



+ PSIRoads/MDS

The intelligent route to smart mobility

An overview on innovative traffic management
and smart city solutions



Winner of the German
Mobility Prize 2017

ollio 2017
preisträger deutscher mobilitätspreis ●●●

PSI 

European communities are facing huge challenges

Smart City continues to be the subject of discussion. This brochure aims to provide visions geared about cooperative mobility and outlines the measures and methods that can help to achieve the desired goals.



Read

- what the key to future-oriented, integrated urban development is
- what the vision of smart connected urban mobility could look like
- how the concept of PSIroads combines infrastructural and ecological goals

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I will be happy to answer any questions you may have.
Enjoy the read!

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Does individual mobility lead to a dead end?

Private transport is one of the communities' biggest challenges. With a share of 74 % the car remains the most frequently used means of transport in Europe. Only 6 resp. 8 % (of the population) use the bus or train. Money spent on traffic and transport is projected to reach approximately Euro 208 bn in the next ten years [1].

CO₂ and NO_x – our everyday toxins?

The consequences of traffic are disastrous for both the environment and us humans. Despite an overall downward trend of greenhouse gas emissions in the EU between 1990 and 2010, the CO₂ emissions have increased dramatically by 21 % [2] and continue to rise further. In Germany carbon emissions from combustion engines increased by a total of 5.4 mn tons in 2016 [3].

In addition, Diesel engines emit nitrogen oxides (NO_x) and are therefore one of the main factors of respirable dust pollution in inner cities. According to the EU, 40 % of NO_x emissions are caused by traffic, 80 % of which are emitted by Diesel vehicles with a share of about 67 % of passenger cars [4].

Per year 400,000 people in Europe die prematurely due to high levels of air pollution and since 2003 the death of approximately 70,000 people has been caused by NO_x [5]. Therefore the authorities have introduced a requirement for member states to create/set up with Air Pollution Control Plans to keep the air cleaner.

Cities are now facing severe penalties

The EU commission identified 130 cities in Europe which repeatedly exceed the limits for air pollution to a considerable extent. Meanwhile environmental associations are forcing communities to take action. The Deutsche Umwelthilfe (DUH) has filed a request at the Administrative Court in Munich for coercive measures to be enacted against the Bavarian government since they refuse to adhere to a final judgement for "Clean Air" which was already passed in 2012, and to take the necessary steps to comply with the limit values for air quality. Exceeding the limit values in Munich, Darmstadt and Wiesbaden has prompted the DUH to file for enforcement measures against the Environmental Ministry of Hessen and Bavaria. In both cases a final judgement has been passed, which is not adhered to.

It is a fact

- that the usage of land and resources,
- noise exposure and
- the pollutant emission in cities

have to be lowered in order to achieve the goals that are of the line with the environmental, health and climate policies and also to meet the needs of each individual citizen. The current situation for cities is far from perfect - which would be an environment worth living, with short distances, a lot of green, easy to reach supply and clean air. And last but not least: environmentally friendly mobility which, above all, includes climate-friendly alternatives like electric busses, car-sharing or bike rentals.

Politics are setting examples

A sense of urgency is arising and politicians are now required to take action. Now action is being taken to avoid driving bans. In line with the "Sofortprogramm Saubere Luft 2017 - 2020" the government of the Federal Republic of Germany has provided funds in the amount of Euro 1 bn: Euro 350 mn will be spent on the electrification of traffic, for example the upgrading of Diesel bus fleets.

A further Euro 150 mn will be spent on exhaust technology of Diesel-driven buses so that they are up to environmental standards. The digitalisation of traffic will be supported with up to Euro 500 mn.
(Source Figures: ZEIT ONLINE).



What can be done to encourage the digitalisation of traffic across Europe?

The promotion of smart mobility across Europe is not regulated in a uniform way. In addition to national subsidy programmes like in Germany, European funding lines, such as "Horizon 2020" or the European Structural and Investment Funds (ESI-Fonds), will be considered to provide funding for municipal mobility projects.

Municipalities should now take this opportunity - not just for the sake of their residents' health. Now is the time to create the necessary technical conditions!



+ Routes to Smart City

Smart City – how to make European cities fit for the future

mobility

Smart City is no longer a vision

In many places Smart City – or “City 4.0” is being realised rapidly and effectively: To interlink as many different fields on various levels as possible offers cities the great opportunity to a smart technological development.

Connecting everything:

Energy

- + Decentralised, renewable power generation
- + Modern energy management and storage solutions
- + Local intelligent use of network and resources

Mobility

- + Car-Sharing
- + Electromobility
- + Mobility apps
- + Local public transport concepts
- + Bike rentals
- + Multi-storey car park concepts

Urban Development

- + Smart traffic guidance systems
- + Smart living

Efficient mobility through ICT

The key for an integrated city development is to use new information and communication technology (ICT). With regard to mobility, this means maximum cooperation and interlinking of telematic data / systems in real time to efficiently use road infrastructure.

Cities are already responding with systems that are gear towards optimising traffic flow and reducing traffic jams, congestion and emissions: intelligent parking-space management, interoperable ticket systems or mobility apps for a user-friendly local public transport are being tested in various cities or have already been introduced.

Transport services in Munich are going to establish up to 150 mobility units at subway stations and city train stations, where a variety of environmentally friendly means of transport such as car-sharing and rental bikes can be combined.

The examples show: Solving urban traffic problems requires a certain amount of imagination – and experts, who are able to understand the requirements as a whole and are already familiar with the specific needs of the communities.

Tomorrow's perspectives - have already become a reality

Ambitious ventures are being pursued in Europe today. As part of the initiative “Hessen Mobil“, ICT-systems to influence highway traffic have been implemented successfully: reaching from construction site management, temporary release of hard shoulder and traffic light control to digital traffic congestion reports. This is one of many initiatives,

which is progressing rapidly. Partners from industry, research and science are involved in the “DRIVE“ project. On a distance of 200 kilometres (projected: 280 km) going along motorways, main roads and country roads the different forms of innovative telematic systems are currently being tested [6]. The project is defined by the following four pillars of development:



COLLECTIVELY – Traffic management is done via known methods such as telematically controlled road signs, traffic warning via radio and internet etc.

COORDINATED – Carriers and transport authorities are interlinked across responsibilities and organisation levels

COOPERATIVELY – Road users and systems in traffic (road signs, traffic light systems etc.) will be interlinked digitally

AUTOMATED – Functions resp. processes will be integrated in the traffic system digitally - automated vehicles



+ Smart connected mobility

The city of tomorrow is digital



mobility

What tools can cities use?

Intelligently connected mobility – the digital interaction of systems provides a solution to meet the traffic requirements of the future.

- + Traffic control centres and their department heads might evolve into service providers in future. The information/data processed for this will be provided on new mobility data market places. This includes data on the current emission and weather situation and images provided by cameras installed at major road junctions.
- + The traffic control centre communicates with data provider, e.g. a mobility cloud.
- + This cloud is exchanging data with all road users, vehicles and transportation infrastructure and therefore ensures cooperative mobility.

The vision of successful mobility of a “Smart-City” considers numerous factors:

The digital transformation in itself

- Everything is interlinked: Media, social networks - and vehicles
- computers are more and more powerful and allow the real-time processing of large amounts of data.

Requirements for digitalisation

- Mobility services must be widely accepted
- There must be a true benefit for the public and individual welfare
- Data protection/security must be guaranteed

The organisation of traffic

- There must be no self-management via digitalisation

- Public policies and system architectures including climate-friendly transportation are necessary
- Cooperative and individual mobility should be mutually synchronized

The Smart City needs Smart Mobility

Integrated planning and cooperation are fundamental for future urban development and crucial for both, the individual as well as the socially acceptable use of modern traffic infrastructure.

The “Internet of Things” will play a key role in the harmonisation of individual and cooperative mobility.

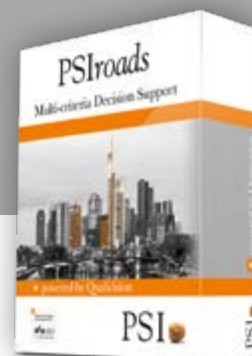
A preliminary final result of this process may be autonomous driving.



+ Proactive and cooperative traffic management

PSIroads/MDS balances traffic flows intelligently

powered by Qualicision



Less traffic jams and congested roads?

PSIroads/MDS powered by Qualicision turns this vision to reality.

Certainly every driver has experienced this situation before: Your navigation system suggests to use a certain route - but when you get there, there is already heavy traffic. The multi-criteria decision support PSIroads/MDS offers a smart solution. The software PSIroads/MDS allows the user, to take a short look into the future and base their decision on what the traffic scenario would look like. For this task PSIroads/MDS utilises the AI-tool Qualicision, which has been successfully used by PSI for similar applications in other markets.

Not only does PSIroads/MDS make suggestions to communities of how to influence traffic directly, it can also be useful to indirectly correct past mistakes made in urban planning. The truth is that with this tool traffic can be managed more flexibly than ever before.

Tested successfully: As part of a Pre-Commercial Procurement (PCP) project, funded by EU subsidies, PSIroads/MDS was implemented with the Dutch traffic authority (Rijkswaterstaat) and the British highway operator Highways England.

PSIroads/MDS

- can easily be integrated in existing traffic control centres
- can be used easily in daily traffic management
- allows regional or national cooperation of different road operators
- can be applied for a number of different tasks.



Optimising traffic flows with a reasonable, holistic approach

PSIroads/MDS optimises the usage of transport networks in a way that road users reach their individual destinations in the best possible way. Accordingly, the system allows road operators and environmental authorities, to control the traffic flow in line based on freely definable strategic and ecological goals. Consequently and in light of these targets, possible measures of traffic management are assessed based on the current and anticipated traffic situation.

In addition, rules for the cooperation of various road operators are defined and applied - depending on the situation. This allows traffic management across the boundaries of responsibilities.

PSIroads/MDS – the App

The road user uses PSIroads/MDS as an app, which is downloaded on handheld mobile devices. After creating a profile, the users select their destination and off they go.

Road users and urban destinations

The term road user covers a large group of different individuals: e.g. local and foreign suppliers and commuters, motorised and unmotorised visitors and tourists, local public transport, cyclists, wheelchair users, etc. The main goal is, to combine the individual goals of road users - to get from A to B as quickly, immediate and congestion-free as possible - with those of the cities - which is avoiding congested roads, traffic jams, road hazards and air pollution.

There are many ways to reach the same goal

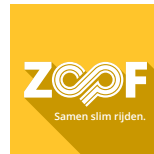
In contrast to route suggestions made by the car navigation system, the self-learning software PSIroads/MDS makes sure that road users use different routes but also different carriers (e-vehicle, buses and trains, car-sharing, bikes etc.) and suggests different times (leave earlier or later) to get to the

same destinations. Hence, the suggested way to the destination will be reached more efficiently with no traffic jams. Suggestions and indications made to road users make sense, thus increasing confidence in the transport system.

How cities in Europe can benefit from PSIroads/MDS:

- + Strategic bypassing of traffic congestions, to reduce dangers
- + Strategic bypassing to avoid exceeding the emission limits (NOx, respirable dust, noise exposure)
- + Strategic routing for different types of road users like freight transport, transport of hazardous materials, electric vehicles, emergency services
- + Strategic measures in response to planned and unplanned events (Football game, concert, accident,...) to avoid traffic jams
- + avoiding detours along critical routes, to protect schools and preschools, districts with historically precious buildings and residential areas from diverted traffic
- + Route recommendations to reach highly frequented destinations like shopping centres, industrial zones and commercial areas
- + Avoiding stop/go traffic (e.g. in front of traffic lights -> „situational green wave“), to prevent additional exhaust emissions
- + Reducing peak loads (e.g. speed limit in case of bridge damage)
- + Individual, situational adaptation to urban climate protection goals by recommending road users to use more climate-friendly alternative means of transport like Car-Sharing, local public transport or bike rentals.

Marketing for enhanced user acceptance



PSIroads/MDS flexibly adapts to citizens' needs

Road users and citizens will accept the PSIroads/MDS system only, if it is beneficial for them. The individual goals of road users don't necessarily coincide with the collective goals of the municipalities. What's more, objectives targeted by municipalities are often inconvenient for the driver, as they restrict them in their own decisions - just think of alternative routes that require you to make a detour, which may entail longer traveling times for the sake of cleaner air in densely populated urban areas.

To ensure that urban objectives are still met and to boost the acceptance for the system, a reward point system (similar to payback, Miles & More etc.) has been embedded in the App PSIroads/MDS in cooperation with the Dutch enterprise V-tron. If the user accepts an alternatively suggested route, which does not meet their personal need but serves an overriding, urban objective, they get reward points.

Example 1:

Ms. Miller is on her way to go shopping. The quickest way to get there is going through the heavily NOx polluted city centre. The app suggests a detour which bypasses this area and at the same time avoids roads with preschools, schools or hospitals. This route is anticipated to take 5 minutes longer. But on the other hand Ms. Miller contributes to cleaner air and helps to improve the quality of urban life. The municipality rewards this behaviour with 10 points, which can be redeemed for a cup of coffee at the shopping centre.

Example 2:

Mr. Smith is cheering for his victorious team in the crowded football stadium. After the final whistle the crowds are making their way to the exit. The app recommends Mr. Smith to hang on for 20 minutes longer to avoid that the exit and driveways leaving the parking lots getting congested and to keep the traffic flowing. Likewise, to keep air pollutants at a low level. If Mr. Smith follows the recommendation and doesn't leave for another 20 minutes, he will get bonus points. These can be redeemed during his next visit at the stadium for a free hot dog, for example.

+ PSI at a glance

PSI Mines&Roads GmbH was founded in 1991 as a fully owned subsidiary of PSI Software AG, which employs around 1.650 employees. The company's largest production location in Aschaffenburg is situated in the heart of the Rhine-Main area. Additional offices are in Berlin, Beijing and Moscow.

PSI Mines&Roads is divided into two corporate divisions. The division Roads is mainly involved in infrastructure monitoring and traffic management – offering innovative software solutions for road and smart city operators.



PSI belongs to the 30 most innovative German SMEs according to a ranking published in the renowned business journal WirtschaftsWoche in December 2017. In June 2017 PSI won the German Mobility Prize for their software solution PSIroads/MDS.



PSIroads/MDS – winner of the German Mobility Prize 2017

The initiative „Deutschland – Land der Ideen“ and the Federal Ministry of Transport and Digital Infrastructure award a prize to groundbreaking best-practice-projects that focus on safety. PSIroads/MDS has been awarded as flagship project with the aim for Smart Mobility

A panel of experts counting 16 jury members chaired by Dorothee Bär MdB selected the winners from around 170 submitted applications.

The German Mobility Prize is aimed at raising public attention for Smart Mobility solutions and digital innovations. The contest is run by the initiative „Deutschland - Land der Ideen“ and the Federal Ministry for Transport and Digital Infrastructure.



The current situation.

Municipal officials (mayors, planning units, council members, spokes persons) are meeting with traffic experts, those facilitating the allocation of funds and industry experts to initiate specific projects for intelligent transport systems.



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- [1] EU Citizen Information Traffic
- [2] Deutsche Umwelthilfe/www.duh.de
- [3] Umweltbundesamt/ZEIT online, 16.03.2017
- [4] Umweltbundesamt/ZEIT online, 16.06.2017
- [5] Umweltbundesamt/ZEIT online, 16.06.2017
- [6] Hessen Mobil, Presentation 21.11.2017

as at February 2018



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