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SMART TRANSPORT FOR CITIES AND REGIONS

Creating the sustainable city

Why the fuel cell versus battery argument is self-defeatist; the Middle East's dynamic new cities; shifting the modeshare in Philadelphia

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'Electromobility is not an end in itself. It is a means to reach certain policy objectives'

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Moving pictures

Traffic information: live! Romania adopts a real-time smart city solution, as **Sonja Koesling** highlights

While it is on the DN2A between HârĐova and Crucea the traffic usually flows but cars on Đoseaua Mihai Bravu in Bucharest, Romania's capital, are moving at a snail's pace this Saturday. Traffic info: live! TrafficGuide.ro is the name of the Internet portal that provides real-time information on traffic across Romania and allows those who need to see it what conditions are like on roads like the Đoseaua Mihai Bravu. The technology, which bundles the necessary data and assesses its validity before harmonising it, is called PTV Optima and is a tool that enables dynamic traffic forecasting.

Be it construction sites, road-blocks, traffic jams or accidents – on TrafficGuide.ro, road users can access information about both the current situation on the roads and the average speed at which traffic is moving. The information platform covers all national routes, motorways and Bucharest's main thoroughfares. The Romanian traffic information portal has been sponsored by the European Union and developed by ELSOL – Electronic Solutions, an engineering and consulting firm which specialises in ITS solutions and is working together with ITS Romania to implement intelligent traffic systems in Romania.

PTV OPTIMA AS A DATA HUB

"Our aim was to be able to map traffic information across Romania and to give network operators the ability to observe their road network and manage traffic events using a web-based interface", reports Sorin Dumitrescu, Managing Director at ELSOL. "The project covers 250,000 routes, monitoring a total of around 80,000 kilometres of road."

It was this scale that prompted the company to look for a solution that could obtain traffic data from

> ***It was necessary that the solution should be able to broadcast traffic data automatically, with a minimum of effort, across a multitude of information channels, sorted according to geographical relevance***

several different sources and in a variety of data formats and data protocols. Furthermore, it was necessary that the solution should be able to broadcast traffic data automatically, with a minimum of effort, across a multitude of information channels, sorted according to geographical relevance. PTV Optima fulfilled these requirements.

COMPILATION AND HARMONISATION

To map traffic information in real time, PTV Optima collects data using Floating Car Data (FCD), automatic number plate recognition (ANPR), detector information and reports of accidents and construction sites from the relevant sources. This data is then compared, validated, harmonised and merged. The data sources are dynamically weighted during the harmonisation process to facilitate adaptation to local circumstances.

Thanks to these solutions, PTV Optima can provide traffic managers with a comprehensive picture of speed, traffic densities and congestion across their traffic network. Vehicles equipped with RDS-TMC navigation and Location Tables (LT), developed by ELSOL, will receive the information within five minutes direct to the driver's cabin.

"Thanks to the open framework and the intensive training that PTV Group and its sister company Sistema provided, we are now able to independently connect new data sources and additional data suppliers to our system", says Dumitrescu. "It has lived up to our expectations in every respect."

ELSOL also values the long-term opportunities to extend the system: "With PTV Optima, you can forecast traffic up to 60 minutes in advance", comments Dumitrescu. "At present, our plan to add this module as an extension to our system has not yet become a reality – but it's something we're extremely keen to do."

FYI

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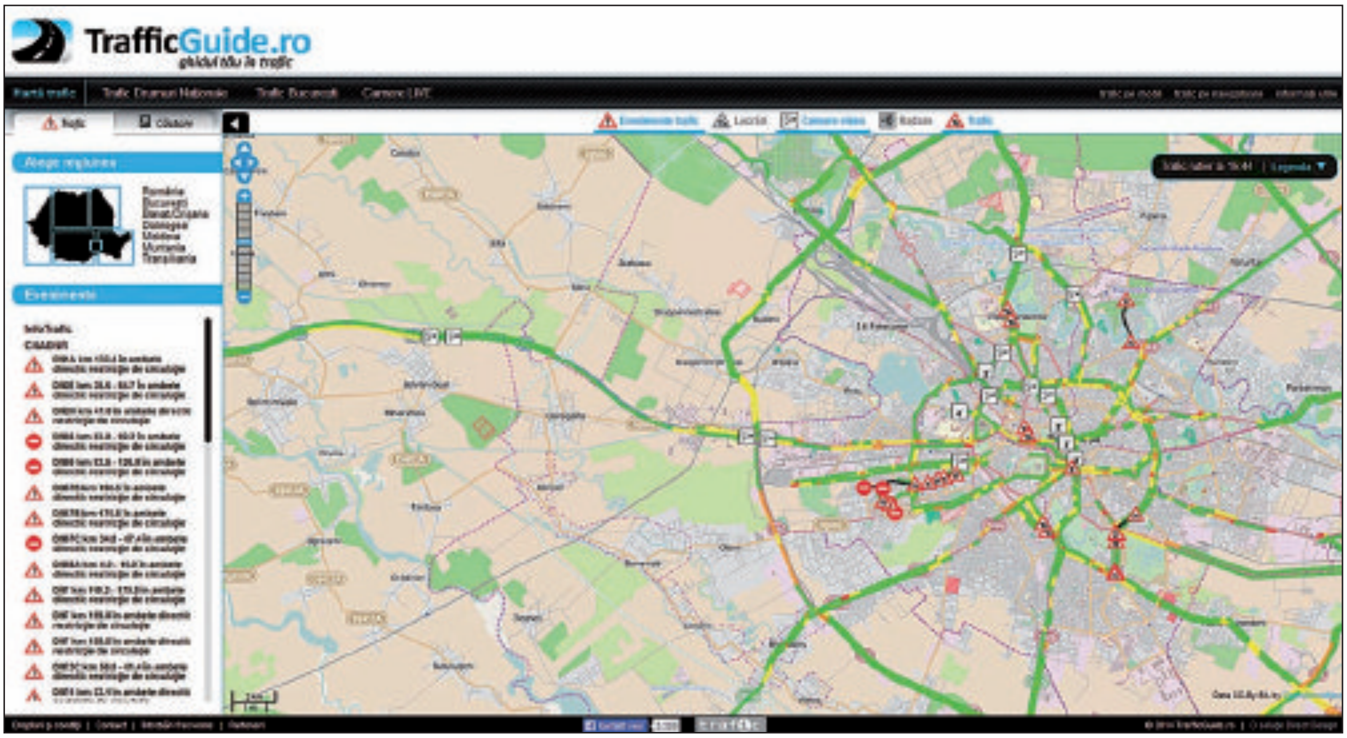

In the background of TrafficGuide.ro PTV Optima is collecting, validating, harmonizing and merging traffic data.

© TrafficGuide.ro

Line drawing

Public transport planning, says **Johannes Schlaich**, needs to provide perfect services all along the line

Today's society has high expectations regarding mobility: It should be powerful, secure, eco-friendly and inexpensive. Public transport has a key role to play in this ambivalent environment[3]. However, not only today's situation is demand, the Public Transport sector is facing major challenges in the future.

A recent survey[2] identified fewer resources and climate change and demographic change as the major drivers for Public Transport in the future:

Therefore, it is important to plan it in an anticipatory and market-oriented manner. However, the design, implementation and operation of public

One of the classic tasks of network modelling is to provide passengers with an attractive line network that at the same time is efficient from an operative perspective

transport systems are demanding tasks. Professional software tools such as PTV Visum assist planners in coping with these tasks. PTV Visum is a comprehensive planning tool that offers detailed planning and analysis functions, easy-to-interpret display options that cover all strategic and operational processes across public transport planning. Important to note is that it is always required to link the transport demand with the transport supply.

DEMAND-BASED PUBLIC TRANSPORT NETWORK AND SUPPLY PLANNING

One of the classic tasks of network modelling is to provide passengers with an attractive line network that at the same time is efficient from an operative perspective. In terms of spatial planning, this means to determine the line routes and transfer points in the network. Temporal planning, on the other hand, focuses on the optimum headway, the coordination of lines and connections between the stops and the analysis of supply in terms of line performance and output.

Users usually import timetable and network data from common systems and use it for modelling the current public transport supply. Network data is imported via interfaces to geographic information systems (GIS) and timetable information systems, such as Google Transit, HAFAS or railML. Moreover, it is possible to import data from different sources, including automatic passenger counting, vehicle tracking and ticketing systems or MS Office. All services can then be displayed and edited in the public transport network editor, in the tabular and graphic timetable.

In order to analyse the quality of public transport services from the passengers' point of view, planners can use transport planning software to combine public transport supply with statistical data of land use, number of jobs and residents. GIS functionalities shall enable the planner to identify how many residents can reach the next long-distance train station within a given travel time, for example. But users cannot only analyse travel times, there are also detailed parameter analyses to visualise transfer frequencies and waiting times for all connections across the entire network.

How attractive new lines, new connections or more frequent services actually are for all passengers and whether these changes will have the effects and impacts desired can best be judged by modelling demand by means of an origin-destination matrix. Such matrices can be created on the basis of public transport survey data or a multimodal demand model, such as the classic four-stage algorithm. The latter models all passenger choices in both private and public transport – from the choice of the destination to the transport mode and transport connection. This also allows planners to calculate the changes in modal split caused by improved public transport services.

ATTRACTIVENESS – A MEASURABLE BENCHMARK

One can differentiate between three assignment methods that identify possible connections of the passengers for each origin-destination pair and then assign the demand matrix to these connections.

The simplest one is the transport system-based assignment, a quite pragmatic approach to conceptual public transport network planning. It does not include any timetable data and does not even require a line network, however it allows users to differentiate between road- and rail-bound transport. Based on demand matrices it models the desired network from the passengers' perspective. This so-called "what-if scenario" indicates which public transport options passengers would chose to travel from the origin to the destination, if they were not limited in their choices.

If there is a timetable, there are two additional assignment methods – the headway-based and timetable-based assignment. The timetable-based assignment is often used for timetables with high and regular frequency services. Moreover, it enables planners to create impact analyses of long-term planning scenarios, such as transport master plans which, due to efficiency reasons, do not require detailed timetables to be modelled for each scenario. However, precise information on transfers cannot be included in the assignment without timetable modelling. Nevertheless, users can assign pre-defined transfer times to specific transfers. This includes transfers between regional trains and buses, which can usually be scheduled quite precisely.

The timetable-based assignment offers the highest level of detail. It allows for fine-tuned planning and analyses including complex transfers and connections. This means planners can realistically model various effects, such as transfer waiting times and analyse measures for optimising individual stops.

Another important factor for connection choice may be the effects of capacity constraints in the assignment. As a result, overcrowded lines

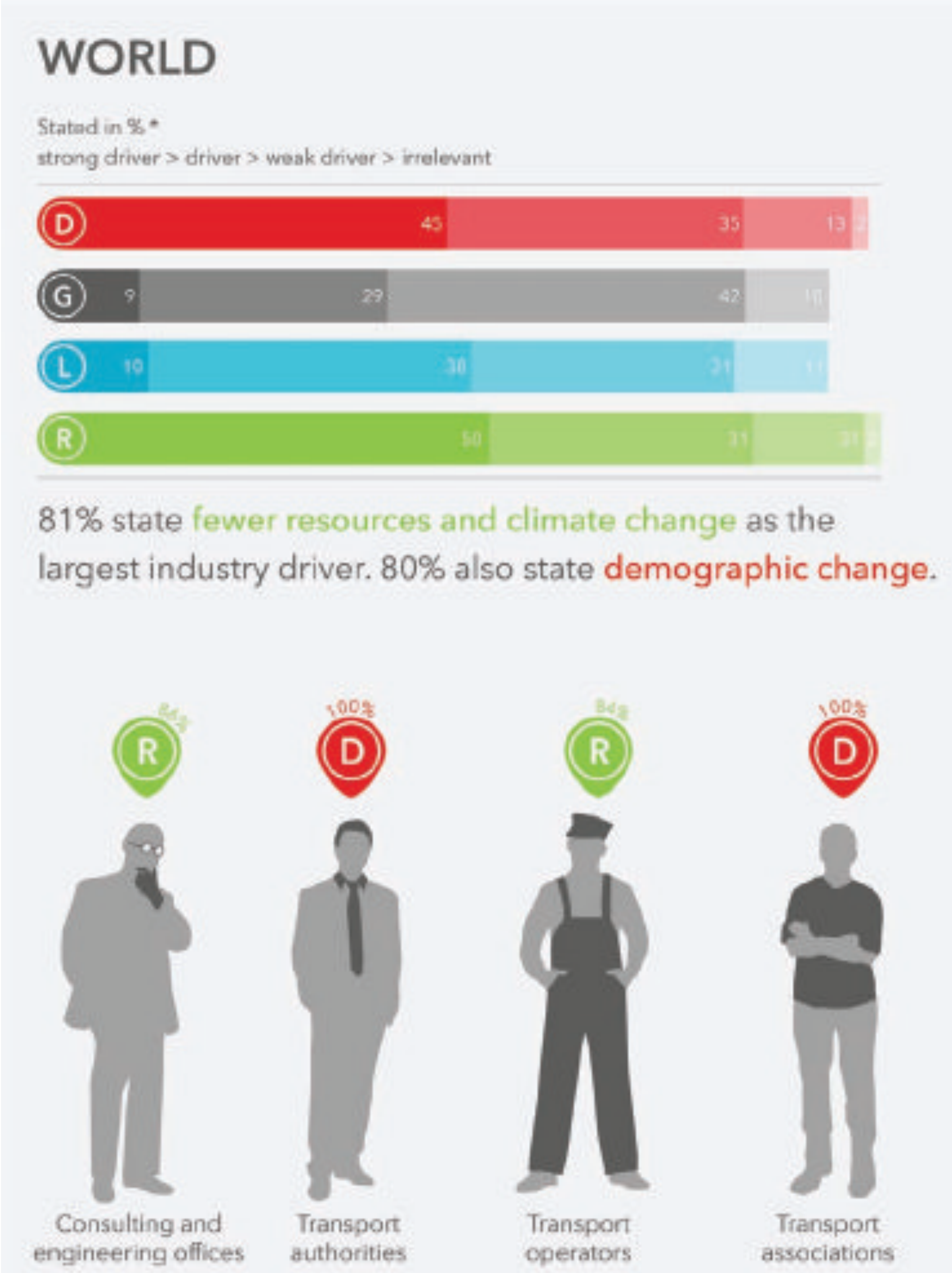

Figure 1: Drivers of future Public Transport planning [2]

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Another important factor for connection choice may be the effects of capacity constraints in the assignment. As a result, overcrowded lines become less attractive due to the large amount of passengers

become less attractive due to the large amount of passengers. Just like in reality, in the model, passengers switch to less crowded modes of transport. From a technical point of view, the capacity constraint is included in the impedance calculation of each connection, in addition to other attributes such as travel time and transfer frequency. This additional component can eg be a function of the assumed standing minutes on a bus or train. The seats are randomly allocated to the passengers for each stop section – a procedure which is quite similar to the popular children's game of musical chairs.

FARE MODELLING

Capacity utilisation of individual connections is not the only parameter that can be included in the impedance calculation during the assignment. In addition to the classic parameters, such as journey time, waiting time and transfer frequency, it is also the fare which may play a major role. As tariff structures are often complicated, a software tool shall allow users to model any type of fare and tariff model in all their facets including dependencies. This, for example, means multiply-counted zones for a city centre can be combined with short-distance tariffs or transitory tariffs for different transport associations.

If fare prices have been modelled in detail, they can be accounted for during assignment. The assignment method then shows how tariffs influence the passengers' route choice. Consequently, only a few people will take an expensive high-speed train for travelling a short distance if they can take a cheaper local train instead. Moreover, users can analyse the impact of fare changes on revenue. It thus allows transport associations and authorities to check how profitable it is to change a fare or introduce a new ticket type and what is the right price of the ticket to secure revenues.

Once fares are modelled, users will expect that the software calculates revenues distinctly. In other words, it should be broken down into different areas (eg transport associations, districts) as well as displayed on the basis of different aggregations (e.g. lines, operators). Flexible revenue distribution models shall enable users to evaluate several performance-based distribution schemes for several operators serving a transport association.

According to a recent survey[2] cost pressure is a major driver or regular modification of the Public Transport network. Beside the revenue estimation with fare and demand modelling, an importation factor for a cost-efficient Public Transport is the vehicle cost. In order to estimate the number of required vehicles for a scenario, vehicle scheduling (also known as line blocking) is required.

For a complete line costing and revenue calculation, which assesses the profitability and cost coverage of an entire public transport network or its service units, it is also necessary to determine the costs of infrastructure and operations[1,4,5]. An important basis for cost calculation is the number of vehicles required. For this the vehicle scheduling process is crucial. There are two approaches for this task.

VEHICLE SCHEDULING

With a basic line blocking, the planner himself defines the vehicle types of his choice. The automatic line blocking procedure completes the process on the basis of the timetable

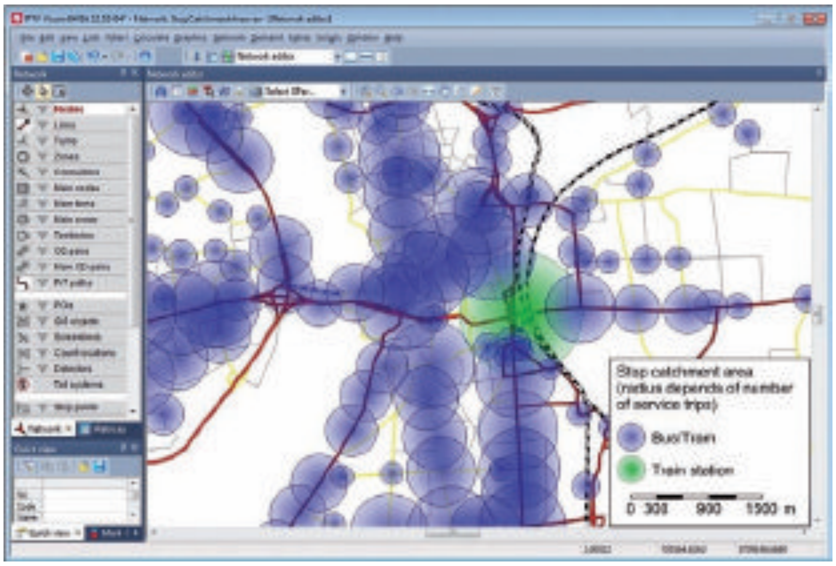

Figure 2: Simple analysis of public transport supply based on stop catchment areas

while following user-defined rules. In this context, depots and their capacities are explicitly taken into consideration. Journey-specific preparation and completion times as well as additional activities such as refuelling or cleaning are included as well.

Detailed line blocking provides greater room for manoeuvre. Planners can model forced chaining or optimise the use of vehicles by also taking alternative types of vehicles into account. Instead of selecting a specific vehicle type, planners can then allocate a number of different vehicle types to the trip. The optimisation procedure then chooses the type that ensures a minimum deployment of vehicles. Here, it is again possible to integrate demand. To permit demand-optimised vehicle deployment, the vehicle choice is based on the capacity of each vehicle type in terms of passenger volume generated during assignment or using survey data. At this stage of the planning process, graphical formats such as block diagrams of line blocking results (see eg Figure 3) also assist planners in identifying and developing the network's optimisation potential in terms of profitability.

COMPACT VIEW: THE SCHEMATIC LINE DIAGRAM

Visualisation of results is essential for the success of Public Transport planning. A schematic line diagram provides an important visualisation option (see eg Figure 4). Using the schematic line diagram, planners can abstract the network according to their needs. The schematic line diagram visualises the network relationships and gives users an ideal overview of transfer stops. A wide range of graphical parameters and labelling options provide the information required.

Stops are displayed as boxes to which users may add timetable details. Information on arrival and departure times for all lines is thus provided at a glance enabling planners to ensure services with regular headways across several lines. The links between the selected stops are displayed as edges. Lines, transport systems, and service frequencies can be classified by using bars of different colours and different types of dashed lines.

> ***Flexible revenue distribution models shall enable users to evaluate several performance-based distribution schemes for several operators serving a transport association***

Figure 3: Block diagram: schematic display of the line blocking results.

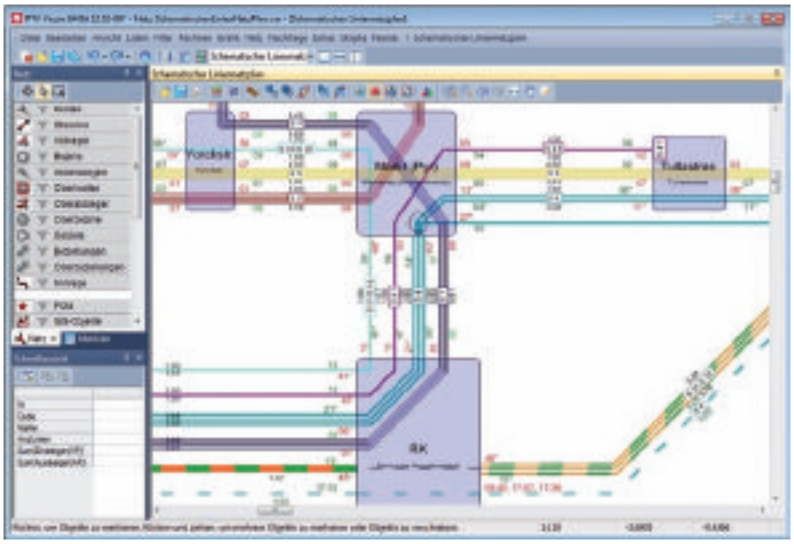

Figure 4: The schematic line diagram provides users with detailed information on stops and routes at a glance

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