Using Trip Planners in Developing Proper Transportation Behavior

Grzegorz Sierpiński, Ireneusz Celiński, Marcin Staniek

Abstract—The article discusses multimodal mobility in contemporary societies as a main planning and organization issue in the functioning of administrative bodies, a problem which really exists in the space of contemporary cities in terms of shaping modern transport systems. The article presents classification of available resources and initiatives undertaken for developing multimodal mobility. Solutions can be divided into three groups of measures – physical measures in the form of changes of the transport network infrastructure, organizational ones (including transport policy) and information measures. The latter ones include in particular direct support for people travelling in the transport network by providing information about ways of using available means of transport. A special measure contributing to this end is a trip planner. The article compares several selected planners. It includes a short description of the Green Travelling Project, which aims at developing a planner supporting environmentally friendly solutions in terms of transport network operation. The article summarizes preliminary findings of the project.

Keywords—Mobility, modal split, multimodal trip, multimodal platforms, sustainable transport.

I. INTRODUCTION

CONTEMPORARY populations in large settlements on the world account for a large number of trips during a day by a statistical inhabitant. In some professional groups it amounts to 20 trips a day [1]. Mobility of inhabitants in urban areas during a day has been steadily growing in the past two decades [1]. The number of available means of transport has been growing accordingly. Usually, in the existing network, apart from buses, we have trams, trains and metro. New means of individual transport started to appear, such as electrical cars, electrical bicycles and other. Such mobility, with growing dynamics and spatial variety of trips, requires a rational transport system management [2]-[4]. Uncontrolled or inappropriately manager development of transport networks and transport behavior result in negative impact of transport on its environment. A frequent phenomenon, especially in city centers, is high congestion [5]-[7]. It is also possible to point out other negative consequences, such as increase in noise level, emission of noxious substances to the environment and deterioration of road infrastructure assets. A growing use of non-renewable resources is yet another important issue. In this

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context, the existence of a certain information entropy in transport systems is rather rarely discussed. It can be seen in applying various tariffs, lack of cohesion between tariffs and time schedules used by various transport companies, frequent changes of routes used by means of transport, etc.

The above issues necessitate goal oriented and coordinated measures at various levels and of various nature as regards changes of the transport system, approached holistically. However, key measures in this respect; according to EU guidelines [1], [8]-[12], should take into consideration take into consideration such issues as changing of transport behavior. Firstly, it should lead towards environmentally friendly travelling (as regards users of transport network). Secondly, it should involve implementation of technical measures improving traffic of certain types of means of transport [13]. Both types of measures aim at changes in modal split [14] and sustainable development of transport (or its approximation). The article focuses on the first aspect of the issue – changing transport behavior by people travelling. The change is to be achieved by providing relevant information to travelers concerning real alternative possibilities of travelling in the transport network while rationally using all its resources. This puts order into trips of stochastic nature prevailing in the transport network. It is worth mentioning that by providing more information (than usually) to users of the transport network about other possibilities of travelling, users make more knowledgeable choices from a set of interchangeable and complementary ways of travelling. This way (within existing technical and organizational solutions, e.g. ITS, Intelligent Transport Systems) it is possible to promote development of transport behavior. In long-term planning and in reference to a larger group of people (inhabiting certain area), this should produce measureable results in the form of improved modal split, a change aimed at environmentally friendly choices made by travelers. It also enables using existing reserves in transport networks (mainly in public transport) and at the same time reducing traffic intensity at specific cross sections where at the moment the capacity is exhausted. Such a change in modal split is important in the context of EU guidelines: 'reducing negative impact of transport on the environment cannot be achieved by limiting mobility' [8].

II. MULTIMODAL TRIPS

A multimodal trip involves using more than one mode of transport or a specific mode and travelling on foot within a specific stretch other than exit and access route to a public transport node. Multimodal trips can be made using any

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modes of transport, including on short distances on foot or by bicycle. In order to implement an effective multimodal trip, access to information about possible alternative trips and convenience of services is crucial. It is related to properties of information systems in transport networks. A major division, frequently referred to in literature (while referring to land transport) [15]-[17], includes: travelling on foot, by car, public transport and by bicycle. While using such a modal split of traffic, the analysis covering 318 European cities in 2001-2011 shows significant increase in trips made by bicycles, and at the same time reduced use of individual cars (Fig. 1). It is worth mentioning that the further east and north we move in Europe, the use of such a multimodality becomes more troublesome.
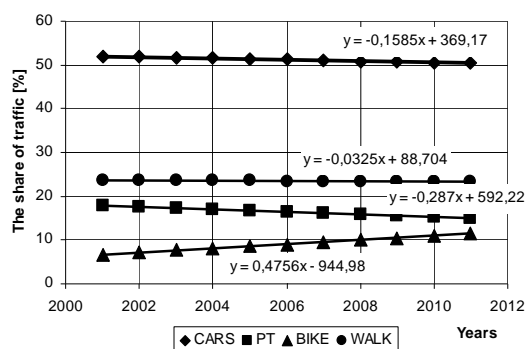

Fig. 1 A comparison of the trend lines for the share of various mobility methods in traffic [18]

In managing transport networks, an individual car has been considered the least environmentally friendly. More common use of new means of transport implies the need to introduce changes in the transport system. Environmentally friendly niche solutions can also be found in individual cars, e.g. electric and hybrid cars (Fig. 2).

Scooters, electric bicycles and micro scooters, etc. can be frequently seen in transport networks (Fig. 3). In the Upper Silesia Agglomeration, the authors noticed a new trend among young people, namely using public transport for transporting folded two wheel vehicles.

At the same time, new organizational solutions brought major changes in the modal split of traffic into individual and public ones. A good example is bicycle, which from a means of individual transport turned into a co-use of public bicycles (bicycle rental [19]). A similar solution applies to city cars (which can be rented) [20]. For this reason, a widened division of modal split seems more appropriate [21]:

– on foot,
– other than foot:
o individual transport
▪ private (bicycle, motorcycle/motorbike, passenger car)
▪ public (city bicycle, city car)
o public transport
▪ bus
▪ tram
▪ trolleybus
▪ metro
▪ fast urban train

▪ ferry
▪ suspended trains
▪ monorail and other.

Fig. 2 Electric car Nissan leaf, on the street, Mikołów, Poland, August 2014

Fig. 3 Electric bicycles rental in Zakopane, Poland, August 2014

Nowadays, multimodal trips more frequently include a stretch covered by air transport. This applies especially to domestic flights in countries of more developed air transport infrastructure.

Directions for developing transport systems defined in various EU policy papers (e.g.. White Papers [11], [12]) highlight the need to increase multimodal trips. Those documents stipulate directly the requirement to secure conditions supporting planning and implementation of transport based on chains using various environmentally friendly means of transport. Initially, the idea was to use individual cars to travel to a transfer point (Park&Ride) and then continue with public transport. There are also instances of using combinations such as bicycle and public transport. In the Upper Silesia Agglomeration, Poland, some buses is converted to provide an opportunity to transport bicycles (operator: PKM

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Jaworzno). The authors noticed that where it was not possible, other solutions were used. For example, there are instances of using folded bicycles transported in passenger compartments in buses or trains (when folded). A trip like this may involve a number of configurations (Fig. 4).

A traveler who has an individual car chooses it for various reasons. The point of view presented by such a person while choosing a way of travelling is egoistic. Subjective factors and the choice are based on a conviction that the trip is going to be more comfortable, faster and safer than traveling using public transport. This may also happen when the public transport is really competitive or having better traveling parameters than an individual car. On the one hand, on order to change their behavior, such people need to receive relevant information concerning actual social consequences of such a behavior. On the other hand, they need to obtain information concerning benefits derived by changing their previous patterns of traveling.
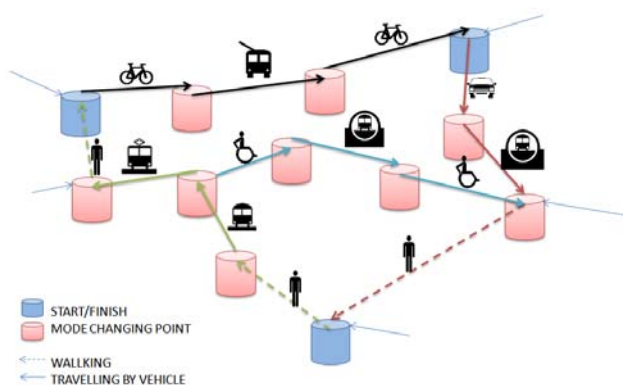

Fig. 4 Examples of multimodal travels

Shaping transport behavior is difficult. It may start with choosing a method of analyzing the transport network, traffic modelling, artificial intelligence, behavioral studies, etc. Sociological, psychological and other factors play an important role in the process. Thus, it is a problem of interdisciplinary nature. To change their behavior, a traveler needs to receive reliable information about the transport system in a given area. Frequently, the reason for bad transport decisions as regards public transport as regards individual travels is mere shortage of knowledge. This includes information about alternative means of transport for each trip. It is difficult, however, to obtain such information since there is no synchronization between public transport carriers. Additionally, a traveler should be informed about consequences for the transport system of his or her negative decisions. This can be implemented by providing periodical balance of time lost, use of non-renewable resources, etc. for individual users of means of transport. Paraphrasing a well-known quotation we may conclude as follows: 'To drive or to multimodal trip live'. The approach is not possible, however, without meeting several conditions, including:

– building of trip planners integrating resources within transport systems (planned to be multimodal),

– building of integrated systems for analyzing the transport system based on using individual planners.
– integrating services in the transport system while diversifying them at the same time.

III. TRIP PLANNERS

One of key solutions for Intelligent Transport Systems as regards information provided for travelers is a trip planner (e.g. in [22]-[26]). A trip planner enables choosing, visualizing and comparing possible travels, as well as supports their implementation in a given transport network between two specific points while using a chain consisting of one or several means of transport. A multimodal planner would enable travelling while using more than one means of transport to reduce the environmental impact of a travel. Such an impact is measured in the form of a footprint for an individual travel. The planner should be available at any location in the transport network, which in practice requires their implementation on mobile platforms (smartphones, navigation systems, consoles, virtual reality glasses, etc.). The travel in question should meet preferences of transport system the client (time, desired means of transport and other), and at the same time provide for the most efficient use of resources available in the transport system. Some basic functionalities of the solution include:

– module providing information about lines and time tables of collective public transport in given area (frequently GTFS standard [27])
– module converting names to specific locations (converting array of characters written by user into geographical coordinates of specific buildings or streets)
– routing module, namely algorithm (or set of algorithms) setting optimized route from A to B according to required criteria and available transport system resources and public transport carriers (including dynamic and selective routing)
– module converting information about route (obtained from routing) into messages understood by user (e.g. go straight, in 200 m turn left, etc.).

The functionalities can be extended and modified. For example, the module integrating the planner with the Traffic Control Management is an important ITS solution, which enables planning of the transport system (routes for public transport) and its control (traffic lights control) in real time. People managing traffic can influence results shown by planners at the level of end user and the operation of the entire system depends on the current utilization of the transport network. Information about travels can be obtained using data exchange with mobile equipment (e.g. in [28]-[30]), and detecting equipment used in the transport network [2], [15], [31]-[34]. As we can see, planners may become important and useful solution for people travelling and local governments alike. Planners have different possibilities of classifying routes by defining one or several criteria. Most frequently the user makes a choice between the fastest and the shortest route. However, there are also more complex solutions. For instance,

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multimodal planners define the most environmentally friendly routes.

One of indirect tasks of the Green Travelling Project (GT) [35], described in greater detail in the next section, was the analysis of existing Open Source planners and choosing the most appropriate one for implementing multimodal trips and actually this one will be further developed during the project. Below presented are findings of the comparison involving several out of several hundred planners analyzed.

IV. SELECTING TRIP PLANNER

A trip planner is a system solution (developed in different technologies) that enables selecting an option for your trip in the transport network. A multimodal planner enables selecting a trip consisting of several stretches with the use of at least two modes of transport or one of prevailing stretches is covered on foot. The planner platform is a programing environment (set of programing tools) with planner modules, data about the transport network, transport service companies, and servers that enable remote implementation of the planner for various transport networks. The trip planner is used in a specific transport network and its implementation is local and unique. To be generally available in any transport network, the planner needs to be programmable as Open Source [36]. Such a planner should be based on a platform that enables several options and modifications adjusting it to conditions in the local transport network and specific requirements. Possible requirements include e.g. multimodality. This applies to the layer of data, API (Application Programming Interface) and routing algorithms used in the planner. In the world, a large number of planners is used but one some of them meet conditions specified above. The majority of planners is commercial and implemented for a specific area of the transport network or selected carriers. Such planners have been rejected due to the objectives of the GT project, since the project focuses on building a planner which is open and generally available.

Additionally, the project looked for planners which can be considered complete and comprehensive – platforms integrating all tools necessary for building and implementing it in a given transport network. It means that a single software package should integrate all available functionalities of large, multimodal transport networks. The planner should also be flexible and modifiable.

After a research among existing OpenSource platforms/planners, we selected 15 out of hundreds of OpenSource or partially free products (e.g. restrictions applied to side of transport networks maps). The list of planners defined by the authors as Open Source is presented in Table I (in some instances they may include paid services).

Yet another criterion for analysis was the availability in public domain of information about a transport network for the planner, source code and technical documentation. The majority of planners used such data formats as OSM (Open Street Map) and GTFS (General Transit Feed Specification), so the criterion was met by many of planners.

TABLE I
OPEN SOURCE PLANNERS FOR DETAILED ANALYSIS

No.	Planner name	Internet address of the trip planners
1	HSL Navigator	http://www.reittiopas.fi/en/
2	HERE Nokia	http://mapy.interia.pl/directions
3	Open Trip Planner	http://www.opentripplanner.org/
4	Navitia	http://www.navitia.io
5	Graphserver	http://graphserver.github.io/graphserver/
6	OSRM	http://project-osrm.org/
7	ORS	http://openrouteservice.org/
8	Yours	http://wiki.openstreetmap.org/wiki/YOURS
9	Cycle	http://www.cyclestreets.net/
10	Routinio	http://www.routino.org/
11	BIKE	http://www.bbbike.org/
12	RUW	http://www.wanderreitkarte.de/
13	Graphhopper	http://graphhopper.com/
14	Pyroroute	http://svn.openstreetmap.org/applications/routing/pyroute/
15	Skobbler	http://maps.skobbler.co.uk/

Source: Own research.

TABLE II
SELECTED COMPLETE REPOSITORY AND PUBLIC (NOT NECESSARILY FREE) OPENSOURCE PLANNER PLATFORMS

No.	Planner name	Remarks
1	Open Trip Planner	
2	Navitia	Planners in table are selected as potential substitution to OTP platform since they are complete, multiple implementation, functionalities, full accessibility and openness. Table I lists all potential free platforms, however some of them have limited licenses in terms of data transfer (Nokia platform) or selected components (ORS). It means that platforms may have only partial application in open platforms.
3	OSRM	
4	Yours	
5	Routinio	
6	RUW	
7	Graphhopper	
8	Pyroroute	
9	Skobbler	

Source: Own research.

A planner which is the most appropriate for further modification needs to meet also other criteria – e.g. free and available source code. This requires web based resources to archive the planner's code, which needs to be complete, free and written in one of popular programing languages. Despite what was initially declared by planners developers, this criterion became a barrier for many of them. After examining repositories documenting a planner, the number of planners was significantly limited to just several ones. Table II presents a list of planners:

- capable of using public data about transport network and schedules,
- open and having public source code for routing algorithms,
- having public repository containing complete platform, and
- provided with technical documentation.

The level of sources for planners presented in table varied as regards their capacity and quality. There are significant differences between planners which comply with the above criteria from the point of view of their future use. Differences apply among other to the following:

- programming language used in source code (in fact selection of such languages),

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- different routing options (number of routing algorithms available and implemented functionalities),
- integration of various modes within platform (multimodality),
- environment (operating system).

The programing language is not a strict criterion for selecting a planner. It is just a technical issue. The majority of planners is based on solutions integrating several programing languages at the same time, such as Java (including scripts), PHP, Phyton, C++ and other. Different languages are used for different functionalities. As regards routing algorithms, Java and C++ as well as other languages can be used. A superior criterion in the case of a routing option is multimodality of a trip planner. This applies to the number and means of transport integrated in a platform. This functionality determines all layers of a planner, from data structures, through routing algorithms, to routing options. The least important is the API layer, which is a mere graphic interface.

After examining multimodality of trip planners (and taking into consideration their previous analysis of accessibility), the authors focused on only one trip planner, namely the Open Trip Planner. The quality of the planner has been confirmed by its implementation in the form of TriMet (Fig. 5, [37]). This popular planner used in Portland, United States, is based on the Open Trip Planner platform.

The OTP platform meets all project criteria. It is based on an open data code for trip planning (OSM and GTFS). It has source codes for routing algorithms (Dijkstra and A* [38], [39]). It also has a special routing module for specific RAPTOR networks. The repository [40] contains source codes and documentation. The documentation in the GitHub repository includes development stages of the planner beginning with the oldest versions. The planner also has a WebAPI layer implemented. The planner has been verified through several implementations in different countries in the world. Initial tests of the OTP platform for a dense transport network in the Upper Silesia Agglomeration, Poland, were successful, thus providing a good basis for developing a multimodal planner.
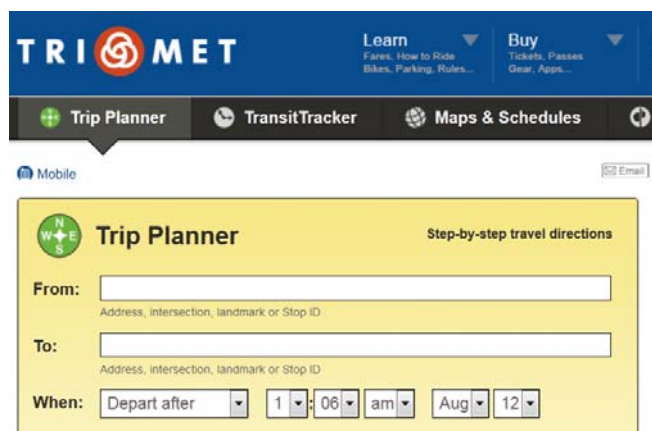

Fig. 5 TriMet multimodal trip planner

Several planners analyzed in the project can be quickly

adjusted to requirements of a generally available and open trip planner. Planners usually miss multimodal options. Such planners are presented in Table III. One may expect that a number of planners of limited accessibility will become public domain, e.g. HERE Nokia.

Comments in Table III regarding existing trip planners are provide a subjective overview. The need of implementing multimodal functionality is crucial. It has a major influence on functionalities of each platform layer. Moreover, such an option is necessary for implementing trip planners due to the need to balance the development of transport as regards efficient use of transport systems. Trip planning using planners with just one mode (mean of transport) is only like a simple navigation in the network. Network management and rationalizing trips are supported by multimodal planners. Moreover, these are planners using all available modes of transport in a forgiven area.

TABLE III
SELECTED OPEN SOURCE PLANNER PLATFORMS QUICKLY ADJUSTABLE TO OTP PLATFORM FUNCTIONALITY (ADVANTAGES/DISADVANTAGES)

No.	Planner name	Remarks
1	Navitia	Limited documentation/development capacity
2	OSRM	Not suitable for servicing public transport, GTFS, no service for mobile devices
3	ORS	No service provided to public transport, GTFS, suitable for handicapped people, incomplete OpenSource
4	Yours	No GTFS service, problem with update, no service for mobile devices
5	Routinio	Stable platform, several development versions, service for handicapped people, no service for mobile devices
6	RUW	Example of specialized platform, based on using external sources
7	Graphhopper	Good documentation, wide selection of platforms, low evaluation versions (development platform)
8	Skobbler	Limited number of platforms (iOS, Android), more of navigation than planner platform

Source: Own research.

Another step is the modification of existing routing solutions in the platform to integrate all available modes transport in a given transport network. It requires modifying the structure of data and changing heuristic routing algorithms.

V. SUPPORT FOR MULTIMODAL TRIPS - GREEN TRAVELLING PROJECT

According to the analysis above the ever changing transport systems and technological advancement require continuous development of new trip planning platforms. In this particular case, different modes of transport in the transport network as mentioned at the beginning of the article, including locations for renting bicycles, charging points for electric cars, as well as area-specific organizational solutions, universal tools used for trip planning do not meet all requirements. Considering the above and directions for development and guidelines included in EU policy papers, an idea was coined to provide support for people planning their trips and local governments defining proper directions for sustainable development of transport in the Green Travelling project implemented under the ERA-NET Transport III programme. The project involves institutions from three countries: Saitec, Factor CO2 and

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DeustoTech (Spain), Silesian University of Technology (Poland) and Mantis (Turkey). Those issues are dual in their nature. When confronted with trends and EU guidelines as regards sustainable transport they lead to implementing two basic products of the project [35]. The products should help eliminating or reducing barriers for an optimized modal split. The first one of them is a public trip planner based on using all modes of transport available in a transport network, as support for travelers. It is expected that a planner of this type should promote environmentally friendly travelling. The second of the products is a multimodal platform. It is a tool supporting local governments as regards selecting relevant measures and initiatives (applicable strategy) for meeting the need of multimodal trips. The tool should use environmental factors pertaining to trips in a given transport network. Since the article analyses the flow of data to a traveler, authors focused only on the first of the two project products.
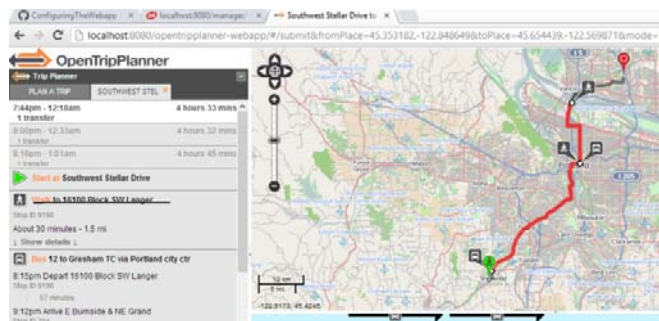

Fig. 6 Trip example from OTP (original Portland Network)

An important part of multimodal planners is the set of data used as a basis for implementing an algorithm setting an optimized route. In this particular case, the user should be able to select one from a number of options available in the planner. Planners use a large variety of data. Some of them are necessary to determine the route, whereas other are optional and improve functionalities of those planners. IN general, data used in planners can be divided into input data defined from the level of the planner (trips graph) and input data defined by the user. The output set comprises output data pertaining to routes, determined according to user's preferences. Such data include influence of trips in a given transport network on the natural environment (CO_2 footprint)

The structure of input data in the form of a graph is a key element of a multimodal trip planner. It should ensure effective access to various sets of data supporting quick and precise optimization of routes. The structure mainly covers two sets of data: transport network including cross roads and specific roads, and public transport network with routes, stops and schedules. Information about the road network is provided in the form of a graph with data concerning location of roads and cross roads, or nodal connections and nodes. At the same time, elements of the transport network are described with attributes: permitted speed, speed limitations, limited gauge, accessibility for various modes, permitted maneuvers e.g. U-turns. Attributes (large in number) and actual or statistical data concerning traffic conditions (frequently in real time) enable

calculating the following: cost of travel, traffic parameters (average speed), expected travelling time for specific routes, and impact on the environment. This set of data also includes data not used by the routing algorithm, e.g. data concerning type of road or number of lanes.

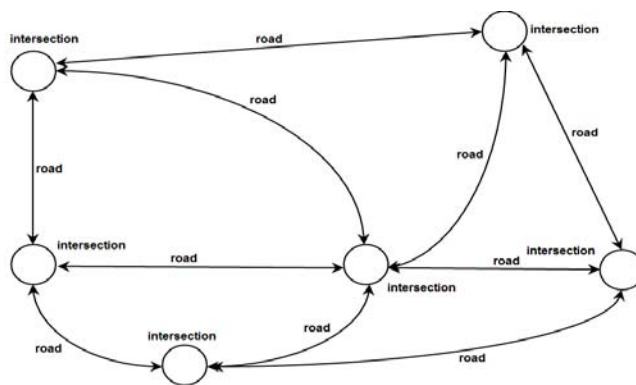Fig. 7 presents a part of a road network with certain elements.

Fig. 7 Example of network scheme

The figure includes a directed graph, which aims at examining one-way streets. Using a non-directed graph requires defining an additional attribute for determining traffic direction at a given route.

A public transport network is another complex set of data in the form of a graph. The graph is more complicated, since it contains relations between stops and service times. Data concerning public transport services include: (1) location of stops, stations, transfer centers, and Park&Ride facilities, (2) solutions for integrating modes of transport, and (3) schedules for particular stops along specific routes.

There are two popular methods of describing the trip graph for public transport: Time-Expanded Approach (TEA) and Time-Dependent Approach (TDA)

TEA is based on defining the graph as a set of points (nodes) describing incidents in time (arrivals, departures) at stops, and connection between points (nodes) describe travelling between consecutive stops or waiting between consecutive partial trips. A disadvantage of the solution is the spread of the graph which depends on time-expanded incidents, in other words all possible stops in the public transport network. Additionally, it is difficult to take into consideration changes of schedules (delays) in the graph and thus the graph needs to be built anew. A major advantage of the method is the use of the shortest route algorithm to determine a route. The second TDA method is less complex in terms of calculations since the graph does not include time dependencies in a selected node. It is, however, a problem when calculating cost of bends between nodes, a cost which in TEA was eliminated by describing time dependencies in the graph. In the transport system where public transport services are provided in regular intervals, TDA is the most advantageous.

Data about Park&Ride facilities are important for developing a graph applicable to multimodal trips. Such data

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enable integrating public and private transport and information concerning use of roads and streets to incorporate travelling on foot or by bicycle.

The set of input data defined by users include:
− departure point where trip starts.

Information about location is based on geocoding and is defined using one of the three solutions below:
o (1) geographical longitude and altitude based on GPS or interactive GIS maps,
o (2) street database, and
o (3) database registering Points of Interest.
− destination point. Information about location is obtained similarly to information about departure point.
− mode of transport; in this particular case user defines one or more preferred modes of transport. The planners examined cover the following modes:
o walk,
o bicycle,
o motorcycle,
o car,
o bus,
o tram,
o trolleybus,
o train,
o metro,
− departure or arrival time, where user defines time when trip starts from current location or time when trip ends – expected arrival time.

Additionally, the planners enable defining parameters related to user preferences while setting the trip. These include:
− average and maximum speed when travelling on foot,
− average and maximum speed when travelling by bicycle.

The multimodal function requires the user to define additionally:
− maximum distance for accessing public transport stop,
− maximum time of waiting for means of transport and transfer,
− maximum number of transfers during trip.

While defining the structure and set of data for the multimodal trip planning algorithm, the following objectives for optimizing the route should be taken into consideration:
− fastest trip,
− cheapest trip,
− safest trip,
− minimum transfers,
− no transfers (single mode),
− most green trip,
− shortest distance on foot,
− return trip.

For the return trip, it is necessary to define additional functions, such as traveling time to destination or time of departure.

The structure of input data should include information about the cost of using different modes of transport. As regards public transport, the data include information about zones and

tariffs. The cost of travelling by car include cost of fuel, zones and parking fees, and fees for travelling on particular stretches and elements of infrastructure. The cost data are supplemented by the cost of renting bicycles, vehicles, including electric cars.

Considering safety and comfort, the set of input data should define status parameters, e.g. small suburban traffic = safe travelling, main road = limited level of travelling safety, motorways = no access which is important for travelling on foot and by bicycles. Information about land configuration, including heights above sea level which enables planning trips to cover the least burdensome stretch on food or by bicycle.

Information about road incidents and traffic parameters in real time is another important issue improving functionality of a multimodal trip planner. Such data should cover information about road works, track works, accidents and collisions and other limitations to traffic. The data need to precisely define locations and scope of an obstacle and expected duration of disruption. Unfortunately, information about road incidents and traffic conditions require an ongoing access to a database.

VI. CONCLUSION

Promoting certain behavior among travelers is a research challenge. In the longer term perspective, it may have a positive influence on traffic flows (global approach to individual trips) and modal spit in a selected area. It should be noted, however, that currently without accessing clear and complete information about modes of transport available users of the transport network will not change their egoistic travelling behavior. Every transport network includes modes of transport and other resources which are not used efficiently. Reasons of the situation are less important, but this needs to be changed. Efficient use of resources should be understood as justified and purposeful linking of various modes to implement individual trips in the transport network. Trip planners, being one of possible solutions, may contribute to the goal. The comparison of planners presented in the article shows that despite apparently large number of planner platforms, only limited number of them is fully available to the public. This applies not only to the licensing policy, but also physical accessibility of resources in repositories of specific planners. Actually only one planner bodes well for building a multimodal and accessible planner.

The objective of the Green Travelling Project (GT) is to develop a trip planner which enables incorporating several different measures contributing to sustainable development of transport. The first one of them is building of an available and common trip planner, a planner which enables integrating all available modes of transport within a given transport network. Such a planner should also be a basis for local governments to develop sustainable transport systems.

As shown in this article, very important in the trip planner construction is to get data about the transport network and public transport (like schedules, number of lines, routes etc.). Despite various sources available, in order to be acquired such data require much field studies and large scale inventory.

The Green Travelling Project offers new possibilities for

changing transport behavior by expanding functionalities of trip planners and drawing special attention to environmentally friendly travelling and multimodality. According to EU guidelines, the two aspects should be further developed in the future (in line of EU policies until 2050).

Summarizing the research, we may imagine a transport system of the future in which every user is supported in an interactive manner in the transport network, a network in which particular interest of specific groups of users are not considered important, and rational use of all available resources promoted for sustainable development of transport. According to the authors, the building of a trip planner available to the general public, which can set trips based on multimodal chains, is a step towards such a development of transport system. In the opinion of the authors, we should primarily use all information available in the transport network, whereas the planner is a kind of a platform enabling effective management of information.

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