MOBILITY PLANS INCLUDING IMPLEMENTATION OF AUTONOMIC ROAD TRANSPORT SUPPORT SYSTEMS

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Abstract

Rational urban development is the key to the sustainable future. European Commission underlines need for improving mobility management in cities, especially the deployment of mobility plans, as well as introduction of new technologies. Newly developed autonomic systems have the potential to improve the accessibility, safety and attractiveness of public transport. The paper contains results of evaluation of two potential implementations of autonomic technologies. Firstly, mobility and environmental aspects of implementing driverless cars in the city scale were assessed, with the biggest impact identified and quantified in the field of road safety. Secondly, elaboration covered introduction of the Smart Mobility Plan – a mobility plan dedicated to a company, including implementation of autonomic technologies. The mobility plan was based on a concept of an autonomic travel planner, which provides selection of possible routes and awards eco-friendly behaviour. This paper is a result of a Short Term Scientific Mission conducted within the COST ARTS Action.

1. INTRODUCTION

Improving the accessibility, safety and attractiveness of urban mobility, especially the public transport, is one of the most important challenges in the forthcoming development of European cities. Including the increasing urbanization (GHO, 2015), influence of the transport in urban areas on the environment and road safety and implications of the aging population (WHO, 2011), a great need for new tools improving transportation can be identified. Those tools should include a whole range of different factors related to mobility, road safety, and environmental impact; and be able to provide in this complex environment the optimal solutions. Currently used automated systems release the operator from implementing repetitive, previously defined tasks (of a certain structure and order). Use of rapidly developing new technologies can enable development of road transport support systems, which could be able to take decisions, which are currently at the discretion of the operator. This **autonomic** road transport support systems need to be able to manage, configure, adapt and optimise themselves and, as a result, contribute to road safety improvement, as well as reducing congestion and emission of pollutions and noise (Kornalewski and Malasek, 2014, p.4). Thesis contained in the paper is that development of road transport support systems in a city scale, which use a broad spectrum of input data and autonomic technologies, can improve the urban mobility, road safety and decrease the environmental impact of transport in urban areas.

1.1 Methodology

The following report presents results of the Short Term Scientific Mission (STSM) "Mobility Plans including implementation of Autonomic Road Transport Support Systems", carried out in February 2015. The survey was conducted at the DLR – Institute of Transport Research in Berlin, within the COST TUD1102 Action "Towards Autonomic Road Transport Support Systems TU1102.
Study consisted of four phases:

- Literature review, which covered topics related to mobility planning in European context, as well as current use and research in the area of the autonomic road transport support systems in the city scale;
- Data collection concerning mobility plans using autonomic solutions, with particular emphasis on concept of smart travel planners and driverless cars. The collection took place using a brief survey among the members of COST TU1102 Action, which provided basic overview on mobility planning including autonomic solutions;
- Discussion on possible use of the autonomic road transport support systems in mobility plans, concerning possible benefits and threats, implementation scenario and a concept of the business model for implementation (specifying case city: Warsaw);
- Conclusions providing summary of the data collected, as well as recommendations on approaches to mobility planning.

Data analysed in the presented report were obtained thanks to the courtesy of German Aerospace Centre and COST TU1102 Action Members.

2. ANALYSIS OF DATA COLLECTED

3.1 Mobility management in Europe

Topic of mobility planning was one of the main concerns of the project MAX "Successful Travel Awareness Campaigns and Mobility Management Strategies", conducted between 2006 and 2009 within European Union 6^{th} Framework Programme. Project focused on mobility management and travel awareness in transport. Referring to definition proposed by the consortium, "mobility management" is a concept to promote sustainable transport and manage the demand for car use by changing travellers' attitudes and behaviour. The "mobility plan" is described as one of the possible site-based mobility measures and defined as "a site based plan that aims to manage and, often, to change the travel patterns of the persons travelling to and from this site (…).The mobility plan most often consists of a whole package of measures (…) tailored to the needs of the particular site" (MAX, 2007, p. 16). This vague definition was dedicated to the mobility management measures for companies or institutions, however, it can be used in a bigger scale as well. Properly selected measures, adjusted to the characteristics of the company, can reduce up to 40% of car travels (Berman and Radow, 1997). British experience from implementing mobility plans in 20 entities shows that even 50% reduction is possible (UK, Department for Transport, 2002). Potential benefits from implementing mobility plans can bring 1.4% increase in travelling by alternative travel modes when providing information about eco-friendly travelling options; 8.5% reduction of individual car trips by including other transportation options (e.g. carpooling); 16.4% reduction by including financial incentives and 24.5% reduction by providing combination of communication measures and financial incentives (Nosal, 2011).

Results of the literature review show that there is a strong need for implementing mobility plans for cities from a certain size. Investigated plans provide an overview of included measures and recognize the possible scope for the implementation of new measures. European strategy towards mobility planning in urban context (White Paper, 2011) states that cities above a certain size should be encouraged to develop urban mobility plans. The strategy underlines need for reducing congestion and emissions in cities. It requires use of a mixed strategy involving land use planning and alignment with integrated urban development plans. Also, pricing schemes, efficient public transport services and infrastructure for non-motorized modes or alternative fuels is mentioned, as a required element of a mobility plan for a city.

Currently, there is no legal regulation concerning the introduction of mobility plans. Initiatives from the scope of "Integrated urban mobility" (White Paper, 2011) include establishing procedures and financial support mechanisms at European level for preparing urban mobility audits and urban mobility plans. Moreover, they recommend examining a mandatory approach towards implementation of mobility plans for cities of a certain size. This aspect was considered by European Commission. Four strategies on regulations regarding implementation of mobility plans in urban areas (differing in scope of impact) were compared. Conclusions of the comparison state that it is recommended to implement non-binding recommendations for European cities on mobility plans with comprehensive requirements for their policy framework (European Commission, 2013)

3.2 European policy towards new technologies in RTS

The need for improving mobility in line with the policy of sustainable development in urban areas and the need for development of new technologies, including autonomic technologies, were identified by the European Commission. Strategy for competitive and resource efficient transport system underlines meaning of innovations and promising technologies in transport systems, including development of automation in cars and development of traffic and information management systems (White Paper, 2011).

Deployment of autonomic technologies firstly requires resolving challenges regarding legislative and technological issues. Due to a rapid progress of autonomic road transport support systems (e.g. advanced driver assistance systems) estimation of possible future impacts of implementing autonomic systems is needed. Also, identifying the user groups, their needs and possible profits and foreseeing the public response to the application will benefit the whole process of implementing automation into area of road transport support systems. White Paper also recommends considering long term effects of decisions taken now, their possible impacts and the future environment, giving the time horizon 2050.

3.3 Implemented or tested autonomic systems for city mobility management

Driverless cars

Successful development of driverless cars go back to 2004, when in DARPA’a (Defense Advanced Research Projects Agency) Grand Challenge winning vehicle drove 7 from assumed 150 miles. Only one year later five vehicles were able to finish the race (Fagnant and Kockelman, 2013, p.2). Driverless cars are autonomous vehicles capable to operate and perform as traditional vehicles, without the presence of the driver. Their performance is classified from no automation to full self-driving automation in a scale from Level 0 to Level 4 (NHTSA, 2013). Driverless cars are delivered by several manufacturers, including e.g. Audi, BMW, Volkswagen; testing them is allowed in four US States (Smith, 2013) and in several European countries, e.g. France, UK, Germany. From 2012 project CityMobil2 runs in Europe, aiming to deliver an automated road transport service running for at least six months at five sites across Europe. However, due to legislative, safety and liability issues self-driving individual cars are not available on the market. Currently in public operation there are only two personal rapid transit lines (Heathrow airport in the UK and Masdar city in Abu Dhabi) and two cybercar systems – the Group Rapid Transit in Morgantown, W. Virginia, USA and the Rivium Park Shuttle in The Netherlands; and these operate in fully segregated infrastructures only (CityMobil2, 2013).

Concerning the implementation of autonomous vehicles in the city scale, the literature review included model for Shared Autonomous Vehicle system conducted by University of Texas at Austin (Fagnant, 2014). Author states that introduction of Autonomous Vehicles (AVs) can bring significant improvements in fields of safety, mobility and parking, dependent on the market penetration level. Proposed estimation states that AVs annually, with 10% market share, can save up to 1 000 lives in US. However, author underlined significant barriers including AVs: costs, liability, security, privacy, and missing research to be overcome. In his paper, D. Fagnant describes the shared automated vehicle (SAV) system, which assumes introduction of the on-demand service features with self-driving capabilities. The model was designed for Austin’s transportation network (population of Austin in 2013: 885 400). Model results indicate that SAV brings possible benefits in reduction of overall number of cars, reduction of overall vehicle-miles travelled, reduction of energy use and volatile organic compounds emission and can contribute to creating a more sustainable transport system.

Travel Planners

European initiatives include development of travel information. Basing on the studies on use of information and communication technologies (ICTs) in urban planning, need for following actions can be stated:

- Conducting more research on potential impacts of ICTs, individually and as a collective, especially on transportation equity (possible privileging some parts of the city over others) and sustainability;
- Coherent attitude towards transportation planning and land use planning.

Technological development improves safety level and usefulness of transportation systems, however, also implies increased driving, with all the consequences of the increased traffic. Information and communication systems are crucial to the operation (Mondschein, 2014), including significant role of travel planners. They not only facilitate travel, but provide new activity choices and possibly result in new travel behaviour (Kelley, 2014). Travel planners vary on the level of information delivered. Tools developing and classifying routes on the basis of the travel time select the fastest travelling option (e.g. Rejseplanen in Denmark) or propose a selection of routes, varying in modes of transport (e.g. Futar in Budapest), dependent on users choice. Transporlis operating in Lisbon include also CO_2 emissions and costs of the proposed travel. In UK, application GoSmarter calculates several routes, providing information about the travel time, CO_2 emissions and personal energy use by a choice of modes.

International application Waze can be considered as an example of a travel planner using autonomic technology. The application connects users to each other, creating a local community. Drivers passively contribute traffic and other road data and have a possibility to inform about other road incidents (Waze, 2015). Technology of crowd-sourcing and floating data is also used in the application developed by DLR Institute of Transport Research in Streetlife project – a travel planner aiming to develop city mobility management (Streetlife, 2015). The project started in October 2013 and is to finish in 2016. The project conducted and funded from the European Union Seventh Framework Programme aims to reduce carbon emissions using advanced ICTs. The main objectives are:

- to develop multimodal mobility information systems for urban areas and to motivate citizens to select sustainable transport means;
- to develop solutions for monitoring, control and planning of urban traffic, using comprehensive database of real-time data.

The main concept of the project is to create an application which would enable exchange of information between the traffic managers (providing travel information) and the end-users (providing information on their location and travel preferences) and develop outputs with potential to improve the city mobility management. Several challenges were identified during deployment, some of them related to encouraging citizens, concerned about the data protection, to use the application. The DLRs solutions included financial incentives for participants, distributed as a lottery awards.

3. POSSIBLE IMPACTS OF AUTONOMIC ROAD TRANSPORT SUPPORT SYSTEMS

The third phase of the project included discussion on possible impacts of autonomic technologies in road transport. The discussion was based on the outcomes of the literature review, and data collected and used experiences from previous studies and the DLR Institute of Transport Research.

First estimation concerned the example of **urban insertion of driverless cars**. A brief assessment of such insertion was bases on following assumptions: (up to 10 times) lower number of cars is necessary to maintain the same or higher mobility level (Fagnant, 2014, p.7), driverless cars have quicker time reaction and more efficient maintenance than human-driven vehicles, road safety improves in relation to elimination of human error. Basing on these, following benefits can be identified: environmental benefits (decrease of noise and emission pollutions), drivers' time savings, increased mobility of elderly and disabled, road capacity increase (vehicles can communicate between each other and decrease the distance between them), road safety improvement, economic savings (connected to fuel consumption reduction, lower insurance and parking fees, potential tax reductions), improvement of health. Main benefits were identified in the area of road safety improvement. Basing on the estimation conducted and Polish road safety data (Police Headquarters, 2014), analysis concerning state of road safety in Poland could be conducted. As reported by European Commission (2014), Poland is still at the forefront of EU countries with the lowest road safety level. Between 2007 and 2013 294 582 road accidents took place, 30 616 people died and 369 686 were injured. In 2013 number of fatalities per million people was 87, which was the second worst result in EU (European Commission, 2014). Car drivers were responsible for more than 60% of road accidents. Table 1 presents number of road accidents in Poland caused by the improper conduct of driving a vehicle, specifying the causes of the accident in relation to the total number of road accidents in Poland.

Table 1. Number of road accidents in Poland caused by the improper conduct of driving a vehicle, between 2007 and 2013

Road accidents caused by the driver	Road accidents		Killed		Injured	
	Total	%	Total	%	Total	%
Involving driving without required lighting	29	0.01	9	0.03	35	0.01
Involving driving on wrong side of road	3 804	1.29	855	2.79	6 336	1.71
Involving speeding	56 618	19.22	7 636	24.94	83 332	22.54
Involving improper reversing	3 586	1.22	75	0.24	3 685	1.00
Involving improper pedestrian crossing maneuvers	12 548	4.26	624	2.04	12 889	3.49
Involving improper turning	3 613	1.23	130	0.42	4 816	1.30
Involving improper overtaking	11 004	3.74	1 555	5.08	16 463	4.45
Involving failure to yield right-of-way to pedestrian	15 456	5.25	868	2.84	15 652	4.23
Involving failure to yield right-of-way	46 246	15.70	1 922	6.28	65 576	17.74
Involving improper following	10 988	3.73	177	0.58	14 479	3.92
Involving crossing on the red light	2 763	0.94	91	0.30	4 130	1.12
Involving other driver errors (improper turn, passing, etc.)	10 390	3.53	1 054	3.44	13 845	3.75
Total 2007-2013	**177 045**	**60.10**	**14 996**	**48.98**	**241 238**	**65.25**

Table 1 highlights majority of road accidents in Poland involving prohibited driver errors. Road accidents caused by physical weakness of the driver are listed in the Table 2.

Table 2. Number of road accidents in Poland caused by the physical weakness of the driver, between 2007 and 2013

Road accidents caused by the driver	Road accidents		Killed		Injured	
	Total	%	Total	%	Total	%
Involving driver's fatigue, falling asleep	3 117	1.06	521	1.70	4 679	1.27
Involving sudden fainting of the driver	807	0.27	108	0.35	1 041	0.28
Involving blinding by another vehicle or sun	213	0.07	20	0.07	248	0.07
Total 2007-2013	**4 137**	**1.40**	**649**	**2.12**	**5 968**	**1.61**

Table 3 presents distribution of the number of road accidents depending on the state of road infrastructure.

Table 3. Number of road accidents in Poland involving malfunction of road infrastructure, between 2007 and 2013

Road accidents involving infrastructure malfunction	Road accidents		Killed		Injured	
	Total	%	Total	%	Total	%

Involving malfunction of signaling or traffic management	25	0.01	2	0.01	36	0.01
Involving improperly secured road construction	55	0.02	5	0.02	59	0.02
Involving bad road conditions	562	0.19	20	0.07	648	0.18
Involving vehicle malfunction	696	0.24	67	0.22	990	0.27
Involving fire	42	0.01	12	0.04	49	0.01
Total 2007-2013	**1 380**	**0.47**	**106**	**0.35**	**1 782**	**0.48**

Road accidents statistics showed that in 2007-2013 61.5% accidents in Poland were caused by the car drivers, from which 1.4% accidents were caused by driver fatigue, falling asleep, sudden fainting or blinding by another vehicle or sun; and more than 60% were caused by the human error. Moreover, only 0.47% of those accidents were caused by poor road conditions or road infrastructure / vehicle malfunction. Estimation based on removing those factors showed that in period 2007-2013 number of fatalities in Poland could be reduced by more than 15 500, representing **51%** of overall fatalities. This indicates the potential of autonomous vehicles to reduce number of fatalities on roads.
In the city scale, potential for crush reduction was analyzed basing on the road safety statistics for Warsaw. Accidents caused by car drivers (Table 4) and accidents involving influence of alcohol and other drugs (Table 5) were analyzed and compared to total number of road accidents in Warsaw between 2007 and 2013 (8271 road accidents, 603 killed, 9629 injured).

Table 4. Number of road accidents in Warsaw caused by the improper conduct of driving a vehicle, between 2007 and 2013

Road accidents caused by the driver	Road accidents		Killed		Injured	
	Total	%	Total	%	Total	%
Involving speeding	840	10.16	80	13.27	1156	12.01
Involving improper pedestrian crossing maneuvers	1415	17.11	81	13.43	1451	15.07
Involving improper lane change	399	4.82	15	2.49	522	5.42
Involving failure to yield right-of-way to pedestrian	309	3.74	20	3.32	304	3.16
Involving failure to yield right-of-way	1464	17.70	48	7.96	1927	20.01
Involving crossing on the red light	361	4.36	15	2.49	527	5.47
Involving other driver errors (improper turn. passing. wrong side of road etc.)	648	7.83	25	4.15	740	7.69
Involving driver's fatigue or sudden fainting	7	0.08	2	0.33	20	0.21
Total 2007-2013	**5443**	**65.81**	**286**	**47.43**	**6647**	**69.03**

Table 5. Number of road accidents in Poland caused by the car driver under influence of alcohol or other drugs, between 2007 and 2013

Road accidents caused by the driver	Road accidents		Killed		Injured	
	Total	%	Total	%	Total	%
Under influence of alcohol	200	2.42	16	2.65	281	2.92
Under influence of other drugs	7	0.08	3	0.50	9	0.09
Total 2007-2013	**207**	**2.50**	**19**	**3.15**	**290**	**3.01**

In Warsaw between 2007 and 2013 65.81% road accidents and almost 70% deatchs were caused by the driver error. 2.5% road accidents were caused by drivers under influence of alcohol or drugs, leading to deaths of 19 people and 290 people injured. Other group of accidents with high risk of mortality and potential for reduction using autonomic cars are road accidents caused by pedestrians, giving 2434 road accidents, 204 fatalities and 1184

injured between 2007 and 2013 in Warsaw. The most severe accidents were caused by imprudent entrance onto the road in front of a moving vehicle, crossing the street in the forbidden location, crossing on the red light. 29.33% accidents were caused by the pedestrians between 25 and 39 years old, however, the highest risk of mortality was in the age group 60+ (44.61% of all deaths). Annually in Warsaw around 40 people die in road accidents caused by the drivers' errors, with significant input of drivers under influence of drugs. Moreover, on the interval of seven years 204 people died due to imprudent or prohibited entrance onto the road, giving around 29 deaths annually. In conclusion, assuming that autonomic vehicles have quicker time reaction and avoid obstacles on the road, urban implementation of driverless cars in Warsaw has the maximum potential of reducing 1125 road accidents (95% of all accidents[1]) and 70 fatalities (81%) annually.
Second estimation concerned implementation of **autonomic travel planner** in the mobility plan (on local level). Estimated impacts bring benefits linked with environment: eco-routing can lead to significant CO_2 and local pollutants emission (Bandeira et al., 2014), health improvement (promotion of walking and cycling) and time savings. Potential for individual car trips reduction was estimated, in reference to Dutch and American practice (UK, Department for Transport, 2002), for 30%. In 2010 average commuting distance in cities was around 13km in one direction (Poland, CSO, 2011), which gives annually around 873kg CO_2 emissions from travelling by car for single commuter (European Federation for Transport and Environment, 2012). Implementation of the mobility plan has the potential to reduce around 262kg of CO_2 emissions for single employee. In reference to those impacts a concept of the mobility plan using autonomic road transport support systems dedicated to a private company was discussed.

4. SMART MOBILITY PLAN

Smart Mobility Plan is a mobility plan dedicated to a private company, which uses technology of autonomic road transport support system. The Smart Mobility Plan includes developing a sophisticated travel planner (Smart Travel Planner) proposed by Dr Jacek Malasek in the COST ARTS Roadmap (COST ARTS, 2014): an application which uses personal preferences of the user and broad spectrum of external data and provides a travel plan, favouring sustainable means of transport (e.g. walking routes, cycling paths, propose car-sharing partners). During operation, the application optimizes itself, using users' choices and preferences. Users gain points: positive for choosing ecological routes and means of transport and negative for behaviour incompatible with the idea of sustainable transport (e.g. for using high-emitting vehicles). Main aim of the Smart Mobility Plan is to improve city life quality standards by decreasing traffic jams and promoting public transport and cycling, by changing travel behaviors of the citizens. It includes engagement of three interested parties: the city, the company and the employees. The combination and cooperation of the parties involved has the potential to reduce traffic and related emissions in cities (Streetlife, 2015).

The city

Implementation of the Smart Mobility Plans requires following actions to be undertaken by the city:

- Implementation of sustainable transport policy measures;
- Improving sustainable means of transport and related infrastructure (e.g. PT, P&R, cycling);
- Providing favourable tax policy for participating companies.

Prospective profits for the city include lower costs of road construction and maintenance, creating work places in new technologies labor market, shorter travel times and less congestion, lower emissions from transport, better health of inhabitants and creating a "green

[1] This is in line with National Highway Traffic Safety Administration estimations, witch assume that more than 40% of fatal crashes involve drugs, distraction and fatigue (NHTSA, 2012) and the driver error is the main cause of more than 90% of all crashes (NHTSA, 2008)

city" image. Prospective losses for the city include cost of subsidizing participating companies.

The company

Implementation of the Smart Mobility Plans for a private company assumes undertaking various actions, including ones recommended when implementing a standard mobility plan and others, directly related to use of the Smart Travel Planner.

In reference to the outputs of the project MAX (MAX, 2007, p. 16), following range of recommended measures was selected:

- Multi-modal information about how to reach the site (e.g. signs for pedestrian routes, etc.);
- Carsharing scheme for a company (e.g. the company offers shared company cars for business use and sometimes for private use after work);
- Guaranteed ride home service so that people who carpool can get home if something unplanned occurs e.g. their children suddenly being taken ill;
- Changing working or appointment hours to avoid congested periods and/or coordinate with public transport times;
- Allowing and helping staff to work from home some of the time (teleworking);
- Re-organising and rationalising business trips and/or substituting telecommunications for some business trips to reduce travel on works business;
- Re-organising and rationalising deliveries by a company and/or by suppliers to reduce freight trips to and from the site;
- Showers, changing rooms, lockers, irons, curling tongs and hairdryers for people who choose to walk, run, skateboard, skate or cycle to work;
- Secure cycle parking;
- On-site free bicycle repair service at the start of the bike season;
- Safe and direct cycle and walking routes on the site linking buildings with all site entrances;
- Paying or negotiating with public transport operators to run shuttle services between the site and nearby transport interchanges or park and ride sites;
- Managing the access to parking lots and the charges for parking on site (and sometimes, in conjunction with the local authority, off-site as well).

Deployment of the Smart Travel Planner as a part of the Smart Mobility Plan requires:

- Introduction and promotion of the Smart Travel Planner to the employees;
- Encouraging employees to use the application by subsidizing PT tickets;
- Providing employees reasonable travel routes and travel modes by the Smart Travel Planner;
- Providing information about the company carsharing system and potential carpooling partners;
- Motivating employees to choose more sustainable travel behaviour by gamification methods (gaining points and competing with other users);
- Changing allowances paid to staff for using their own vehicle on works' business to favour more environmentally-friendly vehicles and modes (e.g. for longer distance trips paying only the equivalent rail fare regardless of the mode used, not a per km rate for car use);
- Awarding users with attractive incentives, e.g.: annual PT tickets, attractive parking spaces for carpoolers, incentives for not using their cars/parking spaces (parking cash-out).

Overall gains of the Smart Mobility Plan implementation for a private company include creating the "green image" of the company, lowering costs related to parking infrastructure, favorable fiscal system and mobile, healthy employees. Costs of implementation include expenses related to PT tickets subsidizing and related to development of cycling infrastructure (if needed).

The employees

The main idea behind the Smart Mobility Plan is to equip employees of the company with mobile application providing multimodal personalized routing (Smart Travel Planner). The application will integrate real-time data and consider all kinds of available transportation modes. Main aim is to engage users to choose carbon-reducing mobility, awarding/penalizing particular behaviors in a dedicated scoring system. The secondary aim is to develop city mobility management using comprehensive data from the application end-users, providing their location data and travel preferences. Basing on the concept from the Streetlife project data from existing sources will be complemented with crowd-sourcing and floating data. After data correlation and analysis, provided comprehensive database will be a potential measure for urban mobility plans improvement or mobility strategies assessment (Streetlife, 2015). Implementation of the Smart Mobility Plan requires from the employees:

- Aware participation in the mobility plan;
- Potential change of travel habits to more eco-friendly;
- Consent to provide their location data and travel preferences.

5. CONCLUSIONS AND RECOMMENDATIONS

Results of the discussed studies show that there is a strong need for implementing mobility plans for cities from certain size. Investigated plans provide an overview of included measures and recognize the possible scope for the implementation of new measures.

Need for improving mobility in urban areas and for development of new technologies, including autonomic technologies, was identified on the European level. Deployment of those technologies firstly requires resolving challenges regarding legislative and technological issues. However, due to a rapid progress of autonomic road transport support systems estimation of possible impacts of implementing autonomic systems is needed, regarding impacts in the field of road safety, traffic management and city mobility; also, identifying the user groups, their needs and possible profits and foreseeing the public response to the application will benefit the whole process of implementing automation into area of road transport support systems. Prospected benefits from implementing ARTS bring benefits in terms of road safety, environment protection, time savings, road capacity, health improvement and others, which argues for encouraging cities to deploy autonomic road transport support systems. Implementation of the system of driverless cars has the potential to reduce 95% road accidents and 81% fatalities annually in the urban area. On the other hand, deployment of the mobility plan using ARTS technology for a company can reduce number of commuters travelling by car in 30%. Also, it can bring possible benefits including environmental (e.g. emission reduction), economic (e.g. reduced need for parking spaces or subsidiaries for PT tickets) and social (e.g. gamification methods, commitment to environment protection) aspects for three parties involved: citizens, companies and the city.

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