

How can new forms of Mobility support the urban and regional transition to sustainable mobility?

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Dipl.-Ing. Jan Garde (jan.garde@ils-forschung.de)

Dr.-Ing. Dirk Wittowsky (dirk.wittowsky@ils-forschung.de)

Research Institute for Regional and Urban Development gGmbH (ILS); Research group mobilities and space

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Without an efficient transport system a successful everyday life and the maintenance of economic structures are not possible. In addition, the key objectives of climate protection and energy transition must be implemented as far as possible. With regard to minimizing the negative effects of transport, for example on health or air pollution, the negative effects must be further reduced. Numerous social developments and new engine technologies as well as new forms of mobility and services lead to new challenges. Moreover, increasing information and communication technologies (ICT) are pervading modern lifestyle activities and influencing consequently demand for individual mobility. For the transition to sustainable mobility without limiting mobility it is necessary to implement a sustainable spatial and transport development - including the reduction of energy consumption and negative climate aspects. Moreover, it is important to increase the quality of life and the public health as well to modernize the transportation system. Using the region of Cologne/Bonn as an example, this contribution analyses the upcoming transformation process of the transportation system by modelling different scenarios.

The main challenges within the region of Cologne/Bonn are currently a continuously growing volume of road and rail traffic as well as an increasing gap between transport demand and the transport supply. Between 2010 and 2016 the demand for local rail passenger transport in the Rhineland's regional public transport (PT) network area increased by approximately 22 %. On the other hand, the capacity of PT infrastructure could not be increased to the same extent - only about 10 %. This is clearly shown by the high utilization of transport capacities in regional passenger transport, but also in light rail and bus services. Similar developments can be seen for motorised private vehicle (MIV): Within the region, road congestion occurs in the transport network which is reflected in high dust levels and travel time losses – especially during peak periods. Due to the central location of the Cologne/Bonn region in the European spatial and infrastructure system, the regional traffic interdependencies overlap with supra-regional flows of long-distance traffic in both passenger and freight traffic.

Through a comprehensive analysis of the transportation system and the regional traffic flows, the relevant developments for the future transportation system are shown as well as the traffic and spatial effects for the year 2040 were analysed. In addition to the initial analysis and derivation of key factors, two consistent future scenarios were developed. Furthermore, approx. 2,000 residents from the region of Cologne/Bonn were interviewed in a representative individual online survey within the framework of a project funded by the Federal Ministry of Education and Research.

The aim of the survey was to identify potential behaviour changes and user acceptance of new forms of mobility and mobility services. The stated-choice approach was primarily used to determine the potential for modal shifting from private cars to new mobility services. The test persons were confronted with concrete decision situations and could choose between various means of transport, during a trip either within a city centre or from a suburban area to a city centre. The interviewees had to start from the hypothetical situation that it is no longer permitted to drive into the city centre with a fossil fuel-powered car. Depending on the query, the characteristics time and cost varied according to the means of transport.

A view at the mobility of the future also reveals the need to highlight trends that will determine the basic patterns of tomorrow's traffic. Transport will be characterised by multimodality, post-fossilility and digitisation. These trends will also have a significant impact on passenger and freight transport. So far, however, there has been a lack of reliable and comprehensive research findings on the changes to be expected in people's mobility behaviour in the future that could potentially lead to imminent upheavals in the transportation system, especially as a result of technical and digital change processes. Differences between urban and rural areas are to be expected because of different spatial framework conditions, which could have an impact on the design of services of general interest.



Figure: Visualising the scenario "awareness and innovation"

This is where this contribution comes in. Thus, the overall aim of the research is to find out which significant developments will influence the urban regional transport system in the future, to what extent they can contribute to traffic relief and which spatial effects can be expected. The scenario "Laissez-faire" explains the state of development of the mobility system in the region of Cologne/Bonn in 2040. Transport policy and legal framework conditions remain unchanged in 2040 and are based on the defined target traffic-networks.

The focus of this scenario lies on the development of mobility and accessibility in the sub-regions under almost unchanged framework conditions and on an update of the status quo. In the scenario "awareness and innovation" the focus is on technical progress in the mobility sector and environmentally friendly mobility behaviour. The result is a perspective of the future in which mobility and accessibility in the region will develop by the year 2040 if technological trends and a sustainable mobility culture fully unfold and are shaped within the region in an innovative environment.

The results of the survey allow important statements about the extent to which the possible transformations in the regional mobility system, described within the scenarios, lead to a change in mobility behaviour and what spatial effects can be expected. The results show that both adaptations of the infrastructure and of the mobility culture and thus a change in the mobility behaviour of the individual citizens are necessary. This provides valuable information for the development of future strategies that serve as orientation for solving the current and foreseeable problems in the transport system.

On the basis of these survey results, the effect of the described scenarios can be modelled by determining elasticities. The results can support future-oriented urban and transport planning in the region.