SUSTAINABLE URBAN MOBILITY AND COMMUNTING IN BALTIC CITIES

THE ROLE OF MODELLING AND DATA IN DEVELOPING MULTI AND INTERMODAL TRANSPORT SYSTEM – STATUS QUO AND FUTURE PERSPECTIVES

SUMMARIES FROM SUMBA CONFERENCE PRESENTATIONS, TALLINN, 04-05.12.2018

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The conference texts were summarized by different project partners of the SUMBA project consortium. The SUMBA project - in full: SUSTAINABLE URBAN MOBILITY AND COMMUTING IN BALTIC CITIES - is part-financed by the INTERREG Baltic Sea Region programme and runs from October 2017 until September 2020.

The main goal of the project is to address the burden of car-based commuting by developing and testing tools that help urban and transport planners to assess, plan, and integrate inter-modal mobility solutions into transport plans and policies of their cities and municipalities.

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Introduction

The conference on transport modelling and data management organised by the INTERREG BSR project "Sustainable Urban Mobility and Commuting in Baltic Cities" SUMBA took place in December 4-5, 2018 in Tallinn, Estonia. More than 70 participants took the chance to discuss current developments in this field.

The conference concentrated on transport modelling and data related opportunities for creating a seamless and efficient intermodal transport system that would make commuting more sustainable. The conference included sessions focused on data sources, data collection methods and open source modelling tools as well as sessions about building transport models for cities and practical examples.

Another focus of the conference was on incorporating cycling into a multi- and intermodal transport system – how to collect data and how to model cycling. Presentations covered topics related to challenges and possibilities for solving first and last mile by combining public transport with cycling, and implementation of innovative cycling counting methods, data collection approaches and simulation on bicycle traffic.

This report summarizes the presentations in short paragraphs. All presentations are also freely available on the SUMBA homepage: http://sumba.eu/en/page/transport-conference.

Plenary session I: It's all about data – New data sources and collection methods

Modal share potential by mobile positioning – a key performance indicator for cities

Marek Rannala, Positium Ltd., Estonia

Positium Ltd. is a spin-off company from Tartu University that has been working with Mobile Positioning Data (MPD) since 2013 and is providing analytics, statistics and algorythms on human mobility. Marek Rannala introduced the benefits, challenges and future perspectives related to mobile positioning stating that there are several advantages of mobile positioning, such as:

- Huge sample size, in many cases the whole population as a sample
- Full coverage in time and space
- Avaliablity of historical data
- Mobile networks are denser in cities provides more concentrated information

Currently the company is developing a Modal Share Potential methodology that is yet to run on a city scale. As mobile positioning gives a lot of data about other where-abouts in addition to home-work vector, including also information on commuting pattern (shape and distance), it would help to assess the suitability of a potential mode of transport for certain commuting patterns. For example walking is suitable for the people whose home/work anchor or work-time anchor and secondary stay in the range that is up to 2 km. Same applies to cycling – if we increase the range to 5 km we can see who could use bicycle. Then one can say that today this is suitable mode is ok for them. Public transport on the other hand is good for commuters who do not move all over the place but their commuting corridor is rather narrow, and for the people who do not fit to any other transport mode due to their commuting patterns and volume, the car can be considered as the most suitable mode of transportation. Unfortanately the Modal Share Potential methodology does not show what are the actual modes people are using meaning that the method cannot be used for mapping the actual modal share. Though the information about people's movements and potential modes of transport provides valuable information for modelling, urban planning, and for making decision where and what to invest – for example investing in bicycle infrastructure where user potential is highest.

Collaborative data collection in urban environment,

Raul Kalvo, Inphysica Technology Ltd., Estonia

Testing out new tools and trying out of data collection methods was the aim of the Estonian Academy of Arts Summer school. This summer school is an international event gathering students from all over Europe and world. Participants at the workshop were prepared for participation by getting familiar with local context. Each participant selected one aspect to monitor, e.g. passing pedestrians over time, buses, cyclists, etc. Collected data are used to construct interrelation plots. The tool on collaborative data collection platform "Dataoverlay.org" was introduced. The platform aims to be open ended and extendable solution. Easy application is ensured to multiple customers providing opportunity, for example, to simultaneous carrying of a survey.

Measuring the potential for sustainable mobility in Skane County, Sweden

Corey Ragosnig, Skane County, Sweden

The starting point for the work in Skane County was that there was already a strong bicycle culture and the planning department wanted to capitalize that. The department knew how people travel today, but not what the future potential was. They did an analysis and worked with available data: pairs of coordinates for all registered residents in Skane (home and work/

school address). For the further analysis, network data were used where existing. It included bicycle paths, trains and busses (including timetables), road network including travel speeds, directions of streets etc. A consultant calculated routes trips home to work in 4 different modes (walk, bicycle, car, PT including coming/going to stops). This generated pattern on a regional level when the data were aggregated. It revealed heavily used routes, catchment areas of stations or workplaces etc. It also showed that 70 % could commute without a care, while actually only 42 % do so today. There were a number of challenges during the analysis, e.g. addresses are stored on property level not on address level, so the place of resident could be wrongly assigned to the closest route/bicycle path. The model is now being further refined, e.g. by adding perceived safety of cycling infrastructure to the model.

Assessing and optimising complex Public Transport systems in low data environment: Odessa and Kyiv

David Brenig-Jones, Integrated Transport Planning Ltd., The United Kingdom

Mr Brenig-Jones addressed a challenge faced by many European cities, particularly in Eastern Europe: the revision and optimisation of their public transport systems without having sufficient data. This includes network data such as lines, routes and timetables of public transport services as well as traffic demand data such as passenger numbers, demand data, and origin-destination matrices. The methods presented were developed in low-income countries. Public transport in these countries is often characterised by organically developed routes, rudimentary or non-existent coordination, unreliable services with many operators, sometimes in competition with a state public transport provider. In many Eastern European cities similar structures exist, as a consequence high economic and ecological costs arise in such poorly organized public transport systems. The collection of the data listed above and necessary for optimisation was carried out using the open source application Transit-Wand, which enables the collection of survey data in a standardised format (GTFS). Mr. Brening-Jones pointed out that meaningful data can be obtained even with small sample-sizes and that these can be used for an extrapolation to the overall network as well as for the evaluation and optimisation of the networks. He showed this in the second part of his presentation using the two case studies Odessa and Kiev. The results of the optimizations showed that strong economic and ecological effects are possible with simultaneous improvement of the offer for the majority of the users. He also made it clear that in addition to a change in the transport services offered, changes in the regulatory regime are also necessary in order to be able to control competition between the public and private sectors.

Plenary session II: Learning from international experience - Building and using transport models for cities and agglomeration areas

Developing a multilevel transport model (including macro, meso and micro level)

Dr. Romanika Okraszewska, Gdansk University of Technology, Poland

The Gdynia municipality has approximately 247.000 inhabitants. Suburbanisation and rapidly growing car traffic are the main transport related challenges for the municipality. A multilevel transport model was developed and used for elaboration of the Sustainable Urban Mobility Plan (SUMP) 2016 - 2025 of the Gdynia municipality. The modelling was done at macro, meso and micro level. Four different scenarios were created. At the macro (strategical) level it showed how traffic volumes could be changed. At the micro (operational) level, the model helped to simulate options and select the best solutions for bus lines. It was possible to visualise the modelling results being helpful during consultations with politicians and citizens. Considering this positive experience gained, it is advisable also for other municipalities to utilise the results of transport modelling in the decision-making process.

Considering crowding in public transport appraisal

Jens West, HSL Helsinki, Finland

The HSL carried out joint work with Stockholm. In both cities, Cost-benefit-Analyses (CBA) are used to do investment planning. As for public transport, the calculated costs often surpass the benefits. Especially politically sensitive projects with a bad cost-benefit-factor are a problem. In order to make a better decision, a more detailed approach was developed which is described below.

A special point of attention is the "Value of time": It is often the decisive factor choosing between different options. But this value of time also depends on other factors, such as crowding. There are different methodologies to adjust this for crowding. If these perceived travel times are the basis for the cost benefit analysis, then the results may be different. This was shown for a potential new metro line in Stockholm which has a negative outcome of the CBA if standard value of time is used, but a positive outcome of the perceived value of time is considered.

Another factor that was looked at was the waiting time. A formula from Willumsen et al. requires knowing the standard derivation of the bus headways which you cannot obtain from the static model. The HSL developed various independent variables and derived a correlation from that to obtain needed values to bypass this problem.

Mobility in Tallinn and Harju County

Jaagup Ainsalu, Tallinn Transport Department and Pirko Konsa, SUMP project manager, Estonia

Similary to Estonia as a country, Tallinn is also using advantages of e-services also for operating its transport system and related data gathering. Although Tallinn has introduced a free public transport for its residents, the city's commuting trends are still negative and the share of private cars is increasing. This is especially challenging when looking at the whole agglomeration. Therefore Tallinn has initiated developement of its Sustainable Mobility Plan (SUMP) in the frame of which serveral surveys have been carried out (including mobile positioning along side house hold surveys), and new data gathering methods and sources have been conducted together with the national level. Tallinn SUMP focuses on analyzing the mobility needs of the region and sets sustainable transport priorities for its transport investments.

The BVG model of Berlin – a glimpse into the machine room

Stefan Geier, Berliner Verkehrsbetriebe (BVG), Germany

The Berlin public transport operator BVG has developed what is currently the largest urban transport model in Germany. Stefan Geiger, Head of department of strategic demand, presents the model and its components in his presentation. The model is used for the simulation of the traffic situation, the analysis of transport supply and demand as well as their prognosis, calculation and evaluation of the effects of planned measures and the visualisation of the results especially for decision makers. The latter, Stefan Geiger emphasized, is also a decisive and important function of models. The model itself is a multimodal model and considers the transport modes car, PT, bike and foot using the commercial software PTV VISUM. Depending on the task and time horizon, different data are used, thus the model uses both internal data such as employee reports on vehicle utilization and a variety of external data sources that can be embedded in the model via interfaces. Especially Openstreetmap as data source is highly appreciated and Mr. Geier shows the diversity of the data, but also makes clear that the data are not always correct or complete and that they have to be checked for their plausibility before use.

Using mobility and GPS data for planning

Jaanus Tamm, Tartu City Government, Estonia

The city of Tartu has carried out serveral activities related to data gathering with the goal of having a transparent and and updated modal share to make decisions as the city is in the process of revising its transport system. The city has started to built up a transport counting system to obtain comprehensive traffic data. One crucial thing that still needs to be solved is counting pedentrians. In summer 2018 Tartu carried out a pilot project to identify modality of movements which can be considered as a new approach. The idea behind this pilot was to get the most precise data on walking (spatially) but also for cycling. There were some mistakes in the algorithm but the system is self learning and the share of mistakes was quite small. Tartu also developed a smart city platform. Different things connected to this system in addition to traffic are for example street lightning etc. It helps to engage citizens and public servants to get feedback which makes it a good tool for city managers. In addition Tartu has an ESRI platform development in progress that will incorporate sensor network, smart city platform, and some mobile application solutions.

Tartu has taken a bold step to replan and shape its entire bus network. This will be the first data driven and planned activity in Tartu where more than 27 datasets are used, including mobile positioning data. The project is not yet finalized as public hearings are still in progress to gather feedback from the citizens. At the moment Tartu has 20 bus lines and the main difference between new and old solution is the expected increase of service quality (reduced intervals and shorter travel times). A new bus network will start operating in summer 2019. One of the tools used for planning the new bus lines was made by Positium Ltd. and the tool enables to compare movements using current and new busline network to compare travel times.

In addition to the new bus network Tartu will also launch its bike sharing system in summer 2019. For planning the locations for the bikeshare around 20 datasets were used.

Jaanus Tamm stated that for a city it is important to own main data sets or have at least long term agreements to use datasets as getting access to data has been problematic during the before mentioned processes. Although the data are basically avaliable there is no access to it which means that city needs to spend a lot of money for buying data. That is the main reason why Tartu decided to start to building up their own basic data system.

An efficient approach for modelling public transport – The model for the Hamburg's public transport operator

Siegurd Müller, VMZ Berlin Betreibergesellschaft mbH, Germany

In contrast to Berlin, the second largest city in Germany, Hamburg, is still in the process of developing a comprehensive traffic model. In order to answer the questions of the Hamburg transport operator about the effects of major changes in the bus network and the further development of the subway network, it was therefore necessary to develop a simplified model of its own. Siegurd Müller, project manager at VMZ, presented this development work, in which data and results of two already existing and thus older models were combined and supplemented by current data from external sources. When using different data sources, the different spatial resolutions are a recurring problem, so that this formed the core of his presentation. He explained which individual steps were taken and what quality the model results achieved in comparison to real data.

Plenary session III: The world beyond commercial software - Open source modelling tools

Accessibility measures for analyzing a transport system

Daniel Krajzewicz, German Aerospace Centre (DLR), Institute of Transport Research, Germany

Accessibility measures, although not being a new concept, are increasingly used. The major motivation is that instead of benchmarking the infrastructure for motorised individual transport using measures, such as capacity or average travel time, accessibility measures take into account the city shape by incorporating the positions of source and destination points and in addition regard all modes of transport.

At the Institute of Transport Research at the German Aerospace Centre, a tool for computing accessibility measures has been implemented. Different classes of accessibility measures exist, ranging from ones that rely on the physical attributes – positions of activity places and mode-specific travel times – of a region only up to ones that need additional, model-driven data, such as the positions of the persons over a day or utility measures for visiting a certain place. The tool uses physical attributes only and thereby delivers accessibility measures that may be counted to the class of "contour measures". Nonetheless, some efforts have been done to make the tool as exact in the computation as possible: the path from / to each individual source / destination is taken into regard, as well as possibilities to cross a road. This chosen level of detail is targeting at computing accessibility measures that allow in-depth investigations of accessibilities for different user groups. In addition, the tool offers some flexibility by allowing different limits and different aggregation options. It supports intermodal routes and generates different output measures. The tool has been made available as open source and can be downloaded from https://github.com/DLR-VF/UrMoAC. Besides the tool itself, the presentation included some basic examples, some of which were based on work performed within the SUMBA project.

Traffic Simulation with SUMO

Jakob Erdmann, German Aerospace Centre (DLR), Institute of Transportation Systems, Germany

An open source software SUMO was developed in 2001. It allows simulation of vehicle dynamics on roads in large cities at the micro level. This worldwide used, free of charge research platform provides a toolbox for creating, running and analysing transport simulations. It allows multimodal and intermodal simulations and can be applied for planning of traffic management, analysing the changes in infrastructure, evaluation of results and optimisation, traffic forecast. Besides various vehicle-based measures, public transport (vehicles and passenger trips), pedestrians and emissions can be modelled. SUMO can be enhanced with custom models and provides various application programming interfaces to remotely control the simulation. Limitations of the platform are related mostly to the network accuracy. SUMO has been already used within several projects. The platform is available for downloading at the Internet homepage www.sumo.dlr.de.

Plenary session IV: Incorporating cycling into a multi- and intermodal transport system – data collection and modelling

Bicycles and public transport – first and last mile challenges and possibilities. Bicycle parking and experiences of providing rental bicycles at stations

Michael Koucky, Koucky & Partners AB, Sweden

Public transport has the drawback of the first/last miles, cycling is however very quick and efficient on shorter journeys. Combining both allows covering a large partner of the city in an acceptable travel time. If you travel further, you are in principally ready to cycle longer to

the station. On the other hand, if you cycle to a bus station people are ready to cycle just for a shorter duration to the stop. In order to connect cycling and PT, you need adequate infrastructure. However often there is no good connection of e.g. the train station to the cycling network. Adequate parking (quality of parking and close proximity to platforms) at stations is needed. Oftentimes it is unclear however how much cycling parking spaces you need. This must be planned early on, because otherwise there is not enough space at stations. From experience, existing parking spaces fill-up quickly. Cycling is not considered in most of the electronic travel planners either. It could however show quite some time-saving, e.g. if people would cycling instead of walking to the next station.

Cycling is less important for egress trips. Bikes are often banned during rush hours, so either you have a second bike or use rental bikes. A test was done by at Boras Station. 40 bikes were bought, and 250 commuters volunteered for the programme. It was much less used than expected – on average 10 to 12 bikes were rented a day. Approximately a third were people renting it for 5 EUR/day. Most bikes were used within a 2 km radius, which confirms the readiness to cycle up to 3 km to/from a station. As a learning, it's not such an important add-on for commuters but more for tourists, leisure/private visits – you do not need a large number of bikes for that. It was pointed out that prioritized parking is the more important issue.

BRUTUS-simulation tool: Examples of cycling simulation in Helsinki and Netherlands, and ongoing multimodal application development

Ilari Heiska, City of Helsinki and Markku Kivari, Strafica Ltd., Finland

As an example for microscopic transport demand models, the Big Data-driven simulation tool BRUTUS was presented together with the examples Helsinki and the Netherlands. The tool enables the simulation of journey chains within one day considering all relevant transport modes as well as their multimodal combination. In addition, the tool is able to integrate demand responsive transport options, a topic that will become increasingly important in the future. As a result, the simulation tool can show exactly how each individual will move in the transport system. Such simulation on an individual level enables highly detailed analysis of the socio-economic effects of policies as well as capacity utilization of PT services for instance.

In the example of Utrecht, the tool was developed with a focus on bicycle traffic; its diverse applications include, for example, the analysis of the effects of various bicycle policies on traffic demand, optimization of winter maintenance of bicycle paths and network analyses for finding missing connections in the cycle path network. Various attributes of the bicycle infrastructure such as gradient, traffic volumes on crossroads and expected waiting times at intersections were used.

In the second part of the presentation, the Fixed Route Finder function was introduced, which can be used to hierarchically optimize a PT network. The goal is to help public transport planners to find optimal roles for fixed transit lines and demand-responsive services (service areas) based on the spatiotemporal characteristics of the local demand, local preconditions and modal characteristics. Using the example of Helsinki, the interaction between different tools and models as well as the results were presented.

Up and running with UNA toolbox for Rhino. Tallinn Bicycle Strategy case study

Raul Kalvo, Inphysica Technology Ltd., Estonia

Raul Kalvo introduced why the toolbox was created and how it was used during the process of developing Tallinn's bicycle strategy. According to Raul Kalvo, the Rino tool is more stable than QGIS. It enables to get very quick interation between different design options to understand what happens on the road between origins and destinations which enables to get probability where people are going what route they are choosing. Currently there are many options to get population data but the main problem is to understand where are people going as there's

no proper data in Estonia. For example workplaces are registered to headquarters and not to locations where people actually work. Therefor when developing bicycle strategy for Tallinn the team drew up one of the potential networks and started to evaluate the number of pedestrians, which street is serving more people, but also how many businesses could be reached with this network. The assessment included:

- Locating the largest shopping centres
- How many citizens live in 2b km radius from the railwaystations
- Then it was looked what is actually going on on the gound – is there enough space to add bicycle roads
- Sketching out locations after choosing the locations
- Prioritizing which of the cycling roads to build first

Innovative Cycling counting methods and data collection approaches

Viesturs Laurs, IE.LA inženieri, Latvia

Viesturs Laurs presented innovative counting methods for the detection and counting of cyclists. The background was the development of a bicycle traffic strategy for Riga. Due to missing counting data, in a first approach it was only possible to estimate traffic flows using origin-destination matrices. He explained that counting methods based on the evaluation of camera data are more reliable than existing technical counting methods such as induction loops, especially for large traffic flows. In addition, they offer the advantage of collecting further qualitative data depending on the particular question, such as whether a helmet is worn, child seats are available or the proportion of electric bicycles. With regard to an increasing variety of mobility concepts such as e-scooters or electric mono-wheels, camera-based survey methods also offer clear advantages. At present, however, these methods are not yet fully operational, and the results are not yet convincing, especially in bad weather conditions and poor visibility.

Utility of Crowd-sourced GPS Data for Bicycle Transport Planning

Stefan Huber, Technical University of Dresden, Germany

During the session on incorporating cycling into a multi- and intermodal transport system, Stefan Huber, research associate at the Technische Universität Dresden, spoke about the benefits of GPS-based and crowd sourced data for traffic planning and modelling. He explained that for analyses and simulations of cycling traffic different data are partially needed, such as surface quality or waiting times, and that these are only insufficiently available. Crowd sourced data have the potential to close these data gaps cost-effectively. In addition, they offer extended evaluation and analysis options compared to static survey methods such as punctual traffic counts. This became clear when the first results of a project with a specially developed app for the greater Dresden area were presented. When comparing the results with data from third-party providers, it became apparent that essential questions regarding data sample and data processing have to be clarified before using data from external providers, as these can have decisive effects on the accuracy and usability of the data. For example, the data from sports apps such as strava or runtastic only represent a fraction of bicycle users, as these apps are only used by a very heterogeneous group of people. In a comparison of different data sources for bike traffic data, Mr. Huber presented the respective advantages and disadvantages and emphasized that the limitations, however, are offset by high potentials of such data.

Panel discussion: The future of intermodal transport planning and modelling

In the last session, the participants of the panel discussed different questions regarding the future of intermodal transport planning. We summarize the key points of the discussion by question below:

Data systems for successful application by their design are large structures: Who should have access to data?

Cities should be owners of the model, but data serve as a public good. By the responsibilities of cities, they usually order data which are provided by companies (business case), or from open sources. Staff members in cities should be trained to know what data are needed. Important is to ensure control on the obtained data for their representativeness and meaningful use (e.g., in case a company can measure higher mobility data close to street or district aimed to increase value of properties there – how meaningful will be these data?). Data from the National offices of statistics are usable, but these are provided on national level. Cities can use them in cases when data are homogeneous over the country, e.g., socio-economic data.

How the future of models can develop: Can model replace emotional decision-making practice?

Modelling is seen as an aid to support the decision making, as there is a wish to make rational decisions. Good model is transparent and able to provide a background as an alternative to expert opinion. Applications of models have a future with respect to infrastructure development in longer term perspective - 20, 30 or 100 years. Although applied in large scale planning, there is a risk to take models as true prediction of future and use the results for infrastructure planning. Models are important to analyse scenarios, but models are not for justifying, e.g., investment strategies. There is a need for critical use of models to analyse future outlooks and to make strategic decisions. It is wished that key factors, i.e., impact of parking accessibility and pricing for parking is incorporated in models. Models for real-time economy can be useful to address every-day decisions, e.g., closed street events. Resources are needed for models to become a real-time application: small town may not have enough budget, and mega-cities can replace modelling for crowd networks and turn to controlling streets.

Limited number of people use transport models, but a lot of people can ask questions on these: Should we simplify modelling to become assessable for wider use (non-specialists), understandable for politicians and bring to better common understanding?

In fact, the question is not about complexity of models but rather on how to show results in assessible way. Modelling should provide the basis complemented by assessment methods. Important is to accept that models are tools and assumptions are always used for a certain purpose. The aim is that everyone shall understand the outcomes. Visualization tool is needed for better presentation of model outputs to avoid the confusion by abstract values. Good visualization can help to communicate with politicians for decision making and general public. Interpretation and communication about the model results is important.

In conclusion:

Modelling is important. The ground is not to help customers, but rather to help mobility ideas getting incorporated in the model. Modelling provides an opportunity to use operational data sets to predict future, but it is not a “crystal ball” and thus accounts for relations between different aspects. In implementation for city development it is time to plan democratization of different modes of transport.

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