soft policy measures.

Infrastructure scenarios

- Building a new highway between Vienna and Bratislava and a highway ring around Bratislava
- New hourly train connection between Eisenstadt (AT) and Bratislava
- New road bridge connecting Austria and Slovakia in Angern – Záhorská Ves

Soft scenarios

- More frequent public transport services between Hainburg (AT) and Bratislava (SK)
- New train circuit connection Vienna-Bratislava-Vienna (now there are two separated train tracks between the twin cities)

The selection of these scenarios was done in accordance with the members of the accompanying advisory board. This preliminary list is currently being extended.

Quality management

To get reproducible reliable data it is essential to integrate a quality assurance in every transport model, because important political decisions are based on the results of such models. QUALIVERMO (Sammer, 2010) is a recently developed validation procedure and quality management strategy for transport demand models.
The objectives of validation and quality procedure of transport demand models are

- to increase significance of results,
- to raise awareness for the need of quality assurance,
- to disclose the accuracy and uncertainty,
- to avoid the use of black-box models,
- to disclose the objectives of applications and quality needs,
- to improve the transparency of input data and model mechanisms
- to standardize the assessment of results and the documentation and
- to make software results comparable.

QUALIVERMO´s structure is integrated in the documentation of CECBTM to assure a comprehensible, disclosed and full documentation of the CECBTM.

COMPARISON VISEM – VISEVA

Both demand modelling approaches are calculating the first 3 steps of the standard 4-step approach. An important issue when selecting these approaches was the simultaneous calculation of step 2 (trip distribution) and 3 (mode choice) because the choice of destination and the choice of transport mode are related decisions.

The project and its two spatial extensions are still in progress. At the moment the CECBTM is covering the Eastern Austrian area – already extended by the Eastern parts of Styria – and the Western Slovakian districts. The Hungarian part is already prepared and will be implemented in the CECBTM soon. The Czech team is working on the Czech network and the zoning system. The following tables and diagrams will show a snapshot of the present status of CECBTM.

Figure 4 and Figure 5 show the regression analysis of the VISEVA and VISEM demand model. While the present calibration of VISEVA underestimates model in car-traffic-volumes VISEM overestimates car-traffic-volumes. Both regressions concerning car traffic volumes achieve r^2-coefficients of about 0.9.

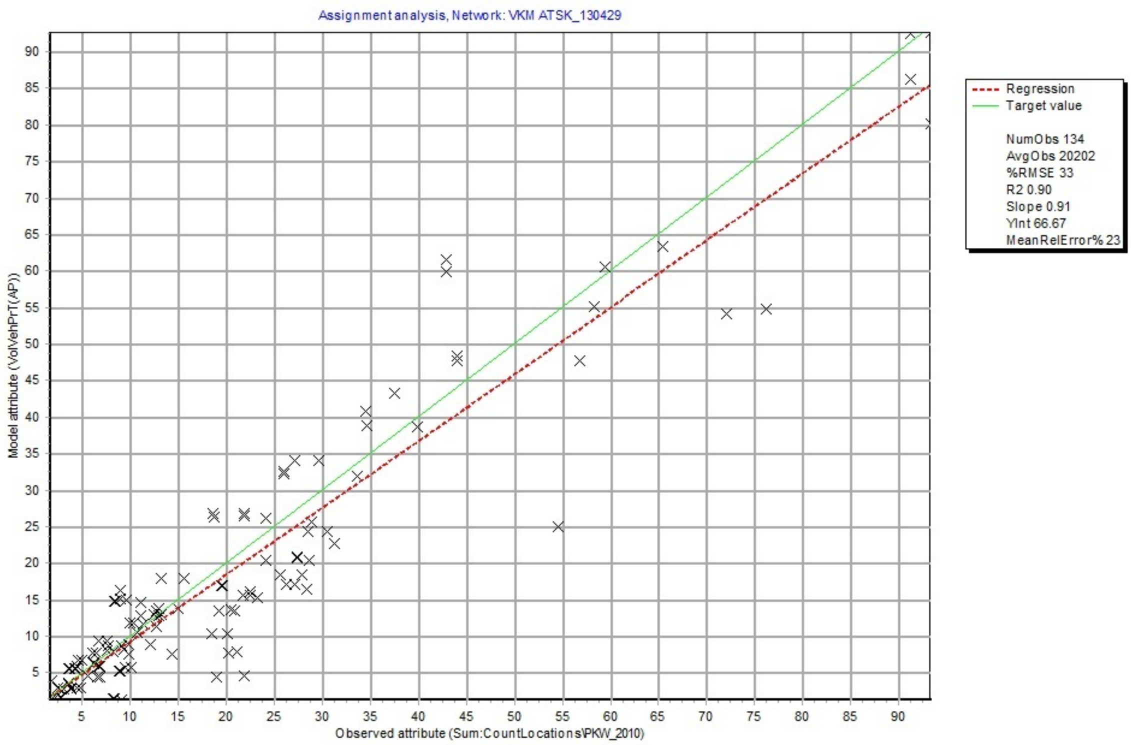

Figure 4: Assignment analysis, demand model VISEVA

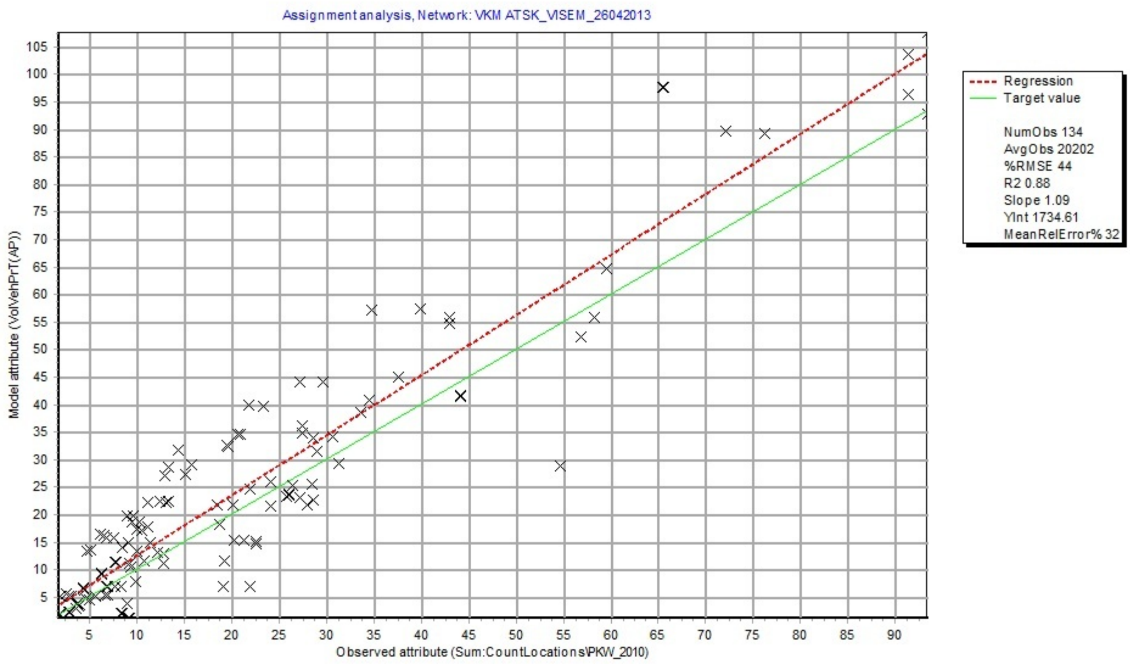

Figure 5: Assignment analysis, demand model VISEM

Table 1 shows the differences in modal split and total number of trips for both demand models. Differences in modal split stem from the two different approaches of demand modelling. While the modal split in VISEM represents a result, VISEVA´s modal split is an estimated input to the model.

Table 5: Number of trips - Comparison VISEM - VISEVA

	Number of trips					
VM	**VISEM**		**VISEVA**		**VISEM - VISEVA**	
Walk	2,797,051	16.5%	4,592,764	26.3%	**-1,795,712**	**-64.2%**
Bike	547,660	3.2%	910,495	5.2%	**-362,835**	**-66.3%**
Car	7,468,243	43.9%	8,963,948	51.3%	**-1,495,706**	**-20.0%**
PuT	6,181,254	36.4%	2,996,722	17.2%	**3,184,533**	**51.5%**
	16,994,208	**100%**	**17,463,929**	**100%**	**-469,721**	

Table 6 shows the differences in car traffic volumes between observed values and VISEM and VISEVA in selected locations near Vienna and Bratislava.

Table 6: Comparison of car traffic volumes in selected locations near Vienna and Bratislava

Location	**Volume Car_VISEM**	**Volume Car_VISEVA**	**Traffic counts (TC)**	**Difference TC-VISEM [%]**	**Difference TC-VISEVA [%]**
Most Prístavný	110,500	121,300	**85,834**	**-28,7%**	**-41,3%**
Most Apollo	29,800	31,800	**45,000**	**33,8%**	**29,3%**
Most Nový (SNP)	49,300	53,300	**43,860**	**-12,4%**	**-21,5%**
Most Lafranconi	83,200	95,900	**74,214**	**-12,1%**	**-29,2%**
Račianska	23,300	26,900	**24,000**	**2,9%**	**-12,1%**
Panónska cesta	24,200	24,800	**25,572**	**5,4%**	**3,0%**
Botanická	47,200	64,700	**52,072**	**9,4%**	**-24,3%**
Šancová	47,700	46,600	**48,212**	**1,1%**	**3,3%**
Cesta I/63 do Dun.Lužnej	29,900	32,500	**18,100**	**-65,2%**	**-79,6%**
D4/A6 Jarovce/Kittsee	18,600	12,700	**12,530**	**-48,4%**	**-1,4%**
A4 Schwechat	71,000	41,600	**80,456**	**11,8%**	**48,3%**
S1 Schwechat Ost	50,800	33,400	**54,757**	**7,2%**	**39,0%**
A2 Wiener Neudorf	179,000	108,900	**148,300**	**-20,7%**	**26,6%**
A21 Brunn am Gebirge	85,700	84,100	**71,916**	**-19,2%**	**-16,9%**

The following figures (Figure 6 and Figure 7) show the trip length distribution in public transport and car transport. While the regression analysis in Figure 4 and Figure 5 give an approximation of reality, Figure 6 and Figure 7 paint an entirely different picture. These diagrams show the public transport trip length distribution (Figure 6) and the car trip length distribution (Figure 7) calculated by both demand models and in order to compare a surveyed trip distribution (Ahrens et al., 2009b). Both demand models are difficult to be calibrated for short public transport and car trips and produce too many trips longer than 20 km.

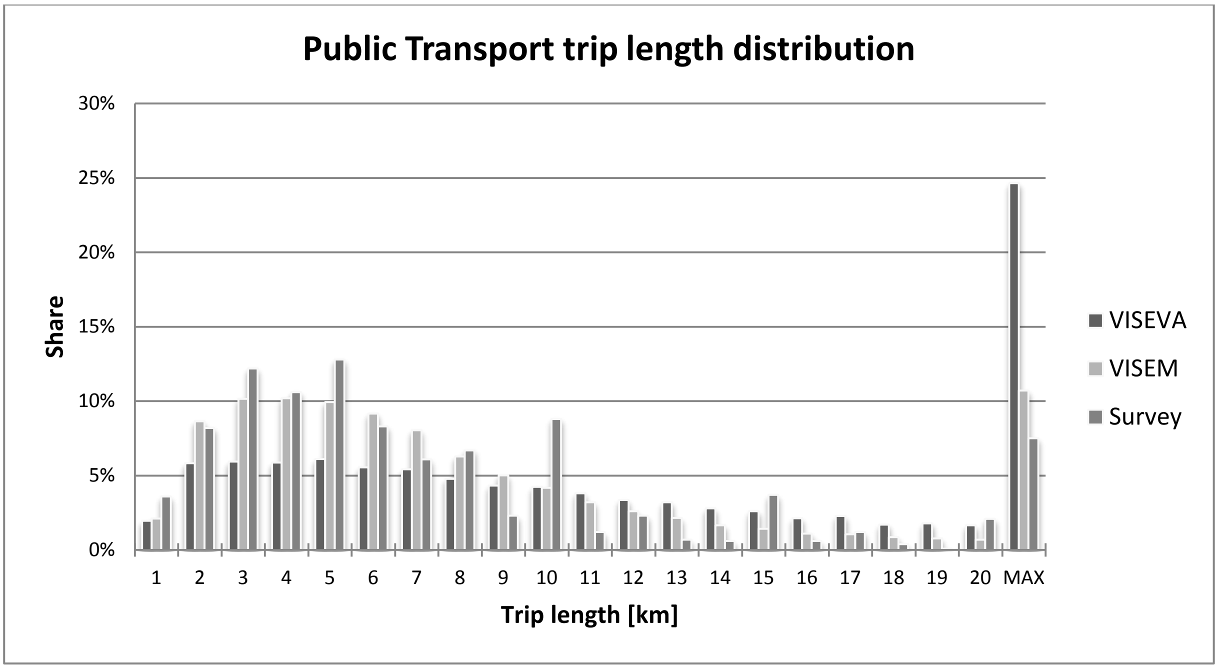

Figure 6: Public Transport trip length distribution

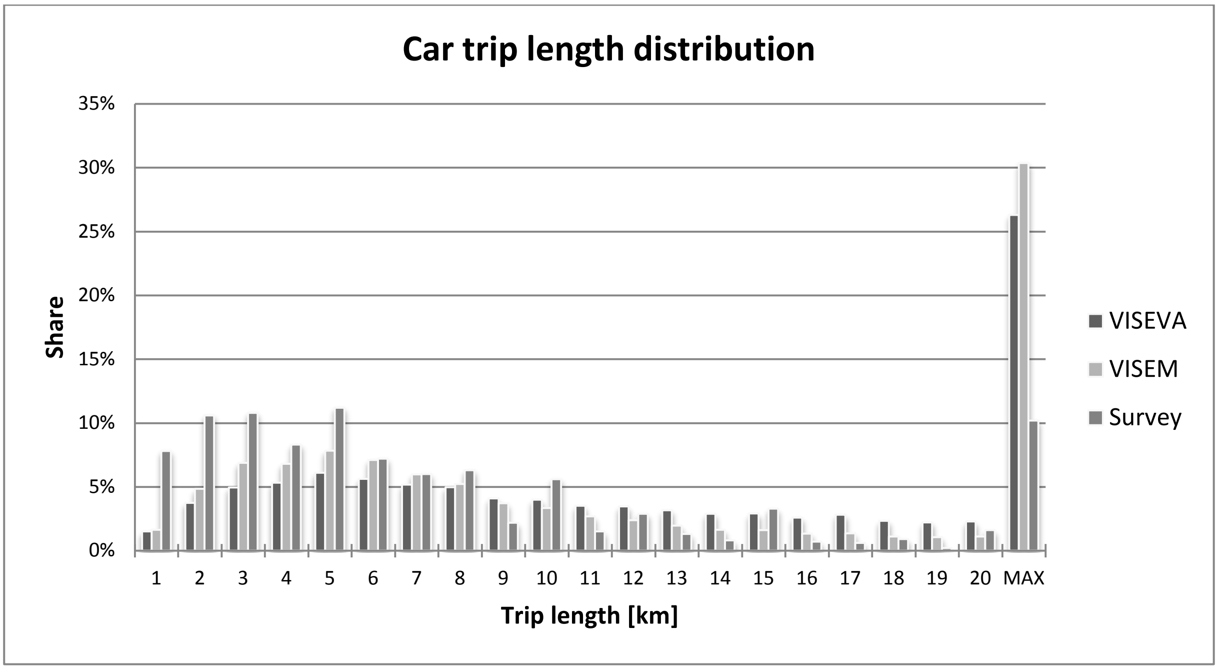

Figure 7: Car trip length distribution

In total VISEVA the results concerning milage travelled by car are 9% shorter, than in VISEM and milage travelled by public transport are 13% shorter than in VISEM (Table 7).

Table 7: Milage travelled by mode

Milage travelled by	VISEVA	VISEM	Relative difference
Car	145.451.000	159.316.000	8,7%
Public Transport	52.799.000	60.533.000	12,8%

Due to the on-going process of calibration there are still gaps between the results of both demand models and observed values. Implementing the results of the BRAWISIMO project will help to improve the results of both demand models of CECBTM.

OUTLOOK

The next step within the CECBTM is to extend the project area to the territory of the Czech Republic covering the city of Brno and the administrative unit of South Moravia illustrated in Figure 2. Simultaneously further refinement of the CECBTM in terms of the method of integrating public transport (capacity utilization) and the integration of further scenarios will take place.
The present investigation of CECBTM prompted a number of additional research questions such as the question about an appropriate level of detail.

CONCLUSION

Integration of transport and infrastructure is a step for improving cross-border relations between neighbouring countries. The emergence of activities in border areas clearly affects the lives beyond the borders and international services will continue to gain importance. It is therefore important to address the modelling of transport beyond the borders of regions, provinces and countries and lessons learned in implementing transport policies and transnational decision.
Availability of transportation-planning documentation should clearly correspond to its importance in the planning of transport in settlements and/or larger territorial units.
The area of Central Europe plays a key role from the view of continental European economic links. Therefore, assurance of compatibility of transport infrastructure and coordination of management of transport are important factors to ensure functionality and prosperity of an integrated Europe. Development of territorial transformations in previous periods pointed to the direct effects of these changes on direction and magnitude of transport relations in the area. For this reason, modelling of transport processes is essential for effective use of available transport infrastructure and forecasting of prospective transport demands in future (Bezák, 2011). It is also very important to redistribute transport demands among effective and environmentally friendly modes of transport in order to prevent environmental devastation by flexible but not environmentally road transport, which penetrates all open spaces which are not carefully defined and managed in a coordinated manner.
From this perspective, the CECBTM project represents the first step of creating a tool with a uniform methodology of collecting and using transport data for modelling multi-modal transport in cross-border regions in Europe (Bezák and Neumannova, 2011). Further the project enables to network prominent experts in transport, thus creating the conditions for synergic use of knowledge for creation of an efficient transport system.

The multimodal transport model for the CENTROPE region is an incentive for the creation of appropriate conditions for environmentally sound and sustainable mobility in the near future.

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