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The organization of European railways: Confusing for the customers



Local public transportation on the streets and railways is organized very differently around the world. Whereas some countries and regions have very elaborate systems of financing and operation, many have only negligible or even no state-run organization.

It is not possible to label a particular system as being either “good” or “bad” without accurate knowledge of its underlying regional economic and social background and an understanding of its historical development. In general, in order to make a qualified judgement about a transit system, it is important to actually see and use it, to become familiarized with it, to analytically understand it and, above all, to appreciate how efficient it is for the passenger.

Europe’s railway sector is characterized by a variety of organizational models. For example, Germany and Sweden have competition-oriented systems based on long-standing and solid financial foundations. In other countries, railway systems exist in protected political spheres, and in part, carry on their operations depending on their current cash positions. Owing to European legislation that has opened public transportation markets, many countries are still searching for an optimal solution.

Passenger rail transport systems show substantial differences with respect to the following aspects, some of which may negatively affect system synergies:

- **Planning security:** Poland’s railway system service is based on four timetable periods per year, with two sub-sections per period. Over the year, service may change considerably from one period to the other. In contrast, railway timetables in Germany are generally offered for the entire year, and typically involve a planning stage of over 18 months. In order to create an even greater planning security for the user, more and more German regional rail service providers include the passengers in the timetable planning as far as two years in advance.
- **Flexibility:** The disadvantage of long-term transportation contracts lies in their rigidity. Service providers in Germany are often over-challenged by changes in demand. Systems with large vehicle reserve capacities, such as in Italy and Switzerland, are often better able to respond to increased demand.
- **Density and frequency of offerings:** Most countries in western Europe base their planning on synchronized timetables, as introduced by and used in Switzerland and the Netherlands, to offer extensive, connected services that run at one-hour intervals or even more frequently. The situation is different in central and eastern Europe, but also in France, where for many routes, it is considered to be sufficient to offer a few trains per day.
- **Fare integration:** For over 100 years, Switzerland has pursued the idea of ensuring passenger mobility “from one source” by

incorporating services from many different transport providers. This approach has been followed in Germany during the last 40 years, where it has increasingly become the norm. Other countries in western Europe continue to rely on less complex systems, most of which adequately cover service needs in metropolitan areas. In recent years, many urban regions in central Europe have also followed this example. However, passengers in rural regions remain disadvantaged: They must contend with extremely limited service and need to purchase a separate ticket to complete their travel.

- **Gaps at borders:** Using public transportation services beyond country borders or demarcated areas of authority is a problem all over Europe. Service provided by one country often ends at the border, even though offering transport for only a short distance would be needed for the journey to remain uninterrupted. When and if such offers are available, they are often based on bilateral agreements that involve a great deal of effort from local service providers and, as such, are expensive. In addition, the integration of fares for lines that cross borders is the exception. Instead, the prohibitive effect of adding divergent fare systems is the norm.
- **Inclusion of long-distance trains:** In most countries, passenger rail systems providing regional and local transport are publicly organized. However, this is not always the case for long-distance train service. This is an unfavorable situation, because the different transport requirements and infrastructures overlap. These overlaps could often be practically resolved in a collective railway system in order to provide economical service. In this regard, Great Britain has commanded a pioneering role for years by tendering large networks, most of which fully encompass long-distance trains. In addition, the Czech Republic Ministry for Transport in Prague, which supervises inter-regional, long-distance trains, has found a solution that better fits spatial planning needs than a pure orientation to independently competitive, long-distance transport strategies.

From the customers’ perspectives, an optimal passenger rail transport system does not yet exist. Overall, further developments and harmonization efforts are warranted, also in order to improve efficiency and above all, to enable the transportation sector to make a contribution towards achieving Paris climate goals. EU authorities need to look beyond regulatory frameworks and demonstrate a stronger commitment to closing the gaps in international transport routes. In doing so, clear improvements in service can be achieved with little costs.

Sebastian Belz

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Transport for tomorrow

Transport will remain a growth industry. That also means it has to start tackling some serious challenges. An outlook by Vincent Benezech, Policy Analyst, International Transport Forum.



Vincent Benezech is a policy analyst at the International Transport Forum – an intergovernmental organisation with 57 member countries which acts as a think tank for transport policies. He heads the team that models scenarios for the future of transport which are published biannually in the “ITF Transport Outlook”.

Global demand for transport has been increasing steadily during the past decades, with the exception of a brief downturn during the 2008 economic crisis. Economic development is still coupled with increased transport demand, and passenger and freight volumes are therefore likely to see continued growth in the foreseeable future. According to the latest scenarios for global transport demand, contained in the International Transport Forum’s “ITF Transport Outlook 2017”, passenger demand could increase twofold between 2015 and 2050, while demand for freight transport could even triple over this period.

The expected surge in the movements of passengers and goods is the result of economic development expected over the coming decades, notably in what today are still low- and middle-income countries. The increased sophistication of the transport systems available in these countries will also be an important lever to increase trade and economic growth; investments in improved mobility systems and transport networks should therefore be encouraged. On the other hand, increased transport activity is already proving difficult to manage in many regions, and further growth will bring challenges at all geographical scales: In cities, congestion and local pollution are already creating significant economic costs and causing widespread health problems. These negative effects of increased mobility are bound to get worse unless strong policy interventions counter the current reliance on cars for urban mobility. At the national level, the supply of energy for the transport sector may become an issue.

Transport’s carbon emissions will increase 60%
Transport significantly contributes to global warming. Carbon dioxide from mobility represents around 24% of CO₂ emission from fuel combustion. In OECD countries,

CO₂ emissions amounted to just under 4 billion tonnes in 2015, which represents 42% of all transport-related emissions. In per-capita terms, this translates into approximately 3 tonnes of CO₂ per inhabitant and per year. By contrast, inhabitants in non-OECD economies emit on average 0.5 tonnes of CO₂ per year from transport activities.

As the non-OECD world develops its economies, this gap will start to close. In the ITF Transport Outlook 2017’s baseline scenario – which describes a world where no significant effort is made by policy makers besides those already in place or easily foreseeable – transport’s carbon emissions will increase 60% by 2050. This alarming growth takes place despite much more efficient use of energy. Indeed, looking at the average CO₂ intensity of transport, this is expected to decrease significantly over the coming three-and-a-half decades: For instance, passenger transport will emit only an average of 60 g of CO₂ per passenger-kilometre in 2050 in the baseline scenario, compared to 100 g in 2015. Similar improvements will take place in the freight sector. But because of the expected strong growth in transport demand, these improvements, significant as they may be in themselves, are far from sufficient to stop the growth in transport CO₂ emissions, let alone reverse the trend.

Currently existing policies and measures are not enough

The political ambition to address the gap is there. The ratification of the Paris Agreement on Climate Change and the submission of Nationally Determined Contributions (NDCs) which quantify the planned mitigation efforts of each country, are a clear sign for this. Now the commitments need to be transformed into actions with measurable results, however. Only about half of the NDCs explicitly mention transport as a potential mitiga-

tion source, and most of these references are vague or only mention targets without linking them to specific policy measures that would achieve them. Some of the proposed carbon mitigation measures also run the risk of only solving short-term issues, while locking in expensive infrastructure. This is for instance the case of Liquid Natural Gas (LNG) for shipping, which requires large investment in port infrastructure but cannot be a long-term solution, since LNG still has a non-negligible content of carbon.

In any case, the added effects of all the pledges in the NDCs will not be sufficient to achieve the ambition of the agreement. Currently existing policies and measures, even when pushed to their maximum potential, are not enough. Indeed, when combining the most optimistic pathways for all modes, freight and passenger, emissions in 2050 amount to 7,370 million tonnes compared to 13,600 in the baseline. This low-carbon scenario necessitates higher efficiency gains for all vehicles (including alternative fuels for ships), higher fuel taxes, full benefits of vehicle optimisation for road freight and land use and public transport planning in the urban sector.

Overall, the mitigation measures envisaged fall short of the aspiration to limit global warming to 1.5°C above pre-industrial levels, as expressed in the Paris Agreement. The exact carbon budget to limit emissions at this level, as well as the share of the budget available to the transport sector, is not precisely known. What is known is that transport emissions even in the low-carbon scenario in the ITF Transport Outlook 2017 overshoot all targets put forward by scientists that would make such a scenario attainable.

Efficient transport is critical to economic development

Efforts to make transport greener will need to be carefully balanced with preserving transport's role as an enabler of economic growth. There can be no international trade without transport infrastructure and services. Efficient transport is critical to economic development, as it provides access to jobs, opportunities or social interactions, and there is a growing recognition that accessibility and connectivity should be at the center of transport policies.

Interestingly, some of the measures that make transport more environmentally sustainable also improve accessibility. This is most evident in cities, where the

promotion of appropriate forms of public transport can limit CO₂ emissions and at the same time provide more equitable access. Decreasing the reliance on cars is also essential to limit the burden of infrastructure building in developing countries, especially in Asia. Most cities with fast-growing populations already suffer from heavily congested road networks. The ITF projections show that maintaining accessibility levels for cars constant will require unsustainable levels of investment in road infrastructure: In Asia, for instance, the total length of urban roads would need to quadruple.

Car-based urban mobility creates equity problems also because not everyone can afford a motor vehicle. In this respect it is worrying that accessibility by public transport is especially low in developing cities, where the motorisation rate is also the lowest. Many city dwellers are thus excluded from physically reaching opportunities these cities offer, and they would greatly benefit from better public transport access. However, local governments will not be able to build full-scale transport systems that are also affordable. In many countries, people with low incomes already cannot pay for public transport fares. The coverage of cities will need to be very carefully planned and also take into account the potential of emerging non-traditional mobility services in cities.

Digitalisation? The next transport revolution is already underway

The impact of digitalisation is felt strongly across the transport sector. But the next transport revolution is already underway, based on real-time streams of data that make it easier and more efficient to match supply and demand. The coming decades will witness the arrival of more disruptive technologies, vehicle automation and on-demand transport. Car-sharing is one of the services with the potential to increase accessibility in a sustainable way. Such solutions need to be promoted and accompanied by sound policies. Without these, vehicle automation could turn out to bring more cars onto the roads, with all the associated problems of air pollution, CO₂ emissions, congestion or access. In order to empower people in their personal lives and in their economic activities, while safeguarding the ability of future generations to meet their needs, there is no alternative to making transport sustainable, and policy makers should be ready to tap into the ongoing stream of innovation to achieve this paramount objective. ■

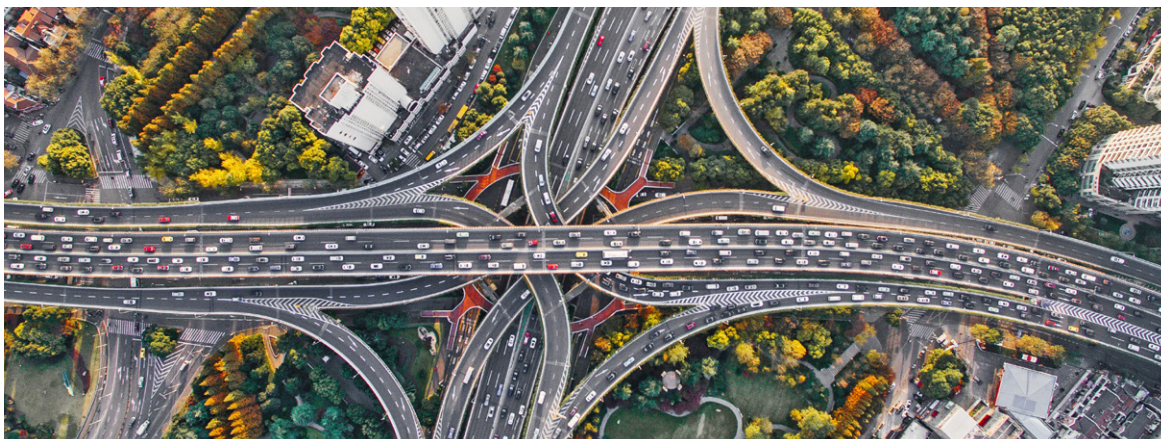


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European passenger rail services in transition

The Fourth EU railway package brings changes and new challenges to passenger rail authorities

European Union, policies, public service obligations, rail markets

In December 2016, the European Parliament adopted the market pillar of the EU's Fourth railway package. In combination with its technical pillar, the package aims at harmonising the EU railway policies for improving the competitiveness and attractiveness of railways and for a further development of the single European railway area [1]. This article describes the amendments of Regulation (EC) 1370/2007 by Regulation (EU) 2016/2338 and gives guidance to competent passenger rail authorities on the decisions to take for governing passenger rail services, the related tasks and their implications when it comes to organising and awarding a public service contract (PSC).

Ludger Sippel, Julian Nolte

Since its coming into force in 2009, Regulation (EC) 1370/2007 has been the frame for public service obligations (PSO) and the subsequent grant of compensations or exclusive rights in the field of public passenger services by rail and by road. Its provisions are of key importance for Europe's transport sector: Most of the public passenger railway transport in the EU has been, and apparently still is today, carried out under PSO (respectively PSC) [2]. Despite the earlier liberalisation of rail freight and cross-border passenger rail services, domestic passenger railway services have not been opened for mandatory competition yet, and many domestic public service contracts are still awarded directly without any bidding

process [3]. It is important to note the reasons behind this situation: A significant number of competent authorities in EU's Member States is not only responsible for organising and financing the services. Some of the authorities are at the same time the owner of an incumbent railway undertaking. Direct awards of public service contracts have temporarily helped them to avoid a serious restructuring of these undertakings. Other competent authorities have less strong links to incumbent railway undertakings, e.g. those authorities organised on the regional level (figure 1).

During the preparation of the Fourth railway package proposal, the European Commission intensively studied the benefits of competition in the railway market and

opted for making these positive experiences accessible to passengers in all member states of the EU [4]. Henceforward, the Fourth railway package will open domestic passenger railway markets in the EU's Member States, starting from the change of timetables in December 2020 [3]. Furthermore, the amendment of Regulation (EC) 1370/2007, carried out by Regulation (EU) 2016/2338, introduces the awarding of PSC for public passenger rail transport on the basis of a competitive tendering procedure as a general rule.

Including the amendments of Regulation 2016/2338, Regulation 1370/2007 now contains the following milestones [5]:

- Until 02 December 2019, Member States shall take measures to gradually comply with Article 5 (on the award of public service contracts) in order to avoid serious structural problems particularly related to transport capacity;
- Between 25 December 2020 and 25 June 2021, Member States shall provide the Commission with a progress report, highlighting the implementation of any award of public service contracts that comply with Article 5;
- The duration of contracts directly awarded in accordance with Article 5(6) between 3rd Dec. 2019 and 24th Dec. 2023 shall not exceed 10 years;
- Article 5 (6) which allows for a direct award of public service contracts concerning rail services will cease to apply as of 25 December 2023.

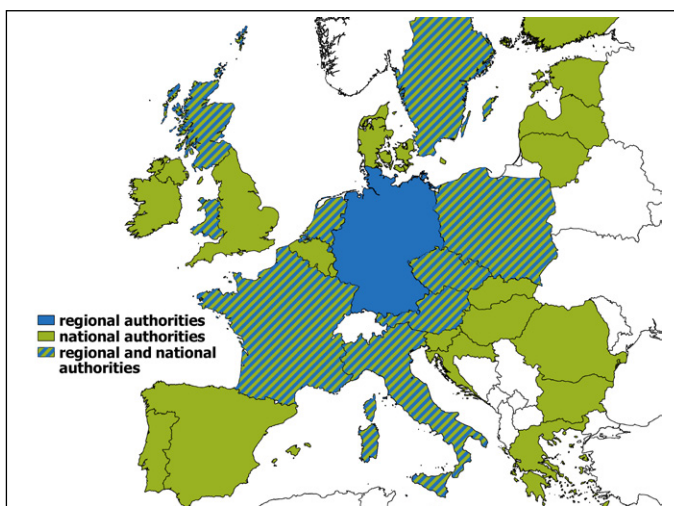


Figure 1: Competent passenger rail authorities in the EU member states
Source: KCW

These milestones mark the further advance of the liberalisation of European railway markets.

At the same time the amended Regulation still leaves exemptions that will enable many competent authorities to decide whether to contract railway services competitively or to directly award the services as Article 5 defines several (new) exceptions for direct awards.

The exemptions to competitive tendering of rail services of the amended PSO regulation now include the following situations:

- A maximum threshold of an annual value of EUR 7,500,000 or the annual provision of 500,000 train kilometres is not exceeded [6];
- The competent authority considers a direct award to be justified due to the relevant structural and geographical characteristics of the market and network concerned and such a contract would result in an improvement in the quality of services or cost-efficiency, or both, compared to the previously awarded public service contract. Member States shall be deemed to fulfil this condition when
 - the maximum annual market volume is less than 23 million train-km (see table 1) when the amendment comes into force, and
 - where just one competent authority at the national level exists (see figure 1) and
 - where only one public service contract is covering the entire network [7].
- Exceptional circumstances justify a direct award in order to optimise the provision of public services. The amended Regulation names as such exceptional circumstances a too large number of competitive tendering procedures that are already being run which could affect the number and quality of bids likely to be received or changes to the scope of one or more public service contracts are required in order to optimise the provision of public services [8];
- Emergency measures taken by the competent authority in the event of a disruption of services or the immediate risk of such a situation [9];
- A regional or even local competent authority (an authority which does not act on the national level) provides the services itself or awards a service contract directly to a legally distinct entity over which it exercises control [10].
- A competent authority may also award a PSC directly to an operator managing at the same time the entire or major parts of the infrastructure where the relevant passenger services are provided. For this

Member State	Million train-km	Year of reference	Source	
DE	Germany	803	2014	[20]
UK	United Kingdom	508	2014	[20]
FR	France	412	2014	[20]
IT	Italy	286	2014	[20]
ES	Spain	174	2014	[20]
NL	Netherland	144	2014	[20]
PL	Poland	135	2014	[20]
CZ	Czech Republic	122	2010	[21]
SE	Sweden	116	2014	[20]
AT	Austria	109	2014	[20]
BE	Belgium	84	2014	[20]
HU	Hungary	84	2014	[20]
RO	Romania	60	2014	[22]
DK	Denmark	51	2014	[20]
SF	Finland	36	2014	[20]
SK	Slovak Republic	32	2014	[20]
PT	Portugal	31	2010	[21]
BG	Bulgaria	21	2014	[20]
IE	Ireland	17	2010	[21]
HR	Croatia	15	2014	[20]
GR	Greece	11	2014	[20]
SI	Slovenia	10	2014	[20]
LU	Luxembourg	8	2014	[20]
LV	Latvia	6	2014	[20]
LT	Lithuania	5	2010	[21]
EE	Estonia	5	2014	[20]

Table 1: Market volume of rail passenger services in the EU Member States. To the extent known, the given numbers refer to PSO and Non-PSO services within the states.

purpose infrastructure must be exempted from the regulations on separation and infrastructure charges of Directive 2012/34/EU [11].

Exemptions to be justified

What, at first glance, seems to be an extensive freedom of decision for competent authorities either in favour of or against competition will be in fact in most of the cases limited either by the required justifications or the maximum duration of directly awarded contracts.

For instance, recital 21 of the amended Regulation stipulates for exceptional circumstances that

- a) the circumstances have to be indeed “exceptional”,
- b) the new contracts may be directly awarded only “temporarily” and
- c) these contracts “should not be renewed to cover the same or similar public service obligations”.

Given the fact that any competitor of the (incumbent) operator favoured by the direct award may appeal against the decision of a competent authority to directly award a public service contract and that the justifications are carefully examined during such

a proceeding, competent authorities might want to substantiate any of their decisions by specific market studies focussing on their relevant market and the issue addressed. In the case of exceptional circumstances it could for example be helpful to demonstrate that competent authorities in similar markets regularly receive only a limited number of bids and that the result of such procedures with limited competition is close to a well negotiated direct award.

A more complex approach is necessary if a competent authority wants to justify a direct award with “the relevant structural and geographical characteristics of the market and network concerned” [12] and needs to negotiate the figures and performance measuring methods with the incumbent undertaking. In this case it would be extremely helpful for the authority to know the cost and production structures of comparable undertakings in detail.

A necessary condition to be met for a direct award of a contract under exceptional circumstances is furthermore the implementation of specific performance indicators as well as effective and deterrent measures to be imposed in case the railway undertaking fails to meet the performance requirements [7]. Reasonably, this require-

ment should take into account the positive experiences made in the EU so far, even if some allowances for the specific situation of each competent authority will be necessary. Important issues include the technical condition of the infrastructure and the rolling stock to be used, the density and the connections within the public transport network and the expectations of the passengers regarding the quality of transport.

Preparation of awarding procedures

Concerning awarding procedures, the amendment of the PSO regulation brings considerable changes for those authorities that so far have not yet competitively tendered their services and will be forced to open or are opening their market by choice. In order to award an economically favourable contract, a competent authority in general will have to execute the following preparatory steps:

- Identification of networks which enable railway undertakings (and in consequence the authorities) to benefit from operation synergies;
- Definition of the duration, scale and scope of the services to be tendered, including lot sizes if appropriate;
- Definition of the type of contract: net costs vs. gross costs or hybrid forms;
- Planning and optimisation of the to be tendered services;
- Modelling of the expected costs;
- Definition of a quality management system with efficient performance indicators (punctuality, capacity, failure ratios, etc.);
- Implementation of an appropriate remuneration system;
- Implementation of an appropriate risk diversification;
- Guaranteeing access to production resources (rolling stock, workshops, sale systems).

The last three steps are of particular importance for competent authorities in order to achieve improvements in the efficiency of the services: With increasing market transparency and reasonably calculable risks, more undertakings are going to participate in a call for tenders. By designing the market, the authorities become the key players of passenger rail transport.

In addition to the specific justifications of direct awards of public service contracts, all competent authorities that operate on Member State level will have to align their procedures to a number of further provisions, especially:

- The development and description of measures to gradually comply with Article 5 [13]

- To ensure an efficient and rapid review of the decision on the type of award [14];
- The provision of a **progress report** by 25th June 2021 [13];
- The assessment of measures to ensure effective and non – discriminatory access to suitable rolling stock [15] and
- The compliance with the rules applicable to compensation [16].

Conclusion and Outlook

The amended PSO regulation leaves no doubt that the European legislator considers the opening of the market as a means to achieve better services for the user [17] and is eager to enhance quality, transparency, efficiency and performance of passenger rail services [18]. It is true that the introduction of competitive tendering increases the amount of work on the side of the authorities and forces the incumbent to adapt to the new situation. Nevertheless, with the implementation of the Fourth railway package these changes are unavoidable.

The authors of this article encourage all competent authorities that are not yet proficient in the application of the PSO regulation, and in tendering especially, to get in a close dialogue with the European Commission on the challenges triggered by the Fourth railway package, with other authorities or with external experts specialised in the field of public service contracts. Such exchanges and external expertise may help to comply with the amended regulation and to minimise the risk of legal uncertainties of the contracts to be awarded in future. ■

IN ADDITION

How to avoid hard cuts

Even in a country like France which has been seen as closed for PSC competition in public rail transport for a long time, things are changing, mainly caused by the dissatisfaction with the performance of the incumbent operator: From 2019 on, an “experimentation phase” on tendering in French regional rail transport is envisaged by the French state and by the regions, which are the competent authorities for regional train PSO services in France: On the one hand, such “experimentation” can give any stakeholder the chance to acquire first experiences in the field of competitive awarding, resulting in tests of forms of governance and regulatory adaptations if appropriate. On the other hand, a transition phase of some years shall avoid hard cuts, before competitive awarding becomes mandatory [19]. Depending on the results of the French presidential election, that might be even quicker than initially intended.

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Repair or replace

Why the “Juncker Fund” is in contradiction with the EU’s transport policy – and how it can still be turned into a success

Juncker plan, investments, TEN-T, infrastructure, EFSI

After his election as President of the European Commission, Jean-Claude Juncker promised that he would initiate an ambitious investment plan for the continent. The “European Fund for Strategic Investments” translates this pledge into action and has already made investments worth EUR 33 billion. But so far there has been little in it for sustainable mobility: the transport sector is underrepresented, the fund channels away the resources reserved for the “Transeuropean Transport Networks” and the investment projects are often not aligned with the overarching goals of EU transport policy. Yet, the EU-Commission has made a proposal to extend and expand the fund, even before the mandatory mid-term evaluation has been carried out. The European Court of Auditors is not alone in criticising this hasty move.

Michael Cramer, Jens Müller

Even the project promoters probably did not expect that one day the extension of the A6 motorway between the small German towns of Wiesloch-Rauenberg and Weinsberg, or the modernisation of Greek regional airports would be considered as investments of strategic importance for the whole continent. Yet, the “European Fund for Strategic Investments” (EFSI) provides almost EUR 600 million in funding to both projects.¹ This is not the outcome of EU transport policies, but result of decisions taken by Jean-Claude Juncker, President of the European Commission. After his election in 2014, he came up with the idea of a comprehensive investment programme, dubbed the “Juncker Plan”.

But Juncker faced two problems: the EU budget could not provide the necessary resources for his plan and the Union is not allowed to contract debt. His team thus

came up with a bold idea: instead of investing its own money, the EU would create a guarantee fund with the help of the European Investment Bank. This concept resembles modern financial alchemy (see figure 1). The fund secures selected private and public investments by hedging against first potential losses, thereby improving the financing conditions. This scheme requires a maximum of EUR 16 billion from the EU’s budget and aims at stimulating investments of in total EUR 315 billion by the year 2020.

Serious concerns among transport experts from across all parties

Juncker’s plan was generally taken up positively. Yet, transport experts from across all political parties had serious concerns from the outset. This was, first and foremost, due to the fact that the capital needed to establish the EFSI had to be taken from other parts of the EU budget, with transport being

the major contributor (EUR 4.2 billion). This cut was all the more painful as the completion of the TEN-T will cost about EUR 500 billion, which is why transport experts had fought very hard for an increase in funding.² The transfer to the EFSI almost offsets this increase.

The Transport Committee of the European Parliament was not only concerned with a funding shortfall. They also wondered whether transport projects would be able to secure a large share of EFSI funding, given the financial requirements and the need for very speedy realisation. And finally, the Members of Parliament also feared that eligible transport projects would contradict the overarching EU goals on better transport connections across borders, good jobs and sustainable development.

In order to counter these concerns, the European Commission suggested that by July 2018 an independent mid-term evaluation of the EFSI should be carried out. It would be the basis for further decisions. It was also thanks to this guarantee that Jean-Claude Juncker eventually obtained a large majority for his idea in 2015.

An early proposal to extend and expand

However, one year later, the European Commission no longer adhered to this promise. They hastily carried out an internal evaluation and came to a positive evaluation of the investment plan. In September 2016, the Commission proposed the extension and expansion of the fund - barely one year after the setting up of the EFSI, and almost two years before the deadline for an independent evaluation. Currently, both the Council of the EU and the European Parlia-

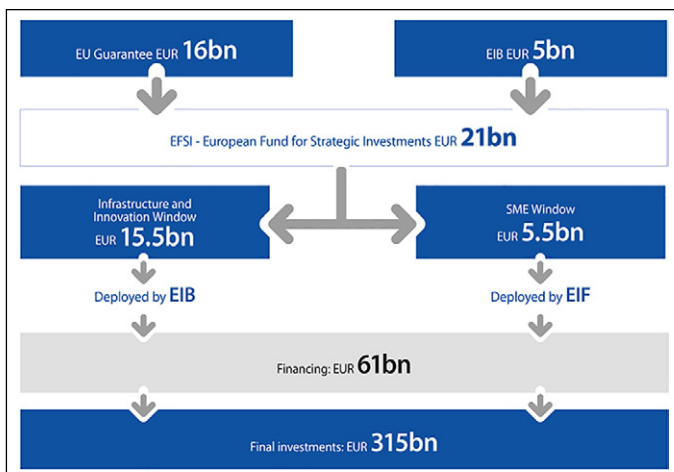


Figure 1: How the EFSI works
Source: European Investment Bank

ment are scrutinizing this proposal. It foresees an increase of the EU guarantee from EUR 16 to 26 billion and, thereby, aims at triggering investments equaling a total of EUR 500 billion. Moreover, the Commission wants to extend the duration of the fund from July 2019 to December 2020. The necessary funding shall yet again be raised from other parts of the EU budget, with transport once more being amongst the major contributors (EUR 155 million).

This approach was met with harsh criticism by the European Court of Auditors, the EU's budget watchdog. "The Proposal was launched without a comprehensive impact assessment (for the second time) and too soon for the economic, social and environmental impact of EFSI to be measured and to enable a conclusion whether EFSI is achieving its objectives", the institution concluded.³ The Transport Committee of the European Parliament was equally alarmed by the threat of seeing a further cut in the EU's budget for transport infrastructure. The Members of Parliament prepared their own appraisal of the "Juncker plan" and arrived at explosive conclusions.

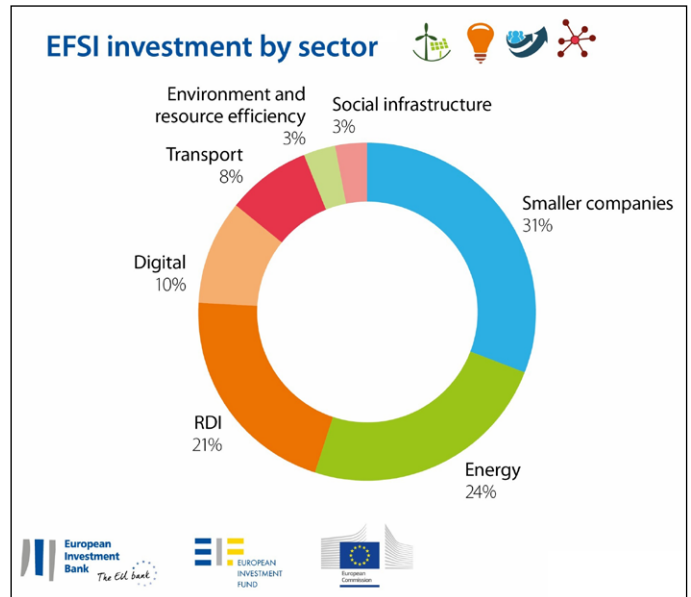
Disappointing results for the transport sector

Probably the most salient insight is that the transport sector is underrepresented amongst the selected projects, despite its high financial contribution (see figure 2). So far, transport only accounts for 9% of the approved EFSI projects. Besides this sectorial imbalance, there also is a geographical one: three quarters of the projects are located in the older Member States, whereas Central and Eastern Europe are underrepresented.

The second important lesson is related to the character of the selected projects. There clearly is a preference for projects with a high investment volume over the ones with clear added value for the EU. Projects of regional or national importance account for the major share of the supported projects, whereas measures for the Trans-European infrastructure and the transition towards sustainable mobility are rare. The aforementioned example of Greek regional airports is an example of the blindness of the EFSI fund with regard to transport policy objectives. In 2014, the European Court of Auditors scrutinized EU spending on regional airports and found that it "produced poor value for money".⁴

What is more, road construction represents 40% of signed EFSI transport projects, while the environmentally-friendly railways only account for 20% and cross-border projects can barely be found on the list. This is exactly the opposite of what the "Trans-

Figure 2: Sectorial distribution of EFSI investments
Source: European Investment Bank



European Transport Networks" try to achieve. It is clear that the "Juncker fund" puts the financial viability of projects before fundamental EU objectives such as cohesion, employment and climate protection.

How the EFSI could be turned into a success

The proposed expansion and extension of the fund appears counterproductive against this background. It would thus seem logical to freeze EFSI spending and transfer the remaining funds to other instruments. But such a proposal would be doomed to fail, given the dominance of the Grand Coalition between Conservatives and Socialists at the European level. It would be more realistic to temporarily suspend the increase and prolongation of the fund in order to draw the right lessons and readjust the fund.

In this context, it is important to note that European economies no longer suffer from weak demand but rather have to cope with their structural deficiencies and the consequences of global trends. The focus on increased spending at almost every price therefore makes less sense than ever. Instead, the EU should put the long-term benefits at the heart of its investment policies. The European Commission's proposal contains one lesser-known idea that shows how this could be achieved: they suggest that EU grants for transport infrastructure be "blended" with private capital in order to accelerate the realization of the TEN-T. This could indeed be an interesting approach – provided that EFSI spending is strictly linked to working towards the goals of territorial cohesion, employment and decarbonisation.

Finally, one may also wonder whether it makes sense that the EU gets involved in

capital markets. There may be benefits in certain cases, but this can never be a substitute for a well thought-out transport policy. It would be of much more strategic importance for the EU to finally turn the promises made in the 2011 EU White Paper on Transport into a reality, rather than putting their hopes in the "Juncker Fund" with its limited size when compared to the GDP of the EU. If the EU succeeded in establishing fair intermodal competition, better consumer protection and a shift towards environmentally-friendly transport modes, this would be a major step towards the future of mobility – and one that needs no additional public spending. ■

¹ The list of projects financed by the EFSI can be found on the website of the European Investment Bank: <http://www.eib.org/efsi/efsi-projects/>

² See Regulation 1316/2013 establishing the „Connecting Europe Facility“, recital 15; http://www.eca.europa.eu/Lists/ECADocuments/OP15_04/OP15_04_EN.pdf

³ See Opinion 2/2016 of the European Court of Auditors, paragraph 26; 11 Nov 2016; <http://www.eca.europa.eu/en/Pages/DocItem.aspx?did=39677>

⁴ See the press release/report of 16 December 2014 by the European Court of Auditors; http://www.eca.europa.eu/Lists/ECADocuments/INSR14_21/INSR14_21_EN.pdf



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Photo: Pixabay

Public transit and land use decisions

Review of guidebooks for transit agencies

Public transportation, transport planning, passenger transportation

The integration of public transit and land use planning in large cities and metropolises is still widely insufficient, at least in the Federal Republic of Germany. As a consequence, the potential of transit-oriented land use could be more fully exploited in order to maximize the benefits for traffic and the environment. This situation clearly needs to be corrected. This can be achieved by re-positioning transit agencies in the processes of deciding how to use land, creating a better orientation of the land use development that incorporates the backbone systems of public transit, taking advantage of innovative financing options, and, last but not least, acknowledging expected changes in future mobility patterns.

Andreas Kossak

Initiated by the Verband Deutscher Verkehrsunternehmen (VDV, Engl.: Association of German Transit Companies), a group of experts met to discuss the topic of transit and town planning. The results of the assembly were published in an article entitled “Integration of Town Planning and Transit for Lively Cities” in the VDV’s journal (*Der Nahverkehr*) in 2016. The article’s subtitle clearly expresses the demand that transit issues should be duly considered in strategic urban and traffic planning processes [1].

The integration of urban and transportation planning has been a topic of teaching and research at German technical universi-

ties since the 1960s. Although issues in transportation planning, including public transportation, have been approached academically, they have not been fully addressed or translated into practice. This has been due, in part, to the lack of interest or cooperation of many transportation industry stakeholders. However, in light of the expected changes in mobility conditions and behaviors, a continuation of this situation could not only weaken but even significantly endanger the role of the public transit in urban transportation systems.

“Mobility researchers” or “Future researchers” often are more or less self-appointed and inadequately qualified to

address the complex issues of public transit, due to a lack of educational background and professional experience. They have been talking idly for years about an impending, drastic change in mobility conditions. In particular, they have also been forecasting a world in which people will more or less exclusively rely on shared self-driving cars. As such, most of their scenarios fail to include mention of classical public transportation [2].

In contrast, independent experts and renowned research institutes worldwide have assigned a much more positive and meaningful role to future models of public transportation in cities and metropolitan

areas [3]. In particular, they expect that urban and regional rail systems will even assume more dominant roles as backbones of passenger transportation systems, provided that public transit agencies and entities responsible for urban and transportation planning react appropriately to the anticipated changes.

Addressing the complex task of fully exploiting the potential of future options that favor public transit and improve traffic and environmental conditions in cities and metropolitan areas primarily involves the following:

- determining the kind and extent of *involvement of transit agencies* in planning regional and urban passenger transport,
- planning the intensity and extent of *transit-oriented development (TOD)*, and
- *strengthening the financial basis* of public transit.

Remarkably, several guidebooks, memorandums, and papers that deal with these complex considerations have been recently published by Federal Administrations, by the Transportation Research Board (TRB) of the National Academies of Sciences, and the American Public Transit Administration (APTA). All of these publications were based on intensive research. Although the respective histories of public transit in the US in Europe differ in numerous aspects, the facts and recommendations documented in the U.S. publications are more or less directly transferable to European transit systems. A survey of selected issues covered in the latest publications is provided in the following.

Linking public transit and town planning

Sponsored by the U.S. Federal Transit Administration (FTA) in the framework of the TRB's Transit Cooperative Research Program (TCRP), the *“Guidebook for Transit Agencies: Linking Transit Agencies and Land Use Decision Making”* was published in the fall of 2016 [4]. The guidebook presents explicitly stated, basic tenets, such as:

- “Land use decisions play a key role in shaping the long-term success of virtually every transit system.”
- “Organizations other than transit agencies hold the responsibility and authority for integrating land use and transit”.

The guidebook emphasizes how “...transit agencies can influence the framework for those stakeholders to routinely make transit-supportive land use decisions”. In this regard, it also calls attention to crucial requirements for successful planning. For

example, transit agencies “...need to be invited to the table (i. e., to participate in the land use decision-making process)” and they “...need the tools to be influential players when they arrive at the table”. To this end, the authors explicitly state that the goal of the guidebook is to promote “...effective transit and land use decision-making by providing the transit agencies with the right set of tools to be effective at the decision-making table”. This is accomplished by providing answers to the following questions:

- “What can transit agencies do to become more meaningful participants in land use decision-making?”
- “When and how is it worthwhile for transit agencies to get involved?”

The guidebook outlines the following five preconditions for success:

- a supportive transit agency board,
- a designated transit agency staff person with technical competency,
- a coordination process,
- a common understanding or language, and
- a transit-supportive community.

The guidebook offers a wide range of tools and tips related to these issues. In this context, the guidebook explicitly refers to the fact that even though transit authorities (in the US) do not have the jurisdictional authority to ensure that land use decisions are transit-supportive, they have multiple possibilities to “proactively engage...major stakeholders and the general public to achieve the desired land use outcome”.

Furthermore, the following key tools for “enhancing the communication and coordination” among the different stakeholders are discussed:

- **Partnering:** This includes early and sustained communication, formal and informal processes of engaging transit agencies in the decision-making processes, encouraging cities to incorporate transit considerations during their development review processes, and establishing working groups, workshops, and educational programs.
- **Publishing strategic guidebooks:** This includes developing region-specific handbooks, guidebooks, and/or websites related to transit-supportive development, thereby highlighting the importance of interagency communication, collaboration, and coordination.
- **Articulating costs and benefits:** Here, all stakeholders (e.g., local governmental land use planners and private developers) should be informed about and fully understand the service and operational

issues related to land use decisions, the benefits of and need for transit, or the relationship between transit and land use decisions.

The guidebook presents four case studies that illustrate how the successful application of the above-mentioned five “preconditions for success” has been implemented in real-life situations involving public transit. In particular, the potential of urban rail systems to enhance and/or intensify transit-oriented development becomes clear in the following two cases:

- improvements made along existing rail lines in New Jersey and,
- the introduction and expansion of a modern streetcar system as a method to redevelop a district adjacent to the downtown area of Portland, Oregon.

In the Portland streetcar project case study, it is explained how town and transportation planners in the early 1970s systematically approached and pursued changing an automobile-centered transit situation to one based on a modern light rail system (LRT) in the Portland metropolitan area. In order to visualize what the consequences of a continued and automobile-oriented transit policy would look like, a photo montage was created to show how Portland's skyline would look with six 40-story parking facilities added to it. According to local authorities' estimates, these facilities would have been necessary if the former automobile-focused transportation policy had been maintained and allowed to expand.

Instead, a previously existing, multi-story parking garage in the downtown area was pulled down, and the land was used to create a very attractive public square (Pioneer Square, see *figure 1*). Since then, Portland's new “living-room” has enjoyed immense popularity, and it has received highest US awards for architecture, urban design, and public art [5]. All light-rail lines of the metropolitan area are connected to one another around the square.

Following the short versions of the case studies (full versions are attached at the end of the guidebook), the key interaction points and activities at the various geographic planning scales (e.g., regional, municipal, county, corridor, sub-area/district, and site) are explained. As well, the specific challenges of cooperating with the various partners involved in land use decision-making processes (e.g., metropolitan planning organizations, state government, philanthropic organizations, non-profit community organizations, and private developers) are described.

In a special attachment, the importance of the five “key features of the built environment ...that strongly influence the use of public transit” is discussed. Termed the “5 Ds”, these include:

- **Density** (of land use),
- **Diversity** (mix of land use),
- **Design** (of the transportation-infrastructure around the transit systems, especially with respect to walking and cycling),
- **Destination accessibility** (connections to the main urban activity centers or “places”), and
- **Distance** to transit (relation between concentrations of land use and urban rail system stops or attractive bus services).

Transit-oriented development (TOD)

Since Portland decided to revamp its public transportation system in the 1970s, the concept of TOD has gradually received more attention from urban and regional planners all over the US. In Portland, the decision to adopt TOD policy into urban planning was based on the results of a public referendum. Since then, transportation system- and land use-planning in major US cities and metropolitan areas has increasingly focused on urban rail systems [6]. Over the recent years, the introduction of bus rapid transit (BRT) systems has also been discussed. A BRT system includes streets with dedicated bus lines, attractive bus services with relatively few stops, high travel speeds, separate right-of-ways for bus traffic, design features, and equipment similar to those used for light rail-based systems, at least at the main stations.

The U.S. Federal Transit Administration (FTA) has also begun to focus more intensively on TOD-based transportation systems. In a recent and frequently advanced FTA memorandum, the principle of TOD is characterized as follows [7]: “Transit oriented development ... creates compact, mixed-use communities near transit where

people enjoy easy access to jobs and services. Well-done TOD connects transit to desirable places to live, work and visit like entertainment venues, parks, retail, restaurants, an improved pedestrian environment and diverse housing choices”.

In particular, the memorandum emphasizes how focusing on growth around transit stations can capitalize on public investments in transit and create many benefits, including:

- increased use and associated revenue gains for transit systems,
- revitalization of neighborhoods,
- greater supply of affordable housing,
- economic returns to surrounding land owners and businesses,
- reduction of traffic congestion, and
- more safety for pedestrians and cyclists.

TOD-activities are promoted by the FTA with “technical assistance”, “financial support of pilot-projects” and “training programs”. Such assistance is described in a comprehensive TCRP report entitled “Transit-Oriented Development in the United States: Experiences, Challenges, and Prospects”, which was published in 2004 [8].

In the US, TOD is currently the subject of interesting public scientific discussions and disputes regarding different issues. For example, one issue concerns the question of whether the focus should be on development-oriented transit (DOT) instead of on transit-oriented development [9, 10]. Another topic of debate is whether it may be more economically feasible to base TOD on BRT-systems than on urban rail systems (e.g., the LRT) [10, 11].

The answer to the first question is primarily rooted in the different phases of urban or regional development. Whereas TOD primarily aims to develop urban and regional structures and traffic conditions, DOT involves introducing certain processes that will improve existing urban structures

so that they create the conditions for providing attractive transit. For example, DOT has been described as a way to create and connect urban highlights: “Transit revival requires regional and systematic integration of transit planning and place-making initiatives that moves beyond incremental transit oriented development” [9, 10].

Regarding the choice of whether to implement BRT or LRT, on the one hand, it is important to consider the basic principle: “Mass transit needs mass to be successful. Low transit ridership and underutilized capacity make public transit infrastructure unsustainable.” On the other hand, compared to bus systems, the economic benefits of properly designed urban rail systems considerably outweigh the construction and operation costs. Furthermore, they are much more stable and represent more attractive infrastructural backbones of the land use patterns. Owing to these considerations, it has become a more desirable and accepted practice to take advantage of the so called “value capture” approach for financing transit infrastructure and operations, especially in the US.

Co-financing of public transit by way of value capture

In the framework of the TCRP, in August 2016 the U.S. TRB published the pre-version of a guidebook entitled *Guide to Value Capture Financing for Public Transportation Projects* [12]. In the introduction, the importance of public transit as a key element of transportation infrastructure for communities as well as local and regional economies across the US is emphasized. However, the guidebook also points out that a large number of transit projects are “...underfinanced, leading to suboptimal service, long-deferred maintenance and failure to realize desirable projects”.

Instead of calling for more federal or state subsidies based on the general tax rev-

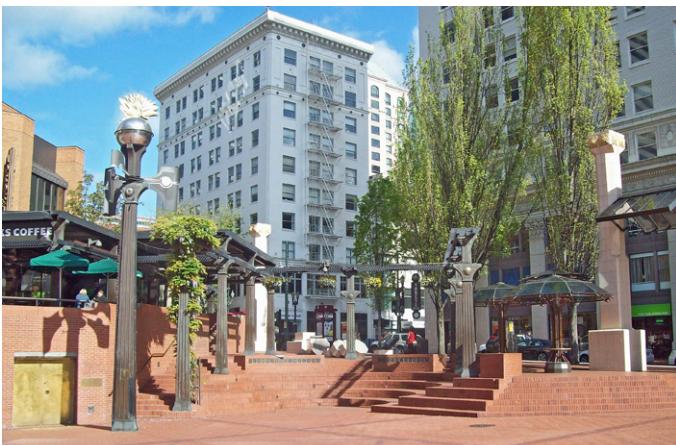


Figure 1. Pioneer Square in Portland, Oregon (left); light rail car and streetcar stopping at a transit mall (right).

Photos: Kossak

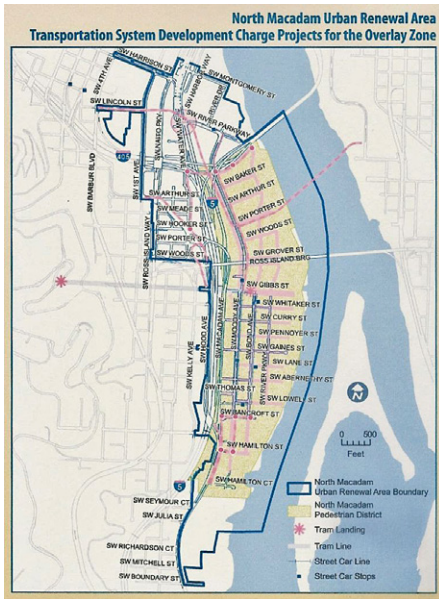


Figure 2. Map of transportation system development charge projects in Portland, OR (left); A Portland streetcar (right).

Source left: [12]; photo right: Kossak

operating costs so that good service can be provided and maintained.

Numerous guidebooks, white papers, and memoranda about this topic have recently been published in the US. They represent rich resources for information about the necessary activities involved in developing public transit systems. Such information can help to promote and ensure a strong and viable future for public transit in European cities and metropolitan areas. ■

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enues (as in Germany), value capture mechanisms are proposed to be the most adequate and effective ways to secure financing for infrastructure development projects. According to the report, value capture “... is the public recovery of a portion of increased property value created as a result of public infrastructure investment.” Some common value capture mechanisms are discussed in detail, for example:

- impact fees,
- joint development / public private partnerships (PPP),
- land value taxation,
- negotiated exactions,
- parking fees,
- sale or leasing of air rights,
- sales tax and special assessment districts,
- station naming rights, and
- tax increment financing.

The reason for compiling the guidebook is described as follows: “The guide ... has been developed to provide transit agencies, local governments, developers, and others with insight regarding value capture as a funding strategy for public transport projects”. The titles of the book’s chapters are as follows:

- Conditions Necessary for Value Capture
- Local Economic and Market Considerations
- Regulatory Considerations
- Articulating the Business Case
- Development Risks
- Creditworthiness, Finance, and Funding
- Institutional Capacity and Partnership
- Overcoming TOD Complexity and Risk
- Case Studies (to demonstrate attributes of successful value capture finance projects)

The six case studies refer to the following projects:

- Boston Landing Station, Boston, MA
- Denver Union Station, Denver, CO
- Hong Kong Mass Transit Railway Corporation
- Kansas City Streetcar, Kansas City, MO
- Portland Streetcar, Portland, OR (see figure 2)
- Dulles Metrorail, Washington DC region

An impressive example of how co-financing can be implemented to cover operating costs for the complete public transit system of a metropolitan area can be seen in the Portland, Oregon transit project. According to the 2016 annual report of the Tri-County Metropolitan Transportation District of Oregon (TriMet), 60% of the operating costs are covered by “payroll and other tax revenue”. The dominant contribution from these sources allows fare tariffs to be kept low, thus making the use of public transit more attractive.

Conclusions

The chronically insufficient involvement of public transit agencies in the urban and transportation planning of cities and metropolitan regions as well as the anticipated changes in boundary conditions and mobility behavior, especially in the urban transportation sector, require short-term actions in order to be able to maintain and/or create lively cities. Such actions include:

- positioning transit agencies more prominently in land use decision-making processes,
- taking full advantage of TOD, and
- using value-capture mechanisms to co-finance public transit projects and cover



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MoviCi – Urban Mobility in the Smart City

The project “MoviCi – Urban Mobility in the Smart City” connects Colombian and German researchers and practitioners

City of tomorrow, Colombia, Germany, traffic, urban mobility

The city of tomorrow is a city, where all citizens manage to travel from home to work, to school or to shopping or leisure destinations faster, safer and more reliable. This requires an integrated transport system that includes all modes and the integration of land use – the locations where people live and the destinations they travel to – and transport. To achieve this, the MoviCi project connects transport and land use practitioners and scientists working for planning and implementation of integrated transport systems. The aim is to build a network of stakeholders from industry local governments, civil society and research institutions in Colombia and Germany to exchange knowledge and good practice.

Mirko Goletz, Dirk Heinrichs, Katharina Karnahl, Mathias Höhne

All around the world, cities and urban agglomerations face similar challenges while trying to integrate the existing modes of public and individual transportation, while new modes driven by digitalization are being developed. With its initiative “Shap-

ing the Future – Building the City of Tomorrow”¹, the German Federal Ministry of Research and Education supports ten German research networks in their efforts to connect with partners from foreign countries to develop solution for future smart cities.

The MoviCi project

The DLR Institutes of Transport Research and Transportation Systems implement the project “MoviCi – Urban Mobility in the Smart City”, in Spanish “Movilidad urbana en ciudades inteligentes”. The project started in February 2017. Over a period of 18

months, it aims to connect Colombian and German partners to develop solutions for future urban mobility. It explores in particular the potentials of digitalization for new mobility services, for improving mobility and for reducing negative effects from transport.

To achieve this, the project connects practitioners and researchers working for planning and implementation of integrated transport systems. The aim is to build a network of stakeholders from industry, governments and authorities of cities, transportation companies and research institutions in Colombia and Germany to exchange knowledge and good practice.

The two DLR Institutes contribute to this goal by co-organizing three events with Colombian partners: a dialogue at the AndinaTraffic fair² in Bogotá, that took place from 27 to 29 March 2017, a workshop with municipal planners and decision makers that will take place in Cali (fall 2017) and a scientific symposium from 18 to 20 April 2018 in Medellín.

Several partners in Colombia and Germany contribute to the project: BerlinPartner representing the City of Berlin, MetroCalí, ITS Automotive Nord, ITS Colombia, German Partnership for Sustainable Mobility and Universidad Nacional de Colombia Sede Medellín.

Achieving integrated mobility: DLR competences in the MoviCi project

The two DLR Institutes contribute specific competences from their research portfolio to the project. This includes the topics:

- intermodal travel in urban areas,
- new and integrated mobility services that emerge with information and communication technology,
- transport demand and traffic modelling in urban areas,
- development of innovative methods for traffic monitoring,
- development of methods to influence traffic operations and quality in transportation

Intermodal travel can be a key component of an efficient urban mobility system in the future. Intermodal mobility describes the use of different means of transport during a single trip. Enabled by digitalization, it promises users a high degree of flexibility and a 'seamless' journey, and increases the attractiveness of public transport. The larger cities get, the more common it becomes that users of public transport combine different modes along their journeys. The two DLR Transport Research Institutes currently assess intermodal travel in cities

across Europe in the *Urban Mobility project*.³ Intermodality requires the integration of high-capacity 'backbone' infrastructure with first and last mile services.

Digitalization enables new solutions that permit a more flexible and individualized usage of transportation systems. Multiple modes of transport are integrated into a seamless trip chain with bookings and payments managed collectively. These solutions require the gathering and usage of data, which can then also be used for more efficient trip-planning, and to support decision-making for government and local authorities regarding improvements in regional public transport systems. The possibilities of managing transport demand by concentrating and optimizing trips in real-time facilitates on-demand services. The Institutes of Transport Research and Transportation Systems are currently involved in the development and evaluation of a flexible bus system in a small sized city in Germany.⁴ In this project information and booking through a smartphone app is controlled by the passengers and requires dynamic real-time routing and dynamic calculation of trip time. This on-demand bus transport is temporal and spatial flexible without a fixed time-table and is suitable for times or areas with less demand.

However, the integration of such new services, when taken to the Colombian context, does not only have to consider existing public transport systems like Bus Rapid Transit, Light Rail Transit or the spreading cable cars in Colombian cities. They also face existing informal services like motorcycle taxis, tricycles or, most recently, platform based taxis services such as Uber. Seeking ways to integrate these services in

an intermodal context will be one of the topics of the MoviCi project. The DLR Institute of Transport Research brings in competences from its current Mototaxi project⁵.

Transport demand and traffic modelling in urban areas is an important tool for decision making on transport investment and regulation, but also to understand the effects of new services on the transport system. The Institute of Transportation Systems develops and runs the microscopic traffic simulation tool SUMO (Simulation of Urban Mobility)⁶ in order to test and evaluate the impact of new mobility solutions. The open source software suite SUMO covers road network imports and enrichment, demand generation and assignment and a state-of-the-art microscopic traffic simulation capable to simulate private and public transport modes, as well as person-based trip chains.

The MoviCi project at the AndinaTraffic in March 2017

The project made a first appearance at the AndinaTraffic fair⁷ (figure 1). This biannual event is one of the largest exhibitions for ITS and ICT solutions in transport in South America. This year, the fair took place from March 27 to 29 in Bogotá. It attracted more than 1000 visitors from 23 countries. Almost 100 exhibitors presented their products. The MoviCi project was present with a project stand. The project team likewise contributed the conference program of the fair.

Dirk Heinrichs highlighted current trends in intermodal travel in urban areas. He provided answers to three questions: Why intermodality is a topic in cities? What do we know about how people in cities practice intermodality? Based on user needs: what are the lessons for planning a user-



Figure 1: MoviCi project team at AndinaTraffic fair with University of Medellín representatives

Source: DLR/MoviCi

centred intermodal transport system? Using experiences from Singapore, Shanghai and Bogotá, the presentation illustrated how transport systems have changed with urbanization over the recent decades. Based on empirical data from a dedicated survey on urban intermodal travel in Germany, Heinrichs showed the importance of the first and last mile and the interchange for intermodal travel.

Katharina Karnahl pointed out how digitalization and the technological development enable new innovative solutions with respect to individualization, flexibilization and optimized usage of transportation systems. Integrated mobility solutions combine transportation services from different providers, organized on one platform for arranging and managing the trips. On-demand services are based on managing transport demand by concentrating and optimizing trips in real-time. In the future self-driving vehicles can support this specific use case, with on-demand services being more affordable with autonomous vehicles. As an example for on-demand services the development and evaluation of a flexible bus system was presented, a project

Find out more



The MoviCi Website provides more information on the project and how to get involved. Project partners are BerlinPartner, MetroCalí, ITS Automotive Nord, ITS Colombia, German Partnership for Sustainable Mobility, Universidad Nacional de Colombia Sede Medellín and Trialog Publishers (media partner). Anyone interested in receiving news on the dialogue with practitioners and the call for papers for the symposium in Medellín is sincerely invited to contact the project team.

www.movici.com - movici@dlr.de

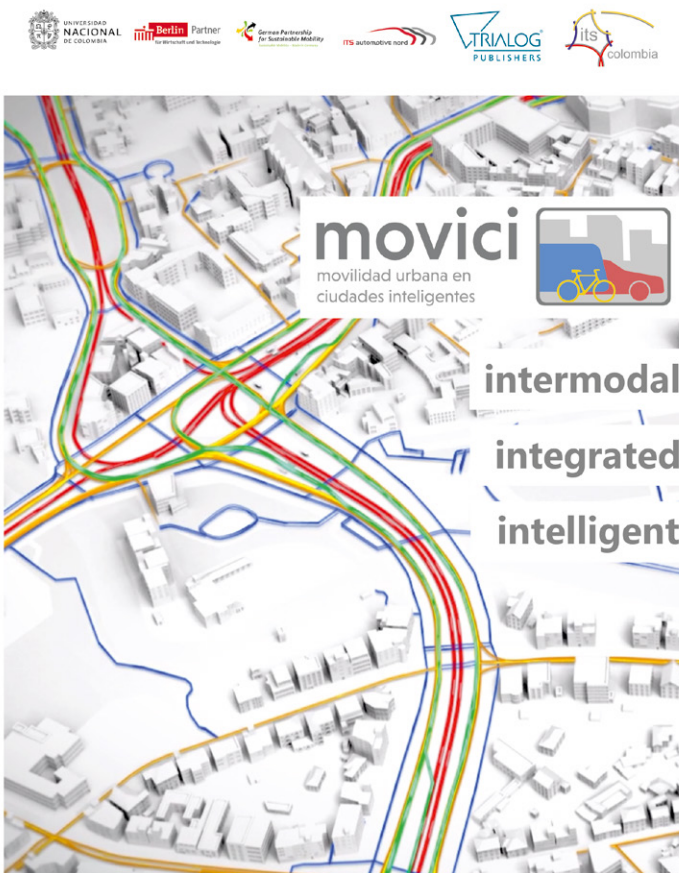
the Institutes of Transport Research and Transportation Systems are currently working on.

Mathias Höhne has shown that traffic signal control strongly influences the quality of traffic within urban street networks. Due to innovation in ICT (Information and Communication Technologies) new data-sources like video capturing, wireless inroad detectors and vehicle-to-infrastructure

communication (V2X) have been introduced to traffic management. Based on this progress the DLR developed two novel approaches that utilize data from ICT for an optimized traffic signal control in fast growing mega cities. The work of the DLR shows how new signal-control methods can help municipalities to reduce congestion, minimize waiting times and decrease vehicular emissions. To do so, it became necessary to bridge the gap between the scientific findings, which are mostly based on simulation studies, and their commercial application in the real world. To validate the simulation results, the new methods have been tested in the field. The results of this work were presented to the audience.

Activities ahead

The project team will present the MoviCi project at the Smart Cities NYC in New York from 03 to 06 May 2017 as part of a delegation from the "Shaping the Future – Building the City of Tomorrow"-campaign. Likewise preparations are starting for the dialogue with practitioners in November 2017 and the scientific symposium in April 2018 in Colombia.



- 1 <https://www.research-in-germany.org/shaping-the-future/about-the-campaign.html>
- 2 <http://www.andinatraffic.com>
- 3 <http://www.urmo.info>
- 4 <http://www.reallabor-schorndorf.de>
- 5 <http://www.urmo.info>
- 6 <http://sumo.dlr.de>
- 7 <http://www.andinatraffic.com>

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The Akechi Railway (Gifu Prefecture) was converted 1985 into PPP.

Photo: Oliver Mayer

PPP in Japan's railway system – a success story

Public private partnerships, Japan, rail service, railway infrastructure, railway operations, rural public transportation

Public private partnerships for railways in Japan are different from those in other countries. Many railway lines in Japan are profitable and can easily generate enough revenues, so that there is no need for either the public sector to pay subsidies, nor for the private sector to invest money in public railways. However, due to declining passenger numbers in some areas, this model does not work anymore. In this paper the Japanese model of PPP is described, where the public sector takes over private railways to prevent them from being closed. The authors describe the main principles and the reasons of successful PPP-projects in Japan.

Wilfried Wunderlich, Oliver Mayer

In the age of global warming, the Japanese government is committed to protecting the environment [1]. Consequently, it supports public transport via railways, as this is the most energy-efficient transport system with the lowest CO₂-emissions. However, railway systems are known to involve capital-intensive infrastructures [2]. For many countries, public private partnerships (PPP) represent an option for sharing the burden of costs. PPPs are agreements between governments and the private sector for the purpose of providing and maintaining public infrastructures, community facilities, and related services. PPPs have become popular in recent years, because the public sector cannot secure enough funds to maintain or operate the public infrastructure, including railways

[3-5]. In the Japanese railway sector, however, PPPs play a different role. Many private and public railway lines in Japan are profitable. In densely populated urban areas, traffic volume is very high, so that steady revenues are generated. These revenues enable the railways to pay for necessary maintenance, buy new rolling stock, and finance small infrastructure improvements. However, demographic changes and the increased use of privately owned automobiles have resulted in a decline in the number of passengers in some areas. As a result, private railways are not always able to continue service on a loss-making line. In such cases, the public sector may have to step in to prevent the railway from being closed.

When national polices support public transport, the first hurdle of securing fund-

ing is overcome. As shown in *figure 1*, financing is a matter of the railway operator. Different models of joint ventures (JV) for example, special purpose vehicles (SPVs), private finance initiatives (PFIs), design-build-finance-operate (DBFO) projects, build-transfer-operate (BTO) projects, and others have been described and analyzed in the literature [4, 5]. However, these models have mainly been developed for the purpose of building new railway lines. In this paper, we focus on currently operating railways that are facing the problem of declining passenger numbers. In these cases, the general interest in regional transport, the citizens' needs in the community, and, in particular, how the media report about the situation assume major roles. When railway infrastructure is designed and built, it should

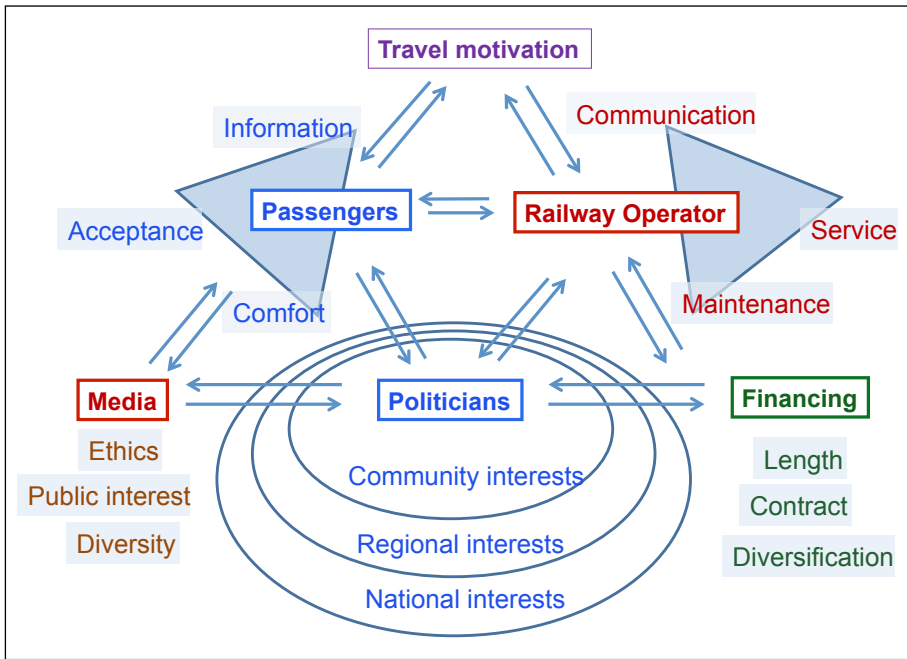


Figure 1: Relationships between railway operators and their stakeholders, such as passengers, media and politicians.

then support the passengers that use it. Passenger acceptance of the infrastructure (e.g., satisfaction with convenience and comfort) is reflected in media reports. Hence, there are complex interactions in the railway business between stakeholders and they are represented in *figure 1* with reverse arrows indicating the mutual dependencies. Railway operators in Japan are also trying to influence passenger motivation to travel by train by launching destination campaigns, public relation programs, or other marketing strategies in order to improve the social integration in the community [6].

Japan’s railway system

Following Japan’s railway reform in 1987 and subsequent privatization of the former

Japanese National Railway (JNR), today about half of Japan’s approximately 200 railway companies are privately owned. The largest railways in Japan are also private companies. About 90–95% of the total number of rail passengers in Japan are transported on their lines, excluding subways. The equity participation of most railway companies is differentiated between shareholders. Unlike railway systems in most other countries, because the largest railways in Japan are private, they do not require any public support to finance their daily operations. Indeed, due to the large number of passengers, many railway companies have been profitable for many decades, and there has thus been no need for the public sector to engage in railway operations.

Private railways in Japan can be grouped into two categories. The first group includes the traditional private railways that have been private since the beginning of their operations. Among them are large companies with a track length of 100 km or more (e.g., Seibu, Tobu, Odakyu, Meitetsu, Kintetsu, Hankyu, and Nishitetsu), but also small regional railways (e.g., Fuji Kyuko and Toyohashi Railway), and tramways (Okayama, Hiroshima, and Nagasaki). The second group consists of former public railways that have been privatized, for example, JR East, JR Central, and JR West (formerly JNR) as well as small local railways (e.g., the Semboku Rapid Railway).

All subways and some tramways in Japan are publicly owned, as are JR Hokkaido, JR Shikoku, and JR Freight (formerly JNR), and some regional railways (e.g., South Hokkaido Railway, Echigo Tokimeki Railway, and Tosaden Kotsu). All other railways are jointly owned by the public and private sector and are thus PPP-railways (more commonly referred to in Japan as third-sector railways) [7, 8]. These railways include former JNR local lines (e.g., the Sanriku Railway) or former JR lines running parallel to new Shinkansen lines (e.g., the Shinano Railway, the Iwate Ginga Railway and the Aoi Mori Railway). These were handed over to prefectural governments, who are now in charge of operating them, often in cooperation with private companies, with a total of 45 lines. However, in many cases, operating results have been mediocre [7]. Because land prices in Japan are very high and infrastructure must withstand earthquakes, construction costs for new railway lines are relatively high. Thus, since the 1960s, about 50 new lines in Japan have been built and operated by companies whose basic capital is jointly held by the public and private sectors. These new lines mainly operate in



Figure 2: Wakayama Electric Railway was rescued after the transfer into PPP
Photo: Oliver Mayer



Figure 3: Hitachinaka Seaside Railway is a PPP between the former private railway operator and the local government.
Photo: Oliver Mayer

urban and suburban areas, but they also provide freight service for newly developed harbors (e.g., Sendai Airport Transit, Yurikamome, Tsukuba Express, Yokohama Minatomirai Railway, Chiba Monorail, Osaka Monorail, Linimo, and Keiyo Rinkai Railway). The last group of PPP (third-sector) railways consists of formerly private railways that have been transferred to the public sector in recent years, as the private owners have no longer had sufficient funds to continue operations. These include, for example, the Wakayama Electric Railway (illustrated in *figure 2*), the Hitachinaka Seaside Railway (*figure 3*), the Yokkaichi Asunaro Railway (*figure 4*), the Iga Railway, Man-yosen, and the Echizen Railway (see also *table 1*).

PPPs prevent private railways from closing

Most railway lines in Japan are profitable due to high passenger numbers. Unprofitable routes can be supported by pooling income generated from profitable routes operated by the same train company or by profits from non-railway business. Government subsidies for loss-making lines have traditionally only been granted if the lines were owned by public or public-private companies; private railways have never been eligible for any kind of grants to cover operating deficits. Therefore, if a private railway line was in deficit, ultimately it was closed and transportation was replaced by bus service. Once the downward spiral started, it was hard to be stopped, as illustrated in *figure 5*. Recent examples include the tramway system of Gifu and the Hitachi Electric Railway (both closed in 2005), the Kashima Railway (closed in 2007) or the Towada Kanko Railway (closed in 2012). A train is a mass transportation system and can be expected to be profitable when the population density in its region is higher than a certain level, which is according to our investigations in the range of 150 to 1000 persons per square kilometer, unless there are other socio-demographic characteristics of the residents in the service area. A recent example of closure in December 2016 was the JR Rumoi Line in Hokkaido in a sparsely populated rural area.

Recently, however, closure of railway lines has not been positively accepted by the general public [8]. Hence, viable railways with potential for passenger growth or regional development have been kept open. In all these cases, the public sector has become involved in railway ownership and/or operations (a previously unknown practice in these regions), thus allowing the railway to continue providing service (see *fig-*

Year	Railway	Former owner	New owner(s)
2002	Manyo Line	Kaetsuno Railway	Takaoka City, Imizu City, Toyama Prefecture, others (mainly public)
2002	Aoi Mori Railway	JR East	Aomori Prefecture and others (mainly public)
2003	Echizen Railway	Keifuku Electric Railway	Fukui City and others (mainly public)
2006	Wakayama Electric Railway	Nankai	Wakayama Electric Railway (operator, fully private) Wakayama City (property owner, fully public)
2008	Hitachinaka Seaside Railway	Ibaraki Transport	Hitachinaka City and Ibaraki Transport (mainly public)
2008	Fukui Railway	Meitetsu Group	Fukui Town Management, Sabae Chamber of Commerce, and others (mainly public)
2010	Aoi Mori Railway	Aoi Mori Railway	Aoi Mori Railway (in charge of train operation only), Aomori Prefecture (new infrastructure owner, fully public)
2015	Ainokaze Toyama Railway	JR West	Toyama Prefecture, Toyama City, and others (mainly public)
2015	Yokkaichi Asunaro Railway	Kintetsu	Kintetsu, Yokkaichi City (operator, mainly private), Yokkaichi City (infrastructure owner, fully public)
2015	Kyoto Tango Railway	Kitakinki Tango Railway	Willer Trains (operator, fully private), Kyoto Prefecture, Kyotango City, and others (infrastructure owners, mainly public)

Note: Unless different ownership for operator and infrastructure is mentioned, the railways are integrated companies owning the infrastructure and operating trains.

Table 1: Recent PPP-developments in Japan's railway sector



Figure 4: Yokkaichi Asunaro Railway is an example of successful PPP

Photo: Oliver Mayer

ure 5). A list of some of these railways and their new ownership structures is provided in *Table 1*. In some cases, the ownership of the infrastructure was separated from the railway operations. This is a common system in Europe, but a new concept in Japan. The Kishigawa Line of the private Nankai Railway was transferred into a PPP consisting of Okayama Electric Railway and Wakayama City in 2006, forming Wakayama Electric Railway (*figure 2*). Unique marketing of a "stationmaster cat" helped to attract media attention, resulting in an increase in revenues. The Hitachinaka Seaside Railway (*figure 3*) is a PPP with Hitachi-

naka City holding the majority of shares, and Ibaraki Transport, the former private owner, a minority. This new railway was formed in 2008, as Ibaraki Transport could not secure enough funds on its own to keep the railway running. The line had been opened in 1913 and has been privately owned and operated ever since, but falling passenger numbers forced the public sector to get involved in operating a railway.

The Yokkaichi Asunaro Railway is another example of a successful transition from private to public ownership. It is a small railway consisting of two lines (Utsube and Hachioji lines) with a total length of

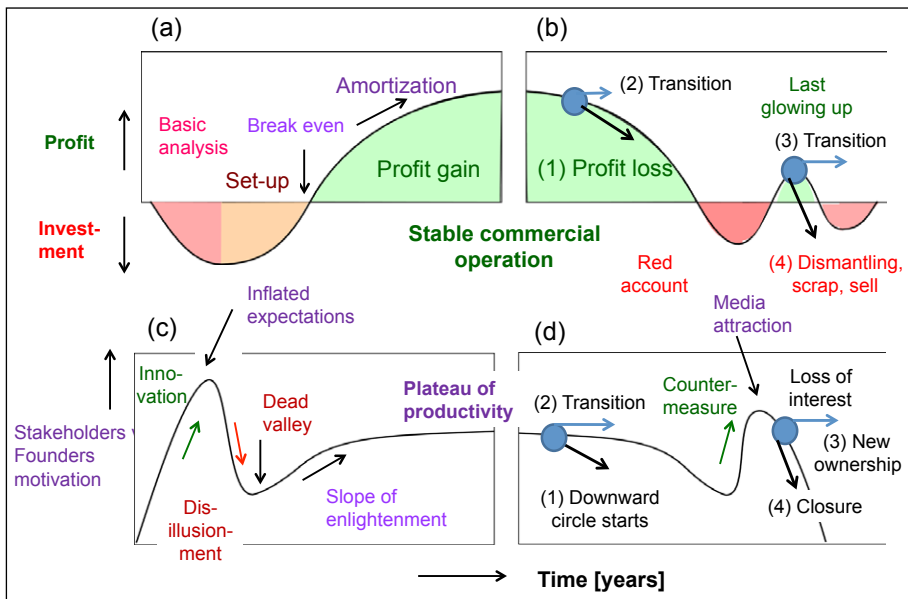


Figure 5: Financial situation when opening a new business (a), when closing (b), and the stakeholder visibility or founder's mentality when opening (c), and when closing a new business (d).



Figure 6: A typical third-sector railway is the Aoi Mori Railway, and the train is bearing the local mascot. Its ownership was transformed into a PPP after the construction of a high-speed line. Photo: W. Wunderlich

7 km, running in the industrial city of Yokkaichi, the largest city in Mie Prefecture with a population of 310,000. Originally built by the Mie Railway between 1912 and 1922, the two lines were absorbed in 1965 by Kintetsu, Japan's largest private railway. The lines, running as urban railways with a narrow gauge of 762 mm, are unique in Japan. During Japan's economic boom after the Second World War, passenger numbers on the two lines rose, reaching a peak of 7.2 million passengers in 1970. However, in the following decades, increased suburbanization and motorization led to a 50% decrease in railway passengers (3.6 million passengers in 2013). By 2010, although the lines were losing JPY 270 million (Yen; about EUR 2.2 million) a year, the losses were fully covered by Kintetsu. Because Kintetsu was a private railway company and profitable as a whole, the Utsube and Hachioji lines were not eligible for public subsidies. In 2012, Kintetsu was no longer willing to cover these losses and suggested closing the two

lines and converting the track into a bus rapid transit system. However, Yokkaichi City rejected this proposal, preferring instead to keep the railway running by transferring the two lines to a public railway system.

For this to happen, the two lines had to be separated from Kintetsu. Thus, in 2015, a new railway company, the Yokkaichi Asunaro Railway, was formed, with Kintetsu retaining 75% of ownership and Yokkaichi City 25%. The Yokkaichi Asunaro Railway company has remained in charge of train operations, but does not own the tracks or the rolling stock, which is unusual in Japan. Instead, all infrastructure and rolling stock have been transferred from Kintetsu to Yokkaichi City for free. The city is responsible for covering maintenance costs. A third of these maintenance costs have been subsidized by the state and a further sixth by the prefecture, so that Yokkaichi City effectively pays only half of the costs. Because the city has leased all infrastructure to the railway

for free, the railway's operations were profitable in its first year, thus resulting in a total financial burden for Yokkaichi city of around JPY 100 million (about EUR 900,000) a year. This arrangement is valid until March 2025 and will be reviewed thereafter [9].

Yokkaichi Asunaro Railway's name refers to its narrow gauge lines. In Japanese, *naro* means "narrow", and *asu* means "tomorrow/the future", thus indicating that this type of railway has a future. Indeed, without Yokkaichi City's involvement, it would not have a future. This is only one example of a Japanese public-private partnership according to which the public sector has taken over financial responsibility for a deficit-making private railway line. Similar examples are the Iga Railway and Yoro Railway, also both formerly Kintetsu lines, in the Mie and Gifu Prefectures.

The dilemma of Japanese railway companies

As mentioned above, there are three main types of railway financing systems in Japan, namely, private railways, joint private-public railways, and public railways. All three types face severe decreases in revenues owing to declines in passenger volume, especially in rural areas.

This situation is depicted in *figure 5* (parts a and c), which summarizes the relationships that exist when a new business is opened (as adapted from textbooks on entrepreneur businesses). The stakeholders and funding bodies must reach the break-even point. After that, the investment is compensated for by the revenues, and even a rise in profit can be expected. *Figure 5* (parts b and d) show the situation when the conditions for revenues worsen, as it is the case for rural railways in the present age of changing demography and high usage of privately owned motor vehicles. The downward spiral, spurred on by negative reports in the media, results in a further decline and is followed by deficit. When the media reports about the situation, it usually focuses on the railway itself and a last glowing up of positive revenues is achieved. This is the last chance of hope to turn a declining business into success. Instead of the worst alternative of closing and scrapping (see *figure 5* parts b (4) and d (4)), there is the option of making a transition (*figure 5* b (3)) from a purely public or private financing system to a PPP. The transition itself increases the motivation of the stakeholders and may reduce the business operating expenses.

There is another point where a transition is even more likely to be a success. If a major change in the business environment is

expected, countermeasures can be implemented. A typical example for this case is the opening of a high-speed line, which leads to a loss of most of the long-distance travelers on the old line. If it is already foreseeable that the revenues from the remaining regional or even local traffic will be much less than before, then this is the point where a transition of the old line is appropriate. Starting from a much higher level of public acceptance prevents the occurrence of a destructive spiral of downgrading and the company can be saved at its present level. An example can be seen in the third-sector railways founded on former JR lines, where the long-distance traffic was converted to Shinkansen [6]. Typically, the prefecture owns the majority of the shares (more than 51%), the municipalities along the line hold minor shares, and local businesses own from 10% to 20%. As around a dozen long-distance freight trains are using such railway lines, there is also national interest to keep them in service. Figure 6 shows a train in Hachinohe belonging to the Aoi Mori Railway, which runs the local services to Aomori. By displaying the mascot in large size, the connection to local communities is strengthened and social acceptance improved [6].

The secret, however, why PPP has been successful in Japan is related to the prevalent work mentality of the operating staff as well as the managers. Let us explain how this psychosocial and cultural attitude against work affects the financial situation. Railways are a predominant example of how to maintain security. In Japan, the following four pillars of risk prevention are commonly embraced [10]: (1) reduce risk factors, (2) be aware of safety, (3) promote priority improvement plans, and (4) provide individual training to prepare for dealing with critical situations. When converting this concept to financing, it means that instead of increasing control mechanisms such as watchdogs or regulators, it is better to address the question, whether inherent safety design can prevent human errors. Adequate and appropriate training is the best safety protection measure to deal with human or system failure, together with observation and detailed documentation of work progress. In addition, eliminating the influence of the most uncontrollable or irrational factors (e.g., short-term decisions of individuals, financial instability, or incorrect forecasts of passenger volume) have been mentioned as representing the most critical success factors (CSF) for PPPs [4]. Instead of analyzing the situation passively, active measures of leadership are the key to success. Such examples are training of the staff, simple contracts, training to prevent unethical behavior, and open discussion to prevent asymmetric flow of information are a few issues that have already been discussed in the guidelines of good governance (GGG) as factors of psychosocial and cultural attitude making further PPPs sustainable [11].

Conclusion

The examples of successful PPPs for railways in Japan were based on the willingness of local or prefectural politicians to make decisions for maintaining public transport, as shown with the Yokkaichi Asunaro Railway. Although it still might be a long way from CSF to GGG in PPPs, the more private-public partnerships are achieved, the more successful and sustainable such projects will be. ■

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Photo: GIZ Transport Namibia

Managing public transport in Windhoek

The implementation of a new public bus service for Windhoek, Namibia

Public bus service, sustainable urban development, Transport project

The Sustainable Urban Transport Master Plan (SUTMP) aims at developing a sustainable, affordable, accessible and efficient public transport system for Windhoek. The “MoveWindhoek” project, a Namibian-German coalition, addresses the challenge to implement a modern public bus system through a diversified, long-term approach. It includes the modernisation of the bus fleet, capacity development, awareness campaigns as well as steering and funding models. It is implemented by City of Windhoek, with support from the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH.

Ernst-Benedikt Riehle, Ursula Hein

Moving Windhoek’s transport system to a sustainable, affordable, accessible, attractive and efficient transport system – this is the aim of a coalition of the Government of the Republic of Namibia, represented by the Ministry of Works and Transport (MWT) and the Ministry of Urban and Rural Development (MURD), the City of Windhoek (CoW) and the

Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH. It focuses on public and non-motorized transport and is supported through the “Transport, Mobility, Logistics” project of GIZ in Namibia.

In 2013, the Sustainable Urban Transport Master Plan (SUTMP) was developed. It serves to enable decision makers in the transport sector to implement measures according to a long-term vision for sustain-

able transport through public participation [1]. The Namibian Cabinet endorsed the plan in 2014, a crucial step for its implementation.

In early 2016 the first new bus lines, together with newly procured, modern buses, were introduced to Windhoek’s citizens. The implementation is continuing and is proving to be a complex challenge. Among others, Public Transport has the image of

transport for the poor, the city faces capacity and funding constraints, the legal planning basis does not yet provide for integrated approaches and scheduled bus services is a new and thus unknown concept for Namibia.

Current situation

On a daily basis, CoW has about 60 busses in operation, on a network of 30 routes and 7 lines, to serve its customers. These usually synonymous words denote two separate types of operation: *Routes* are direct connections between vaguely specific start and endpoints as well as customer-requested stops, representing the old, insufficient system. Lines are newly introduced connections with dedicated bus stops, a schedule and service in both directions. *Lines* shall become a full-day service. All but one of the lines meet at a central interconnection point to allow passengers to transfer.

Bus operations for both lines and routes begin currently as early as 5:30, running until approximately 9:00 in order to bring employees and students to work and school. In the afternoon, operations run from 13:00 through 18:00–19:00. Service is sparse on Saturdays and currently non-existent mid-day on weekdays, at night, and on Sundays.

In February 2016, the City of Windhoek launched the new system with seven bus lines, which stem directly from the SUTMP planning process. For this purpose, a bus network plan was developed. It indicates the bus lines, their respective bus stops and interchange points (figure 1). To enhance the system's quality, 26 new low-floor buses were procured, funded jointly by CoW and the German Federal Ministry for Economic Cooperation and Development (BMZ), as part of the MoveWindhoek project and brand. They operate exclusively on the new lines.

In 2017, CoW plans to shift operation completely to the new network of 14 lines, including the seven existing lines. All lines are planned to finally operate according to fixed schedules at frequencies of 20-60 minutes; the span of service, however, will be limited by the existing resources.

The demand for a public bus service however is high. Estimates indicate that, at present, around 10,000 passengers ride Windhoek's buses every day. A recent survey revealed that 60% of bus users are female and at the same time the majority (two-thirds) live in households earning less than 2,000 NAD (about 145 EUR) a month, with more than 40% earning less than 1,000 NAD.

With current fares for single bus rides of 6 NAD (0,42 EUR), and 5 NAD with a

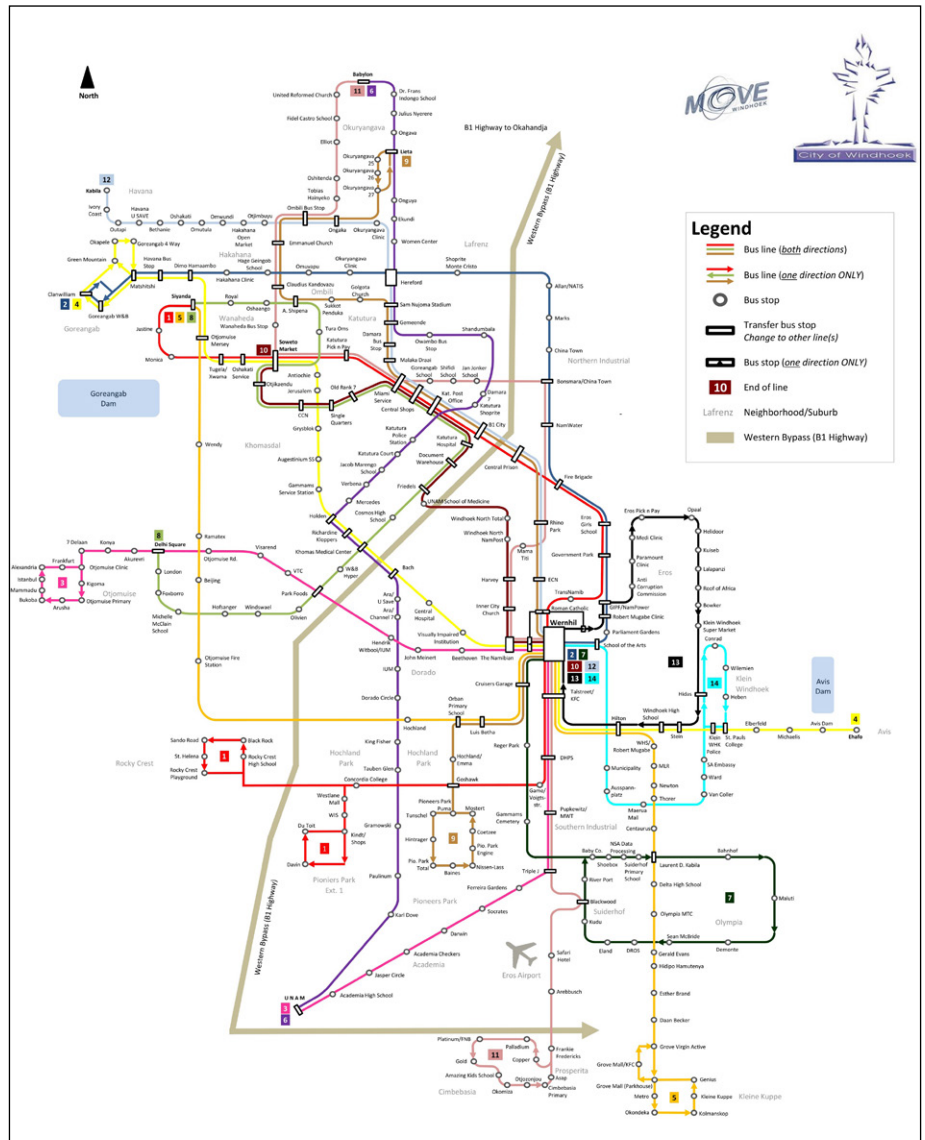


Figure 1: Bus route map for Windhoek

Source: GIZ Transport Namibia



Figure 2: Street scene in Katutura/Windhoek

Photo: GIZ Transport Namibia

rechargeable “SmartCard”, the importance of busses as daily means of transport for a big part of Windhoek’s population becomes obvious. Its relevance for economic participation and enhancement of livelihoods is high. In general, Windhoek’s citizens spend up to 25% of their monthly disposable income for transportation, which is high in international comparison [2]. Moreover, alternatives for daily commute are scarce.

Windhoek residents’ primary mode of transportation is the ubiquitous privately operated shared taxi, which accounts for 38% of all trips [2]. Taxis are hailed exclusively on the street, usually carrying one or two passengers during off-peak hours, and up to four going in the same direction during the morning and afternoon peak hours.

Approximately 7,000 taxis ply the streets of Windhoek. Taxi fares from the north-western suburbs range from 10 NAD (0,70 EUR) for trips to the city centre and surrounding suburbs, to 20 NAD for trips to outer suburbs.

Non-motorized transport, although contributing to about 30% of Windhoek’s modal split [2], is to date unsatisfactory, due to missing or deficient infrastructure for pedestrians and cyclists (figure 2). Windhoek has only one short bicycle lane next to the Grove Mall, a shopping centre in the southern part of town; consequently, virtually no Windhoek resident uses bicycles for non-recreational purposes. The number of pedestrians involved in accidents is high. It is also a core aspect of enhancing a public transport network, as about 90% of bus users walk to and from the bus, thus being dependent on non-motorized transport infrastructure.

The introduction of a new public bus service thus aims at the alleviation of several development challenges.

Implementation – a diversified approach

The Master Plan is a long-term approach to develop Windhoek’s transport system until 2032. Developing public transport services, transforming mobility perception and awareness, providing non-motorized transport opportunities and ensuring an integrated approach to land-use and transport planning is a complex and long-lasting process, which is addressed within this Namibian-German project through different aspects.

Steering structure

The implementation of the SUMTP is guided through a comprehensive steering structure. It contains of different committees. The “Flexible Thematic Units” shall coordinate technical implementation and monitoring. The “Technical Steering Committee”, which consists of Management representatives from the key stakeholders, is coordinating the implementation. It further presents to the “Steering Committee”, which consists of the Permanent Secretaries of MWT and MURD, the CEO and high representatives from CoW and GIZ. The Steering Committee was officially launched in October 2015.

Funding model

The financial side of the SUTMP has been another focus area for the implementation. Currently CoW is financing the bus operations within its core budget. This has proved to be a challenge and therefore governmental and other funding sources are considered. A dedicated grant for sustainable mobility solutions from governmental resources through the involved ministries is under preparation. This grant will be unique within Africa and not only provide funding

for the capital city, but also be accessible for other towns in the country. Further funding streams, from advertising space to parking management in the CBD, are under debate as well.

Capacity building

A key aspect is also to train the respective staff in various fields in order for them to reach autonomous execution of their responsibilities. In the course of the capacity building approach, GIZ is hosting trainings for employees of CoW as well as for the MWT. With the support of GIZ, a German expert for the implementation of the new bus system is employed at CoW. Her work includes operational planning, fleet management, public transport infrastructure and capacity building within the Public Transport Division of the City of Windhoek. GIZ is also supporting the University of Namibia (UNAM) and the Namibian University of Science and Technology (NUST) with specific study paths in engineering and infrastructure planning.

Survey

During the implementation process, it is necessary to monitor the impact on the users, which are affected directly by changes of the system. GIZ conducted a customer satisfaction survey in October and November 2016. At that point in time, the new lines had been operated for half a year and prior to the City’s plan to switch entirely to a new system of 14 lines.

The survey reached about 10% of daily bus users and provides a comprehensive and insightful picture of the customer perspective, their concerns and challenges as well as opinion on the public bus service.

As the economic situation described above shows a majority of low income households use the bus service. Thus it is not surprising that the mayor reasons for customers using the bus is to save money (67%) and secondly for security reasons (12%).

The overall satisfaction with the bus system is poor, with women rating it distinctively lower than men. At the same time the survey revealed that the new lines were rated distinctively better than the former routes (63% fair to excellent compared to 42%). Finally, while the value for money was rated very good, aspects such as waiting time, travel time and personal space were considered negatively (figure 3).

Institutional development

The organizational set-up of the bus operations has been identified as another area of interest. Currently, the Division of Public

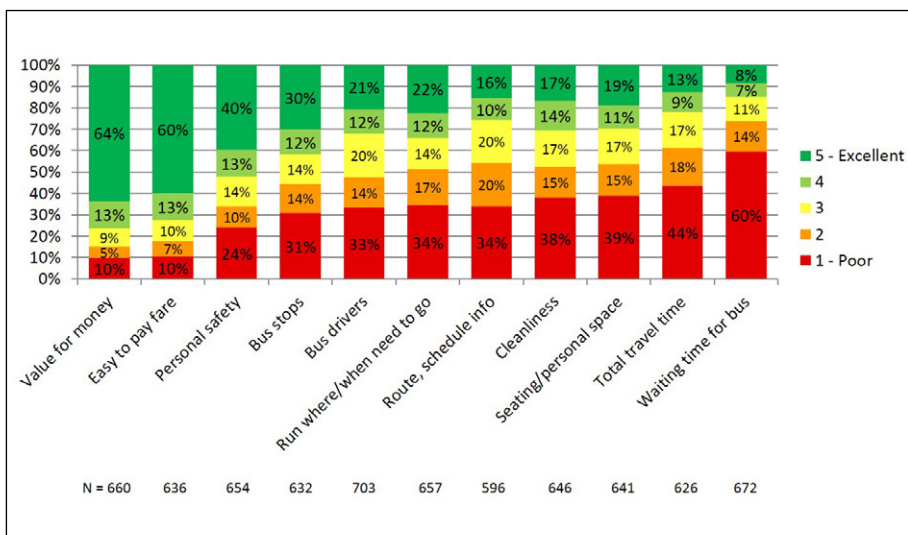


Figure 3: Satisfaction with the bus service, survey 2016

Source: GIZ Transport Namibia

AUF EINEN BLICK

Der Sustainable Urban Transport Master Plan (SUTMP) hat das Ziel, ein nachhaltiges, erschwingliches, barrierefreies und effizientes öffentliches Verkehrssystem in Windhoek zu entwickeln. Das „MoveWindhoek“ Projekt, ein Deutsch-Namibisches Gemeinschaftsprojekt, adressiert die verschiedenen Herausforderungen in der Umsetzung eines modernen ÖPNV Systems durch verschiedene langfristige Ansätze. Es enthält die Modernisierung der Busflotte, Capacity Development, Aufklärungskampagnen sowie Aufbau von Steuerungs- und Finanzierungsmechanismen. Es wird von der Stadt Windhoek, mit Unterstützung der Deutschen Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, durchgeführt.

Transport is within the main structure of the city's administration. Therefore, financing, HR and other administrative processes underlie standard procedures, which do not allow prioritization and effective service delivery. Besides rolling out the operations to a separate entity, further commercialisation is contemplated to integrate existing private businesses in the future public transport system. The aforementioned taxi businesses will be vital to ensure an efficient feeder structure to the public transport corridors.

Awareness campaigns

To enlarge the visibility and enable identification for partners and citizens, the Master Plan is implemented under the campaign "MoveWindhoek" (figure 4). All activities, materials and communication is done in accordance with the specially developed Corporate Identity Manual. It sets the basis of communication and information of the project.

Prior to the introduction of new lines, a first awareness approach was introduced – the so called "Information Bus". Once a week a bus and information stand was positioned at different spots throughout the city, especially in the northern, most populated parts, in Katutura. City employees as well as GIZ members organized the busses and conducted creative activities (e.g. Quizzes) to inform the public about the new system.

Additionally, to the targeted information campaigns such as the information bus, continuous information through various forms of media is necessary to keep the public informed. The project has a designated homepage (www.movewindhoek.com.na) as well as respective Facebook and twitter account. However, the aforementioned survey revealed that the majority of current customers is best reached through newspapers and radio. It is important to investigate

continuously how to best inform the public and potential customers and provide updates on new developments.

Challenges

The ongoing implementation of the SUTMP for Windhoek is currently undergoing a thorough review. This already revealed that implementation is ongoing, however progress is slow and some milestones were not achieved as foreseen, due to various challenges.

Due to driver and bus shortages, many of the ambitions regarding all-day service and frequency could not be immediately realized. Furthermore, drivers' behaviour is often still not appropriate and prevents the lines from following a schedule and dedicated tracks.

Windhoek's bus stops have few of the amenities that bus passengers await in developed countries. In 2013, of Windhoek's 160 bus stops, 45% had no shelter and 85% no sign [2]. While these statistics are now outdated due to the introduction of the lines, they give a solid picture of current conditions. Even where shelters exist, the benches are often broken, and the bus stop signs that do exist have no customer information at all – not even a list of routes or lines stopping at the station.

Travel times of bus passengers often exceed 1–1.5 hours depending on the destination, even for trips from the suburbs to the city centre, despite a distance of roughly 15 km. These long travel times result primarily from heavy traffic during rush hour, long dwell times resulting from chaos (pushing, fighting to board bus) at heavily frequented bus stops, and frequent inspection stops by City Police to check fare collection records. Travel times for passengers traveling from one end of a line to the other can be even longer, as most travel via the city centre, thus encountering additional traffic and following a circuitous route. Windhoek so far has no dedicated bus lanes, despite heavy traffic on main arterial roads during peak times.

During peak travel times – 5:30–7:00 h and 4:30–6:30 h – buses are filled to the brim. Standing passengers completely fill the aisles; slow service often means passengers must endure the crowding and heat for upwards of an hour. Passengers are regularly left behind due to lack of space, and the crowding likely generates personal safety issues for women in particular.

Many of the aforementioned difficulties can be narrowed down to the quite limiting funding base of the public transport system as well as the organisational lay-out of the bus operations. Ensuring sufficient funding



Figure 4: MoveWindhoek logo

for the operation and development of the network will be a crucial factor for the future development of this flagship project for Namibia. ■

The "Transport, Mobility, Logistics" project is implemented by GIZ and funded by the German Federal Ministry for Economic Cooperation and Development. For information on the project, please contact the Project Manager, Prof. Dr.-Ing. Heinrich Semar (heinrich.semar@giz.de).

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Using GPS technology for demand data collection

Introduction to opportunities and challenges of the methodology in developing and emerging economies

Tracking, travel demand, data collection, GPS, smartphone, Ukraine

Travel demand data is a necessary basis for urban mobility planning, but especially in developing and emerging economies data availability is often weak or non-existing. The Global Positioning System (GPS) technology offers a cheap alternative for data collection to traditional diary or survey methods. This article elaborates on advantages and disadvantages of the approach. Also different aspects of the post-processing of GPS data in order to determine trips, mode choice and trip purposes are discussed. In practice, GLZ collects first experiences with the methodology in four Ukrainian cities.

Jakob Baum, Enrico Howe

The goal of every transport planner is to meet the citizen's demand for mobility. In order to provide a reliable, safe and efficient transport system, they have a set of measures to choose from – ranging from different infrastructure measures that enhance the system, but also travel demand management measures such as congestion pricing and many more.

Data necessities for transport system planning

Facing the decision between such an array of possibilities, the planner needs to evaluate and appraise the options and their impact on the system, its users and the society as a whole. This is done through varying appraisal methods, including cost-benefit-analyses that are based on models. To run these models, three types of data are needed:

- Existing network and prices – Especially in developing and emerging economies data availability reveals a serious chal-

lenge: while network information is often freely available through OpenStreetMap (given precautions in quality control), travel demand data and behavioural models are very rare.

- Behavioural models – Behavioural models determine how a person travels given certain circumstances. Most modelling software on the market has a behavioural model implemented that is applied in projects located all over the world. Obviously, this lacks to account for cultural and local characteristics of travel decisions. For example, the travel time cost varies largely between different countries, age and sex groups [1, Ch. 5.2.7].
- Travel demand – This paper will guide through some aspects of GPS tracking as a travel demand data collection methodology. The most common travel demand format is an Origin-Destination-matrix (OD-matrix), describing the amount of people traveling between different places with a given mode of transport.

Classical approach to data collection

With the rise of transportation science in the 1950s, transport models have been based on data obtained from household surveys and travel diaries [2]. In these paper- or telephone-based collection formats, the participants reveal information on each conducted trip at the given day. This method produces a dataset with relatively high information density by using detailed questionnaires. Representative surveys are comparatively easy to conduct and expensive at the same time.

On the other hand, its reliability is often very weak as it relies on stated preferences: The high manual workload for the participants may result in low information quality on trips as well as their distances and durations. Also un-intentional misreporting, especially regarding multimodal and short trips by foot, are a challenge.

The costs implied with a representative, traditional data collection are often close to prohibitive for cities in developing and emerging economies. In order to overcome the difficulties on data reliability of traditional data collection, transport researchers and practitioners started to add supplemental technology into their methodological designs.

Global Positioning System (GPS) – based data collection

For the first time, GPS-technology was used in 1997, in a context of a mobility survey in order to automate data collection

Travel Diary or Survey	GPS-based
- low reliability	+ high reliability on trip times and durations
- no information on chosen travel route	+ travel route information
- low scalability	+ easily scalable
- high collection cost	+ low collection cost
+ information on chosen mode	+ inter-modality detected with higher accuracy
+ information on trip purposes	- complex post-processing needed:
	- no direct information on used mode
	- no direct information on trip purpose

Table 1: Travel Diary vs. GPS-based Data Collection (own work, based on [4])

and to enhance its robustness ([3] as cited by [4, p. 34]). This first study already showed a main advantage of GPS tracking over self-reported travel diaries: the share of short trips in this survey was higher than in previous, traditional surveys. Many short trips have simply not been included in household surveys or traffic diaries – probably because they are not perceived as ‘real’ trips by the participants in the first place or because making the effort of filling out a diary for a short trip is not perceived as necessary. An overview of advantages and disadvantages is given in *table 1*.

Initially, GPS-based data collection took mostly place with special in-vehicle or handheld devices, guaranteeing a high data accuracy. Their handling is easy as they have to be simply carried by the participants without further need for interaction. Energy consumption is, in congruence with the small array of functionality, limited, even though the capture frequency is high and the generated tracks are usually very accurate. Downsides are the burden to carry an additional device for the participants (which may lead to unaccounted trips if (un)intentionally left at home) as well as the implied costs of acquisition.

Smartphones: the omnipresent data collection device

With the dissemination of smartphones, their potency as personal tracking objects has become tremendous. Without need to carry an additional device and hence no further costs, barriers for their utilization are very low. Therefore, the strongest argument for the use of smartphones is the ease of acquisition of participants and scalability through simple software distribution.

However, today’s smartphone batteries are not designed to facilitate constant tracking applications. On account for this, existing tracking software often decreases the frequency of GPS tracking points and the amount of requested satellites. Therewith the track quality decreases substantially compared to specialized handheld devices. Also, low battery status or anxiety for it can lead to interruption of tracking.

Another challenge for GPS tracking is the loss of signal. GPS devices need constant view to multiple satellites. Tracking underground or in an urban environment with many skyscrapers is therefore difficult. Smartphones have the advantage to be able to use auxiliary sensors such as Wifi, mobile network or Bluetooth signals to locate their user.

A general challenge is the misrepresentation of population subgroups in the sample. This bias may be reinforced by using

Handheld Tracking Devices	Smartphones
+ easy to handle for participants	+/- knowledge about smartphones required
+ long battery lifetime	- short battery lifetime
+ high tracking quality	- lower tracking quality
- need to carry additional device	+/- personal disposability of smartphones varies largely between countries (smartphone penetration rate)
- higher cost of provision	+ lower cost of provision
- tracking capability in challenging environments (high building density, underground)	+ WiFi and other signals can be used in challenging environments
	- bias in sample / ownership

Table 2: Handheld Tracking Devices vs. Smartphones (own work, based on [4])

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[...]
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<trkpt lat="46.57661111" lon="8.89344444"><ele>2376</ele><time>2017-01-14T10:14:08Z</time></trkpt>
[...]
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Figure 1: Example of an array of three GPS-points stored in a GPX-file

smartphones as the tracking device, as varying dissemination rates and disproportionate ownership of smartphones in the population groups are to be expected. Especially in many developing countries, a large share of the population doesn’t own a smartphone. Also motivation to participate varies between different socio-demographic groups. This has to be accounted for in the investigation design, e.g. through accompanying traditional interviews, targeted recruiting of underrepresented groups, supply of smartphones and finally weighting in the data analysis (see *table 2*). Using data from the network provider (Call Detail Records) instead may also be an option – however, that comes with its own challenges.

Why and how did you move? The need to post-process GPS-data

A GPS track has information about location, elevation and time attached to each data point. From this, speed, heading and acceleration can easily be derived. Obviously, a high frequency in data point collection leads to higher resolution of location, speed and acceleration data (see *figure 1*).

On a trip level, the track gives valuable and highly accurate insights into route choice, trip distance and duration. However, it doesn’t reveal used modes and trip purposes directly. Therefore, post-processing algorithms have been developed deducting this information from the tracks.

Identifying Trips

A raw GPS track consists of an array of points. In order to divide those points into different trips and stops, a set of criteria is applied as Gong et al. show in their litera-

ture review [5]: most researchers define that one trip has ended and a stop has been reached when a certain “dwell” time has been reached. The threshold is usually set between 120 and 300 seconds. Furthermore, the change of location, heading and the density of track points are common criteria.

In order to account for different segments of a multimodal trip, the threshold can be decreased: More segments are detected, analysed and merged again afterwards. [6, p. 324]

Main challenges arise from signals loss and inaccuracy. However, existing algorithms are able to segregate up to 98 % trips and stops correctly [7].

AUF EINEN BLICK

Wissen und Daten über Verkehrsnachfrage sind notwendige Grundlagen von Stadtverkehrsplanung. Insbesondere in Entwicklungs- und Schwellenländern besteht häufig kein Wissen über Bewegungsmuster der Bevölkerung. Das Globale Positionsbestimmungssystem (GPS) stellt eine kostengünstige Alternative zu traditionellen Datensammlungsmethoden, wie Haushaltsbefragungen und Mobilitätstagebüchern, dar. Dieser Artikel behandelt die Vor- und Nachteile der Methode sowie einige Aspekte der notwendigen Nachbearbeitung von GPS-Daten, um Fahrten, Verkehrsmittel und Fahrtzwecke herauszufinden. Derzeit verfügbare Methoden müssen im Regelfall auf Raumdaten zurückgreifen, um valide Ergebnisse zu erzielen. Verkehrsmittel können dann bereits relativ gut ermittelt werden. Die Bestimmung von Fahrtzwecken stellt eine große Herausforderung dar. Die GIZ sammelt nun erste Erfahrungen mit GPS-Datensammlung in vier ukrainischen Städten.

Identifying Mode Choice

After trips have been extracted, the used mode has to be identified for each trip. In an urban context, foot, bike, car and different forms of public transport are the most commonly distinguished modes.

Mode distinction can be done via different approaches such as machine learning, probabilistic methods or criteria-based algorithms or a mix of the above. Criteria-based (or rule-based) methods often work with speed patterns among other criteria

such as transit network data. Some modes have distinctive characteristics in their speed and acceleration profile. A common speed pattern of a car can easily be differentiated from a pedestrian or a bicycle (see *figure 2*). The probability that an algorithm detects the right mode is very high in this case.

Detecting public transport use in delimitation to car usage is already more complex since speeds of the two modes are similar. Regular stops are a potential way to identify public transit – but how to differentiate between cars and buses being stuck in traffic?

In order to tackle this issue, many algorithms rely on spatial data as a second source of information. By matching the GPS track with road networks as well as public transport routes and schedules, the algorithms can e.g. detect if a person followed a bus route and stopped in proximity to public transport stations, which makes it very likely that transit was being used. Open source solutions like the Open Street Map public transportation database reveal important data such as routes, stops and public transportation mode. This data set varies globally in accuracy and information density but can be used as a solid input source for public transportation recognition. If necessary, local planners can edit the Open Street Map data base.

More sophisticated algorithms are able to detect the mode of more than 90% of trips correctly [6, p. 325ff.]. However, the described limitations in mode detection show that active user integration for tasks like track validation or transportation mode editing can prove beneficial to the aim for adequate data sets (see *figure 3*).

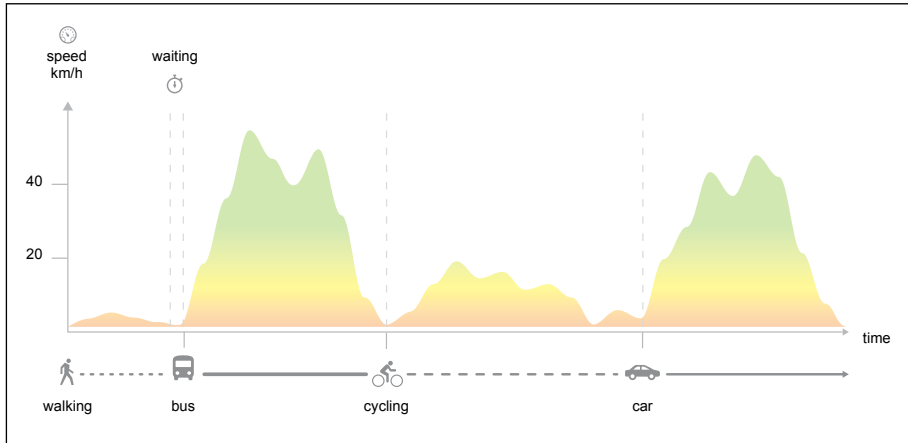


Figure 2: Speed Patterns of Different Modes

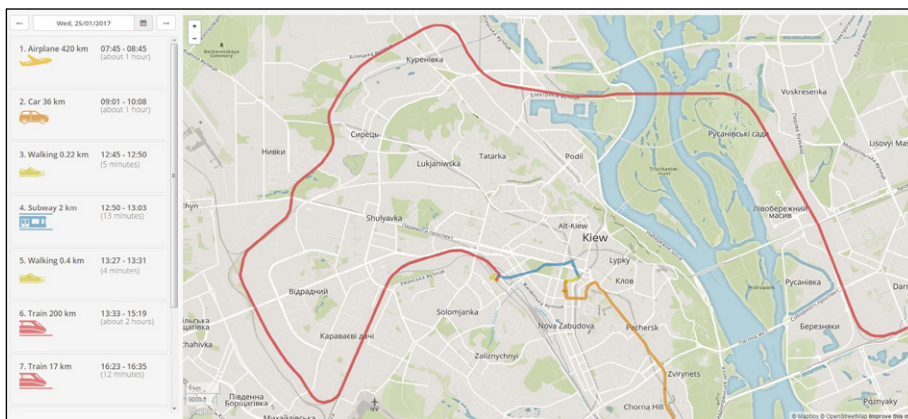


Figure 3: A GPS-Track of a Person using different Modes

Graphic: Enrico Howe, modalizer

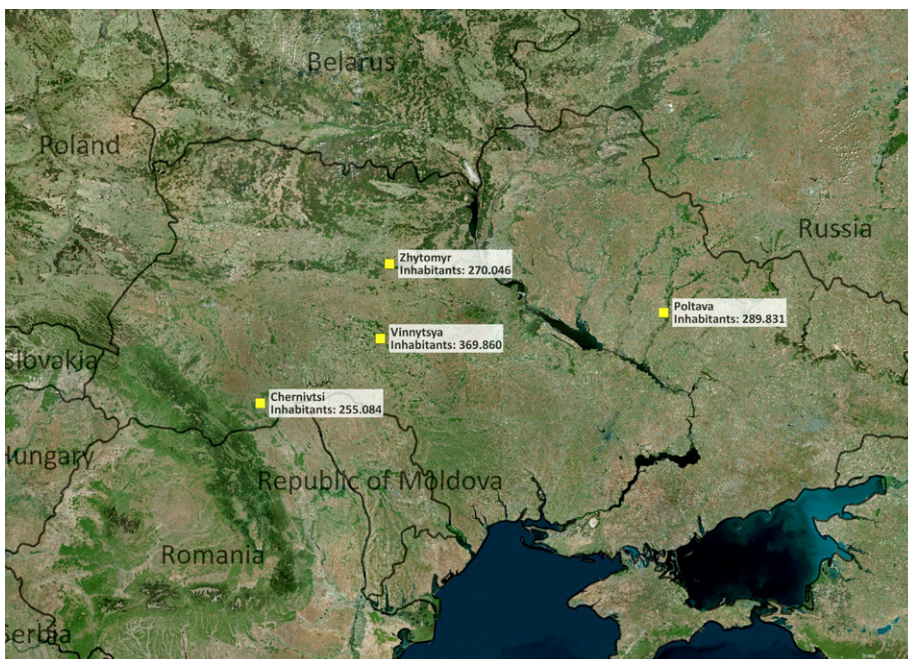


Figure 4: Ukrainian Cities in which GPS Tracking Technology is used by GIZ

Identifying Trip Purpose

Next to the transport mode choice, the identification of trip purposes – the reason why trips were made – is a major issue in the creation of a reliable data basis for transport system planning. Common categories are home, job and leisure trips.

In order to detect a trip's purpose, the GPS data is combined with spatial data that includes land-uses (e.g. residential, industrial) and points of interests (e.g. restaurants, shops). If a trip starts at a residential area and ends at a school, chances are very high that it was a home-school or home-work trip. By adding a portion of personal data, e.g. the home and work address of a person, the predictions can be made even more precise.

However, the accuracy of automated detection of trip purposes is not yet as high as the precision of mode choice detection and therefore much less applied. [4, p. 48] With very high data quality, just above 70%

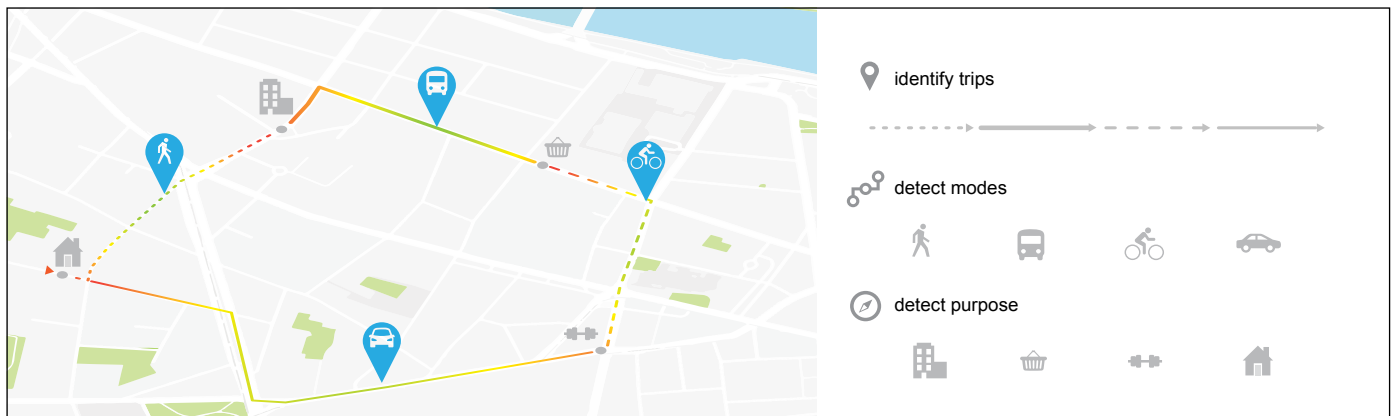


Figure 5: Overview on one Day of Tracking

of accuracy has been reached, with many studies being in the range of 40–60 % accuracy ([8] and [9], cited by [6, p. 328f.]). An overview on the three steps of post-processing is given in figure 5.

Best Practice: using GPS tracking in the Ukraine

The Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) supports local governments in shaping sustainable mobility systems worldwide. In Ukraine, the development agency GIZ cooperates with modalyzer, a smartphone-based traffic data collection app developed by the Innovation Centre for Mobility and Societal Change (InnoZ). It is currently being used in four cities within the project “Integrated Urban Development in Ukraine” to get a better understanding of the mobility demand, identifying travel patterns and behaviour of the population. The generated data will finally be used for the development of integrated urban mobility concepts.

Modalyzer has been adapted to Ukrainian needs and automatically identifies nine transportation modes and transit types. Further modes can be added manually – e.g. users can specify and edit trips by tagging them with the local transportation mode marshrutka, a local form of minibus service. Within the first three months, more than 1,000 participants already recorded over 140,000 km combined. The collection period will last five months.

The individual users of modalyzer can benefit from the app by monitoring their travel patterns through user friendly diagrams and tables, including information on their CO₂ footprint and kilometres travelled by each mode.

Verifying GPS-tracking: Prompted Recall Surveys

As elaborated above, GPS post-processing algorithms are already capable of revealing

information on trip mode and purpose to a large extent. In order to verify these findings or to gather further information, e.g. on reasons why a person chooses a certain mode, so-called Prompted Recall Surveys (PRS) can be used. This increases the burden on the participant slightly, but ensures a higher prediction quality and may be used to enhance the algorithms, too.

PRS has also been used in the Ukrainian case: modalyzer prompts the result of the tracking to the user at the end of each day and the user ensures its quality by verifying the detected trips.

Conclusion

GPS tracking technology has reached usability for travel demand data collection. It is cheaper and, when used appropriately, more detailed than traditional survey methods. However, in order to reach high accuracy in detecting trips, modes and trip purposes, high-quality spatial data and public transportation data is needed. Particularly in cities of the Global South, data availability on informal transit is often low. The Ukrainian example has shown that implementing Prompted Recall Surveys in a data collection application for smartphones is a viable option to overcome the issue of data availability and to enhance data reliability. Limited smartphone ownership is a remaining challenge. ■

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Deutsche Bahn Group is shifting to the DB Enterprise Cloud

A Compliant cloud architecture on AWS seemed to be a good choice

Service provider, Infrastructure as a Service (IaaS), Internet of Things (IoT), network monitoring, multicloud strategy

The lack of IT standardization across subsidiaries, the complexity of organizational structures, and the high cost of maintaining legacy environments was hampering DB Group's growth plans. The group was not as agile as competitors in rolling out new applications and improving the customer experience, which meant some of the subsidiaries were losing market share. Others even had initiated dangerous paths towards "shadow IT". Thus, DB Systel contracted e.g. AWS to provide managed and unmanaged cloud services to the group and implemented a cloud-first strategy.

Bertram Dorn

Deutsche Bahn Group is one of the largest transport operators in the world, with EUR 40.5 billion in revenue in 2015 and with more than ten business units generating over EUR 1 billion a year in revenue. The group consists of around 450 subsidiaries, ranging from DB Schenker (international logistics) to DB Netze Energie (delivery of electricity and gas). Of those subsidiaries, at least fifty have significant IT spending. Overall, the group has around 308,000 employees, of whom more than 100,000 are regular IT users.

DB Systel is the subsidiary dedicated to providing IT and telecommunications services to the rest of the group. The unit is responsible for a broad range of areas, from helpdesk support to telephony, and from maintaining the ticketing system to running the proprietary network that DB Group uses to connect stations and offices. DB Systel is in effect a managed service provider, being paid by other subsidiaries with formalized contracts. It generated a revenue of EUR 825 million and employed 3,600 staff in 2015. From a data center point of view, it owns and operates three physical data centers in Berlin, running around 8,000 physical and virtual servers overall.

Importantly, in 2013 DB Systel was greenlighted by the group board to start offering IT services for third-party companies, leveraging its expertise in areas such as mission-critical logistic back-end and network monitoring. Conversely, the largest of

the other group subsidiaries also host IT staff of their own in their business units. Based on those aspects and on the legacy, subsidiaries have a fairly high degree of independence around when and how they trigger investments in 'their' IT systems.

Overall, the DB Group IT architecture managed by DB Systel is imposing. The service provider is responsible for more than 630 applications in production. 60% of those have been written from scratch in-house over the years, whereas 40% are built on standard software such as SAP or Oracle PeopleSoft. However, more often even those third-party applications are heavily customized, with tens if not hundreds of DB Systel developers whose only task is to maintain and customize them further.

Establishing the DB Enterprise Cloud

At the end of 2014, the situation began to evolve. In February 2015, DB Systel started to explore cloud infrastructure options that could help the group achieve agility and cost savings. In April 2015, the DB Systel board created a small, independent task force led by René Schneider to formally define requirements and engage with an external Infrastructure as a Service (IaaS) provider. Interestingly, being a service provider itself, DB Systel had the luxury of foregoing research on managed service capabilities or IaaS integration partners. All of the implementation and operation skills would come from DB Systel itself. After discount-

ing IaaS suppliers that didn't meet requirements, only Microsoft Azure and AWS remained as options, and only AWS had full control of its German data center infrastructure. At that point, the decision was made to test AWS' capabilities.

With the intention of quickly responding to business needs, DB Systel and AWS worked together on the first proof of concept, which consisted of setting up a full virtual data center on AWS, including policies and network connectivity. The AWS technical team provided extra support and the proof of concept was completed successfully within a week.

The second step was to assess AWS' ability to comply with the regulations impacting DB Group, which is a partly state-owned company. In particular, the IaaS provider has to comply with the German federal regulation for data protection – 'Bundesdatenschutzgesetz'. Following the assessment, DB Systel was able to ascertain that AWS did comply. This provided the backing for DB Systel to select AWS as the preferred supplier, and in May 2015 the formal contracting process kicked off.

With the contract signed, DB Systel became the compliant, compulsory provider of AWS services to the whole of the DB Group. The managed AWS-powered services became officially available to DB Group on January 1, 2016. Two types of service were offered on AWS: DB Enterprise Cloud 'Managed' and DB Enterprise Cloud 'Unmanaged'.

The ‘managed’ cloud offers application hosting, development and maintenance based on AWS infrastructure, similarly to how it offers those services based on the on-premise data center infrastructure it owns. This means the subsidiary has no direct point of contact with AWS services, which are used by DB Systel technical staff. DB Systel is responsible for every layer of the stack, with the exception of the data protection layer that remains the responsibility of the subsidiary.

The ‘unmanaged’ Cloud is enabled by AWS’ advanced capabilities in terms of identity and access management rights. DB Systel is the owner of AWS’ contract, receives the bill for any expense occurring on it and operates with administrator rights on the AWS environment. It then sets up fully compliant “User accounts” that can be requested and employed by the various subsidiaries. User accounts have a restricted set of rights, with limitations around network connectivity and service catalogue.

Successful usage of the AWS-based cloud

In the first couple of months of operation, there were several successful projects within Deutsche Bahn Group. For example, DB Systel is currently using AWS basic and advanced services (e.g., AWS RedShift and AWS Dynamo DB) to set up a vast Open Data platform. The goal is to collect all non-confidential information from the DB Group (e.g., location of stations, travel schedules, length of tracks) and make it available freely in the form of APIs so that local governments, app makers et cetera can leverage them to innovate.

Another example is the strong usage of the Internet of Things (IoT) platform for cargo train tracking and for escalator maintenance. The group is equipping a first batch of cargo trains with small, inexpensive devices transmitting location via GPS. DB Systel is using the AWS IoT service for data ingestion and data collection back-end, with the goal of offering corporate customers real time information on cargo position. Real time information also helps with the maintenance of escalators. Because there are thousands of them in operation daily across German railway stations. Due to their sheer numbers, the DB Station und Services AG, the subsidiary responsible for managing station facilities, had a very hard time detecting problems, with faults going undetected in some cases for weeks. Combining sensors (currently being installed in escalators across the country) with AWS IoT services allows DB Group to monitor status in real time and dispatch maintenance much more quickly.

DB Systel reports that most of the workloads deployed in the “unmanaged” service have been Web-based application space. For example, bahn.de, the main consumer portal for the group, including online ticketing and real time information on the train status, is running a hybrid infrastructure on AWS, managed by the responsible business unit. The application is complex and multitier, including several Java layers and connectivity to other on-premise systems.

Also DB Regio Bus, a subsidiary responsible for local bus services operating 13,000 buses countrywide, decided to migrate most of its IT load to DB Enterprise Cloud “Unmanaged.” It went through the process to receive AWS user accounts from DB Systel and moved its full load to AWS capacity. It had planned for a 21% reduction in overall monthly infrastructure costs, and ended up with a 28% decrease – now gunning for additional reductions thanks to rationalization of the application landscape. DB Regio Bus is now running a “serverless” infrastructure, with 100% of the loads sitting on AWS.

Exceeding all expectations

When it set off with AWS-based services at the beginning of 2016, DB Systel had a goal to generate at least EUR 1 million in revenue per year from the other subsidiaries, linked to those AWS environments. As of August 2016, DB Systel reported that the target had already been exceeded, and in fact it is now facing some pressure to quickly expand the cloud task force team to deal with demand. DB Systel was impressed by AWS’ technical capabilities and IaaS/PaaS portfolio, the geographical reach and readiness of the AWS engineers to quickly set up POC environments and help kick-start the process was also appreciated. In terms of benefits for the DB Group at large, the business plan for moving to a cloud-first approach was built on cost saving expectations of 15–30% versus the on-premise data center environment.

Costs included both capital expenses (annualized) and operating expenses, as long as they were linked to infrastructure elements replaced by AWS IaaS/PaaS solutions. Costs included staff, energy, hardware Capex, system management software licenses, and hardware maintenance fees. All implementations executed so far fell in that bracket of savings, according to DB Systel.

One can also see that the AWS migration is starting to exert a positive influence at a strategic level. Not only is DB Systel gaining lots of respect from the other subsidiaries

and boosting its image as a business-enabler (e.g., with the IoT system for escalator maintenance). More concretely, the division is now able to use that expertise to offer managed AWS cloud services to third-party customers, increasing revenue outside of the DB Group. The compliance and security departments can work with a centralized, corporate-wide data location strategy, logging services and policies. It now can do without shadow IT and avoid the creation of dangerous “black holes.” DB Group as a whole can now leverage large public-cloud capabilities in a compliant fashion to experiment with digital transformation initiatives and fight back against the expanding list of competitors in the mobility service arena.

Looking into the future

While much has been accomplished in the first half of 2016, it looks like the journey to flexible cloud infrastructure for DB Systel and the broader group has just started. A mid-term goal is definitely the migration of ever larger portions of workloads onto AWS. DB Systel does not have a set target for this, and the option of DB Group-owned infrastructure will remain for the foreseeable future. Ultimately, it is the subsidiaries and business units that have to decide on which back-end to host their applications. This game of demand and supply will lead to continued flip of the balance of workloads towards AWS.

Other long-term goals include the standardization of applications and a multicloud strategy: The expanding popularity of standard IaaS/PaaS services is leading IT professionals across the group to rethink the approach between custom applications and standard applications. DB Systel leadership is empowering staff with the concept of standardizing applications that bring no differentiation to the group, and allocated the resources to developing new cloud-enabled business models. On the strength of the experience around AWS, the DB Systel cloud team is now starting to assess multicloud strategies, especially for SaaS environment types in SAP and Oracle cornerstone areas. ■



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Solutions in a nutshell

Overview of selected mobility solutions

PPP-project: MiniMetro to relieve traffic congestion in Pisa



Photo: Leitner ropeway

With the official opening of the MiniMetro PisaMover on 18 March 2017 the Tuscan city of Pisa starts into a new sustainable era of mobility. The 90,000-inhabitant city currently suffers from immensely high levels of traffic, with commuters, tourists and students doubling the population figure. The new PisaMover ropeway will reduce plenty of commuter road traffic, and will play an important role in local transport and improve connections to the existing public bus network. It takes passengers from Galileo Galilei airport to the main train station in the city center. Together with a new commuter car park and an improved network of bike paths, MiniMetro will reduce road traffic and make Pisa a more attractive and better place to live.

In Pisa, the route from the airport into the city center is particularly at risk of congestion. The PisaMover can reduce flows of traffic on this critical route, shortening the

travel time between Aeroporto Galileo Galilei at the southern outskirts of Pisa and Stazione Centrale to just five minutes. Each of the two trains consists of three connected cabins, and offers space for 107 passengers. Both the vehicles of the electrical MiniMetro and the stations were designed by Italian star architect Adolfo Natalini. The bogey on which the vehicles run is also a special new development: It was developed in cooperation with the University of Pisa and makes the ride particularly comfortable.

As a result, PisaMover is another example of the successful use of urban ropeway installations. Marco Filippeschi, Mayor of Pisa, is convinced of the new means of transportation's advantages: "It is a model of innovative urban mobility that will have a positive impact on the entire city". Behind this innovative installation is a joint public-private-partnership project of Leitner ropeways and Condotte d'Acqua S.p.A., one of Italy's largest construction companies. In

addition to planning and construction of the ropeway, the PPP project also entails operating the MiniMetro and the commuter car park at the midway station. The overall costs of the project totaled EUR 72 million, with 21 million provided by the EU, and the remainder by Leitner ropeways and Condotte d'Acqua S.p.A.. The two companies will operate the system and car park under a licensing arrangement for 33 years, after which everything will be transferred to the municipality of Pisa.

The new MiniMetro in Pisa is the first ropeway of its kind equipped with the gearless drive system Leitner DirectDrive. Its outstanding features include low consumption and emissions, as well as low noise levels. The two vehicles shuttle back and forth, with each travelling on its own line. The entire ropeway is operated fully automatically and can be controlled flexibly. The operators expect to serve roughly two million passengers each year. From 2020 on, this figure is expected to increase to roughly 2.6 million.

The Park&Ride service is also to reduce road traffic in the city, with a commuter car park for 1,400 cars near the midway station. Situated close to an important and large highway exit, commuters from the region can park their car for EUR 2.5 per day and travel to the city center conveniently in a few minutes. The ropeway is part of a comprehensive infrastructure concept: A new network of bike paths was built, pedestrian walkways were improved, new rotaries were added and a dangerous railroad crossing was removed.

www.leitner-ropeways.com

New smart system to reduce queues at roundabouts

Long queues at certain approaches to some roundabouts could be reduced using magnetic detection devices under the road surface, which would activate a traffic metering signal at another, less congested approach. Researchers at the Universitat

Politecnica de Valencia (Spain) have released a guide for technicians to implement this intelligent traffic system, already used on roundabouts in Australia and on various highway on-ramps.

Roundabouts allow for motorists to cross intersections without the need to stop before crossing in a safe and more efficient way. However, where traffic flows are not balanced, there can be delays and long queues of vehicles at certain roundabout

approaches, infuriating motorists. As a solution to this problem, engineers tend to enlarge the roundabout and the number of lanes, build direct right turn bays upstream the intersection, convert the roundabout into a complete signalized intersection and even create grade-separated interchanges. However, not all the situations allow for these constructive solutions and often they cannot be implemented due to environmental or budgetary limitations.

In these situations, the researchers have proposed the implementation of an intelligent transport system based on the ramp meter already used on ramps on some foreign motorways and highways to “ration” the number of vehicles from side streets and minor roads joining the main road when the latter is congested. The researchers’ proposal is to apply this to roundabouts using an ad-hoc methodology.

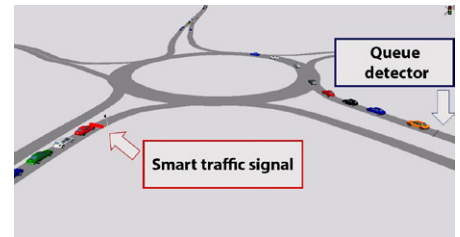
Queues reduced by up to 60%

“One of the main approaches which provides higher demand would be monitored using what is known as queue detector, a magnetic device installed inside the asphalt which detects cars. This is in turn connected

to a smart traffic signal at a second, less congested approach which is impeding the former to cross the intersection,” explained Mariló Martín-Gasulla, the main author of the paper. “In this way,” she added, “we can use programming to generate longer gaps on the roundabout that can be used by drivers, mainly on the congested approach but also from other approaches to the roundabout, smoothing traffic flow and improving the overall operation of the roundabout. In this way, delays can be reduced by up to 60%.”

To carry out the study, published in the journal ‘Transportation Research Record’, the authors used real traffic data recorded at a roundabout in El Saler (Valencia) and microsimulation techniques. Next, they developed a graphical model and a guide for engineers and road managers to implement the smart system, already being used in Australia and on some roundabouts in North America. The system costs around EUR 14,300.

The paper’s authors stress that the system is not based on creating a signalized roundabout; it only uses signals on one particular approach to regulate traffic on the



Source: Mariló Martín-Gasulla et al./UPV

roundabout according to the needs of the specific moment. The system is optimized by programming minimum green (or blank) and red times, and a maximum red time, in order to prevent excessive delays for motorists on the metered approach. The system is only activated when it is determined by the traffic volume.

Reference: Mariló Martín-Gasulla, Alfredo García, and Ana Tsui Moreno: Benefits of Metering Signals at Roundabouts with Unbalanced Flow. *Transportation Research Record: Journal of the Transportation Research Board* 2585, pp. 20-28, 2016. DOI: 10.3141/2585-03
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Supporting transport planning in Europe

Mobility of people in Europe is increasing, as are the challenges faced when planning transport. Planning is to reduce dependence on fossil fuels, counteract congestion in cities, reduce greenhouse gas emissions, mitigate air pollution and noise, improve traffic safety, and support trans-European transport networks. As decisions in transport planning have effects lasting for decades, it is even more important to plan actions in the long term and to assess their consequences at an early stage.

The HIGH-TOOL model simulates transport policy measures and their impacts on the computer. HIGH-TOOL (strategic high-level transport model) is the result of a meanwhile completed EU project and models transport policy measures and their impacts. With this tool, the Directorate-General for Mobility and Transport (DG MOVE) of the European Commission is provided a quantitative instrument to assess the impact of transport policy measures on economy, society, and the environment for decades. HIGH-TOOL can be applied to strategically assess options and to preselect options for analysis using more detailed models.

“The perspective of HIGH-TOOL is global. The focus, however, lies on Europe

and in particular on the EU Member States,” explains project coordinator Dr. Eckhard Szimba, who heads the respective working group at the Chair for Network Economics of KIT’s Institute of Economics (ECON). “The forecast period is divided into steps of five years each and extends until the year of 2050.” Apart from modules for demography, economy and resources, vehicle stock, passenger and freight demand, as well as environment, and safety, HIGH-TOOL comprises a comprehensive data inventory and a user interface. HIGH-TOOL is available as open-source software and characterized by user-friendly application. Any strategy simulation is accompanied by an assessment report that lists major results in the form of Excel tables and diagrams.

Input and output indicators of HIGH-TOOL are largely based on major European strategy papers, such as the “White Paper on Transport,” the “Roadmap for moving to a competitive low-carbon economy in 2050,” and the “EU reference scenario 2013,” a collection of long-term prognoses until 2050. The project consortium already presented HIGH-TOOL at several large conferences on transport research and organized



Source: KIT

workshops for future users. Currently, the model is being used among others to assess strategies for shifting transport from road to rail.

More information is available at www.high-tool.eu



The intelligent railway system theory

The European railway research perspective and the development of the European digital railway strategy

Digital age, railway, ICT, roadmap, intelligent transport system (ITS)

Digitalisation of the railway industry and its future challenges were among the main topics at the 2016 International Trade Fair for Transport Technology (InnoTrans). Digitalisation presents a new opportunity for the future of the railway industry. The digital age and the digital development of transportation also contribute to the competitiveness of the European rail industry. In Hungary, we have been conducting scientific research with the purpose of developing an intelligent railway system within the intelligent transport system since 2014. In 2017, the consortium partners will launch a research and development project worth over EUR 9.5 million. The primary goal is to build an economical branch line railway system that benefits from the advantages of IP-based technologies and artificial intelligence.

Dániel Tokody, Francesco Flammini

Digitalisation technology has created new opportunities for the future of the rail industry and railway networks. In particular, the development of digital transportation has contributed to the competitiveness of the European rail industry. Funds that have been allocated for the development of railway systems can be more efficiently used by generating positive effects in several different sectors, such as the rail vehicle industry or signalling and interlocking technology (cross-fertilisation). Profitability goes hand in hand with the development level of the infrastructure, including that for railway infrastructure and related services. As for the latter, poor service quality in railway transport represents one of the barriers to economic growth. In addition, safety considerations

have become even more significant. Different stakeholders in the railway industry can greatly contribute to the future of the European railway and the development of a more sustainable transport system. Significant research work has been done in the field of railways in order to achieve the goals of intelligent transportation.

Innovation programmes in Europe: Trends in technology

In Europe the creation of a digital ecosystem is very important, especially with respect to sustainability. Digital technologies will change all aspects of transportation, including the structure of the railway system. The full digitalisation of the transportation sector will also have an effect on the quality of life, security, energy efficiency, and competitiveness. In some countries, full digital modernisation of railway systems is planned to be implemented by 2060.

A full-spectrum reform of railway systems, which is necessary to develop intelligent transportation systems, still needs to be carried out. Some positive examples in

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this direction, however, reflect how railway-related research and development can be initiated by the manufacturers of rail supplies, system integrators, passenger and freight rail operators, infrastructure managers, national or international railway organisations, and university research institutes.

According to a recent report published by the Association of the European Rail Industry (UNIFE), the average yearly market volume of the global railway industry is currently around EUR 160 billion. The railway sector has great innovation potential. This is reflected by the fact that in the EU, about EUR 950 million will be spent on railway research and development between 2014 and 2020 [1]. Examples of future developments in Europe include automatic obstacle-detection systems for railway vehicles, medium frequency traction transformers, energy storage technologies, improved regenerative braking, track-friendly, low-cost and silent bogies for freight wagons, complex monitoring systems, satellite-based positioning systems, hybrid and diesel electric technologies, lightweight materials, environmentally-friendly vehicle welding procedures, the application of RFID technology, and smart railway technologies [2, 3].

Other research- and innovation-related activities that pertain to the railway industry are also being carried out, for example, in the field of advanced management and control systems. The seven main areas of such activities include smart and fail-safe communications and positioning systems, traffic management solutions, automation, moving block and train integrity, smart procurement and testing, virtual coupling, and cyber security [4]. A concrete example of research and innovation activity in these seven primary areas is the “Cybersecurity in the RAILway Sector” project (a Shift2Rail sub-project). Coordinated by Claudio Monti (from Ansaldo STS), it has a budget of EUR 1,498,150 [5]. Similarly, another sub-project called “Smart Automation of Rail Transport”, under the management of Dr. Miroslav Obrenovic (Deutsche Bahn), has a budget of EUR 999,600 [6].

Unfortunately, the developments pursued in these projects represent only individual cases. As such, they are not part of a structured development strategy. Research, development, and innovation activities should be governed by scientific and business requirements and conducted proactively at independent sectoral research bases. An example of a project of this kind is the “Intelligent Railway System” project¹ with a planned budget of EUR 9.5 million.

Research on and development of an intelligent and competitive railway system

The purpose of intelligent systems is to make the human environment more “people-friendly”. With respect to infrastructural systems, this means that they should be sustainable, safe, economic, and easy-to-use. At the present, agent planning – the term “agent” standing for something that perceives and acts [7] – is a new field of research which aims to build intelligent systems. Intelligent railway research focuses on two areas, namely, railway system analysis and the explicit adaptation of knowledge obtained in related academic disciplines.

In order to develop a model that may best grasp and describe the railway system on a theoretical-conceptual

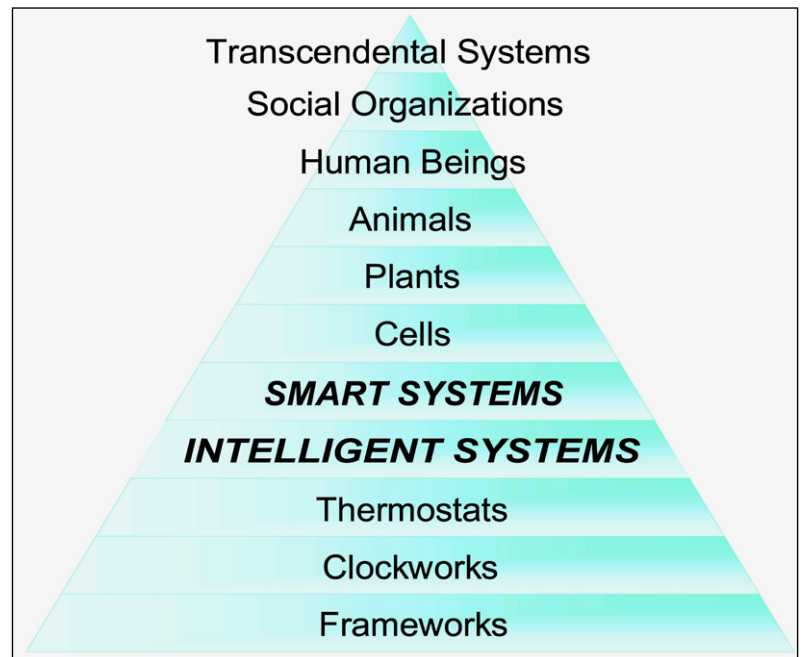


Figure 1. Boulding's classification of systems, adapted to include smart and intelligent systems, as described in Tokody's theory of intelligent systems [9, 10].

level, we are creating ontologies for artificial intelligence, knowledge management, and database management. These ontologies are being developed to ensure the provision of effectively distributed knowledge in a new structure of the railway system: We are creating a consistent knowledge base by asking various questions and answering them. We are also building and planning committed agents (i.e., anything that perceives its environment and responds or interacts to it via sensors and effectors, respectively [7]) which can safely rely on the above-mentioned ontologies. With the help of these ontologies, knowledge can be shared with the agents and among the agents.

Furthermore, we are examining the safety of critical railway infrastructures by looking at different relationships with respect to security. In this process, it is also necessary to adapt knowledge generated by associated academic disciplines (e.g., general system theory, information theory, artificial intelligence, semantic systems, etc.). In this regard, Tzafestas et al. states: “The field of intelligent systems is actually a new interdisciplinary field which is the outcome of the interaction, cooperation and synergetic merging of classical fields such as system theory, control theory, artificial intelligence, information theory, operational research, soft computing, communications, linguistic theory, and others.” [8, p. 21]

A new type of system, such as an intelligent system, may be understood, created, or developed further by applying the basic principles of general system theory. Here it is useful to refer to the works of biologist Ludwig von Bertalanffy and economist Kenneth E. Boulding, who made significant contributions to the foundations of general system theory. Both examined various systems from an economist's point of view, for example, the part-whole relationships of different systems as well as the various processes within them and their self-organising mechanisms. In his hierarchical classification of systems,

Boulding defined nine levels of systems, ranging from simple to complex, as illustrated in *figure 1* [9].

In our opinion, the level of development for currently existing railway systems corresponds to Boulding's category of "thermostats", which are essentially self-regulating control mechanisms or cybernetic systems that operate to maintain a pre-determined equilibrium. The important contributions of Bertalanffy and Boulding towards advancing the understanding of systems should be considered in the process of analysis. As well, theoretical advances in the field of artificial intelligence (AI), which aims to understand and create intelligent entities [11], can be applied to develop future railway systems. The "Intelligent Railway System" is based on such intelligent entities.

Conclusion

The lack of a long-term development strategy can negatively affect the competitiveness of the railway sector. On the other hand, on a European level, there are important developments in the railway industry. The "digitisation of everything" megatrend has an effect on the railway sector, too. Intelligent, autonomous systems must also be developed in this sector in order to ensure sustainability and safety. By using such intelligent systems, the railway infrastructure could be greatly modernised with "more trains, better connections, greater reliability." [12, p.12]

There are further opportunities for development in the railway sector. For example, cross-industry collaboration could also help to boost the economy on a European level, which is beneficial from the aspect of economic sustainability [13]. With regard to the railway sector, digitalisation involves the widespread application of digital technologies. Research and development strategies have aimed to improve and expand the European Train Control System, for example, by installing electronic interlocking equipment, increasing energy efficiency and railway safety, and implementing intelligent maintenance systems [14].

According to the European Union Agency for Network and Information Security (ENISA), smart infrastructure could be developed by combining IoT technologies with critical infrastructures, such as the railway. Public transport, including railway infrastructure, represents one part of smart infrastructures. The public transport system also is part of a larger system (i.e., the smart city), which aims to improve the quality of life for city dwellers by using information and communication technologies (ICTs) [15].

The connection of cyber and physical worlds is creating further challenges for our society. One such issue is the application of cloud-based computing. Although digital technologies like these may offer solutions for more efficient resource and documentation management, railway systems must have access to a protected and secure cyberspace. In the future, the safe operation and security of various infrastructure networks (e.g. digital railway infrastructure) will not be restricted to the "physical world" only.

In summary, if the European railway sector is to remain competitive, then more research and development is needed to generate innovations that will maximize the impact of future transport systems in terms of

supported economic growth, sustainability, efficiency and modal shift from road to rail [16]. The long-term development of the railway sector cannot be ensured without the use of digital technologies. Therefore, a uniform European digital railway strategy, that aims to address many of the above-mentioned points should be formulated. ■

¹ This is a new project to start 28 August 2017 in Hungary. See also: Papp, J. (2016). Embedded Control System with Shared Logic for Railroad Transport. *InnoRail* magazine, Special Edition for InnoTrans 2016, 40-41. Retrieved from <http://innorail.hu/wp-content/uploads/2016/09/1473093522-5c5abab-12645dea0f8e312b0482f81da.pdf>

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Air travel groups and their mobility profiles in air traffic

Towards seamless air travels – the DORA project and mobility (information) requirements of air travellers

Intermodality, seamless travel information, travel time reduction, intermodal routing, air transport, waiting time detection, in-door navigation, usability

The research carried out in the DORA project, clearly demonstrated that traveller groups travelling by airplane were not yet sufficiently specified. DORA performed comprehensive activities to overcome this gap. The following article describes the definition process of defining potential user groups for the development of a seamless door-to-door journey planner.

Michael Abraham, Wulf-Holger Arndt, Norman Döge

The name DORA means “Door-to-Door Information of Air Passengers”. It is a three years Research and Innovation Action project under the EU programme Horizon 2020 focused on Intelligent Transportation Systems (ITS Cluster). It has started on 01 June 2015. Main goal of the DORA project is to design and establish an integrated information system that helps passengers to optimise

their travel from the origin of their travel to the airplane at the departing airport as well as from the arrival airport to their final destination including indoor navigation in the airports.

Thus the DORA integrated information system created within the project together with necessary software platforms and end user applications supports the reduction of the overall time needed for a typical European air

travel, including the time required for the transfer to and from the airports.

The service is developed prototypically for the connection Berlin – Palma de Mallorca and demonstrated during a one-year test phase, beginning in June 2017.

The main component of the service is an intermodal route planner based on real-time data on the road, rail and air traffic situation for the route from and to the airport. The information offer for the passengers is completed with newly developed solutions for terminal mobility, such as indoor navigation via smartphones and waiting queue detection at the security controls. In the event of a fault, alternative routes are automatically dis-

played to the passenger. In addition, the service is integrated into the information systems of transport companies and airport companies.

Partner organisations of the project are the airport operators in Berlin and Palma de Mallorca, the cities of Berlin and Palma, the local traffic information providers and public transport companies as well as technology development companies and universities. Besides VMZ Berlin Betreibergesellschaft mbH, specific partners are the Berlin's Senate Department for Urban Development and the Environment, Berlin-Brandenburg Transport Association, Berlin-Brandenburg Airport and the Technische Universität Berlin. Air Berlin is an associate partner of the project.

Travel chains and user requirements

In order to specify the technical requirements of the service to the needs of air travellers, specific user groups had to be determined. This required – as a first step – to have a look at every single element of the entire air travel chain as e.g. performed by Goswami et al. (2011).

The resulting parts of the air travel chain, consisting of forerun, movement at the starting airport, movement at the destination airport, flight and follow-up movement to reach the final destination are shown in figure 1.

In a second step different mobility alternatives of all potential travellers for all parts of the travel chain at forerun and follow-up ways to the pilot airports have been analysed in a complex process:

The input data based on a review of the mobility options in the air passenger standard surveys, information provided by partners on site and expert interviews with mobility experts, staff at airports and public transport stations. Special emphasis was put on the mobility requirements of persons with special needs like people with walking impairment, families with pushchairs etc.

In a last step the collected mobility options – describing the level of physical movements – were extended by a level of related mobility information. As a result, the complex travel chain, developed for DORA shows – on the example of the pilot connection – all potential mobility alternatives and related mobility information requirements on the side of the traveller. Figure 2 shows the different potential travel options for reaching the airport on the example of Berlin.

If different transport options and the information regarding their usage and restrictions are available, the traveller is principally able to plan the whole travel chain. However, the decision what options will be chosen is mainly related to the personal preferences of the air traveller. As illustrated in Fi, for the small part of the forerun to the airport the amount of information is quite complex to oversee. Moreover, there exist strong relations between the different stages of the travel chain. In order to provide only the – for the trip planning – necessary information it was – prior to the technical development – important to assess by which information and preferences trip planning processes of air travellers are usually being shaped.

Air traveller groups

In order to understand personal mobility preferences and the criteria that are important for decisions related

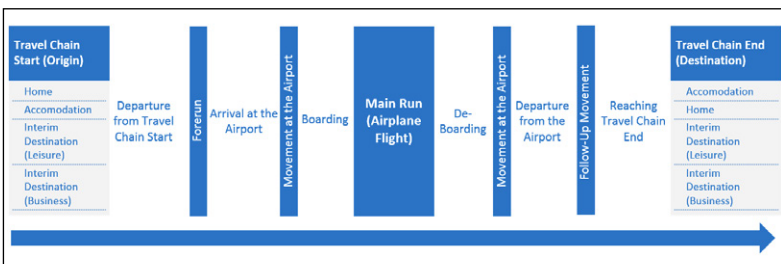


Figure 1: Air Travel Chain Components

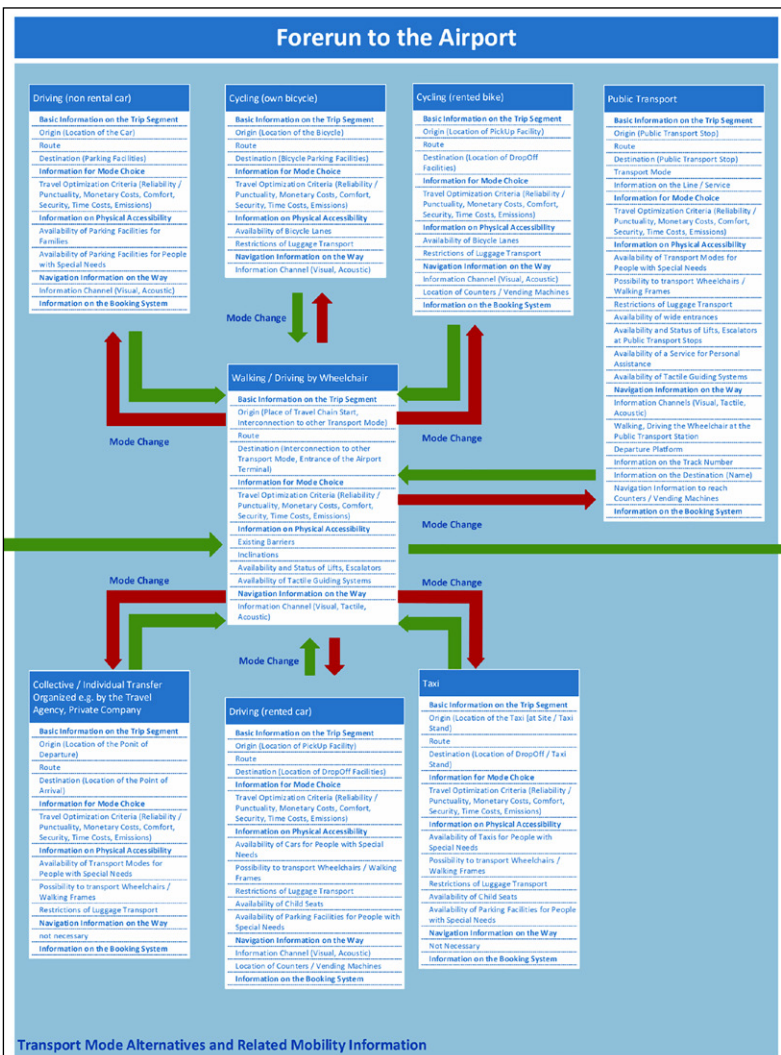


Figure 2: Travel Options and Related Mobility Information Requirements of Air Travelers on the Example of the Forerun to the Berlin Airports

to the trip planning process, it is important to understand the purpose of the trip. Freyer (2006) distinguishes two main traveller groups with different travel motifs. As figure 3 shows, these are leisure and business travellers.

In 2012 the European tourism market was responsible for altogether 1,180 million trips. Leisure travel purposes were responsible for 88.4% of all trips, while business purposes were the main travel reason for 11.6% of all trips. In 2012, moreover, two thirds of all trips were towards a destination inside the country of origin, while one third had an outbound destination and were mostly undertaken for holiday purposes (Eurostat, 2015). Finally it can be stated that most of the air trips inside Europe are related to leisure travels. Nevertheless, business travellers on average are traveling by airplane more often.

Taking this initial differentiation by Freyer into account it was in a next step necessary to observe criteria relevant for decision making throughout the trip planning phase. Under the assumption that the importance of criteria like time costs, time, environmental impact etc. varies across different groups of travellers, the group definition process was also considering socio-economic and socio-demographic criteria as important impact variables.

The desk research investigating the availability of existing studies that observe the trip planning processes of air travellers revealed a significant research gap. Most existing studies considered air traveller flows to and from the airport only in meso or macroscopic transport models. On the individual, microscopic level trip planning processes of air travellers have not been observed in detail.

Detailed classifications of air travellers have only been undertaken in marketing studies rather focusing the airport- or travel agency-sided marketing processes and not the ways to and from the airport. These are for example following studies:

1. Airport Private Traveler Study (Gesellschaft für Konsumforschung GfK, 2011),
2. Future Traveller Tribes 2020 – Report for the Air Travel Industry (Henley Centre Headlight Vision and Amadeus, 2007),
3. Future Traveller Tribes 2030 – Understanding tomorrow’s Traveller (Future Foundation and Amadeus, 2015).

The lack of existing studies and statistics required to apply an own research setting. Due to the fact that the organization of a comprehensive survey on the pilot connection – that would have allowed performing a detailed cluster analysis – was not possible, the strategy chosen applied an approach consisting of a qualitative and quantitative data analysis. This whole process is shown in figure 4.

Following the approach of target group models, values of variables of existing studies on the characterization of air travellers and travel behaviour have been compared and combined.

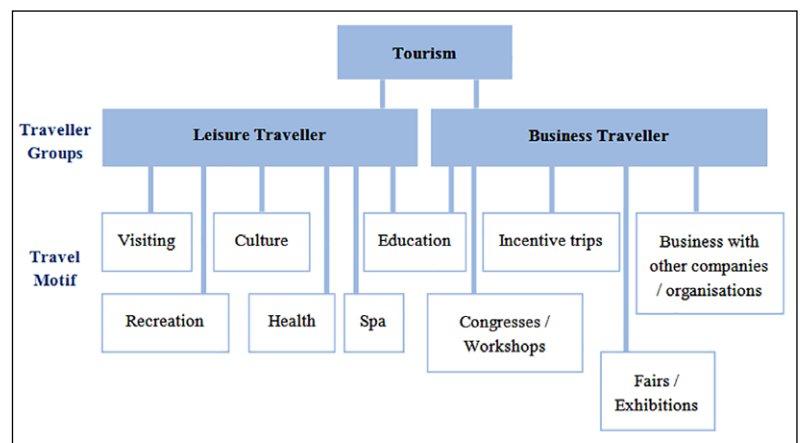


Figure 3: Main Traveller Groups and their Travel Motif (based on Freyer, 2006)

Characteristics	Young Traveller	Family Traveller	Middle-aged Traveller	Senior Traveller
Age	< 30 years of age	31-50 years of age	31-65 years of age	> 65 years of age
Income	Majority lower and lower middle income class (<2000 EUR/m)	> 2500 EUR/m	All income groups (majority between 2000 EUR/m and 4000 EUR/ m)	2000 EUR/m-6000 EUR/m
Most frequently used modes of transport for forerun	Public transport, car (being brought), taxi, collective transport (charter/tour bus)	Car (being brought/parked for the duration of the travel), public transport, charter/tour bus, airport shuttle	Public transport, car (being brought), taxi (between 31-40 years share of public transport 60% on the modal split), charter/tour bus	Car (being brought), taxi, decreasing number of public transport users
Most important criteria for transport mode choice forerun	Reliability, safety and travel time	Reliability, safety, travel time, barrier-freedom, price and environmental issues	Reliability, safety, travel time	Reliability, safety, travel time, barrier-freedom
Most important criteria for transport mode choice follow-up movement	Reliability, safety and travel time	Reliability, safety, travel time barrier-freedom, price and environmental issues	Reliability, safety, travel time	Reliability, safety, travel time, barrier-freedom
Information sources	Homepages of airlines, airports and public transport providers	Homepages of airlines, airports and public transport providers	Majority no, minority webpages of public transport, airport, airline	Travel agency (written, oral)
Check-in behaviour	Counter, online via PC	Counter, online via PC	Counter, check-in machine	Counter
Smartphone availability	85% to 95%	100%	90%	Majority not
Internet connection abroad	50% to 60%	75%	50%	Majority not

Table 1: Leisure traveller groups

Characteristic	Business travellers below 35 years of age	Business travellers over 35 years of age
Age	< 35 years of age	> 35 years of age
Most frequently used modes of transport for forerun	Public transport, taxi	Taxi, public transport, car (also small shares of rented cars)
Most important criteria for transport mode choice forerun	Reliability, safety, comfort	Reliability, safety, travel time
Most important criteria for transport mode choice follow-up movement	Reliability, safety, comfort	Reliability, safety, travel time
Information sources	Internet search engines, websites of public transport providers, navigation system inside the vehicle	Internet search engines, websites of public transport providers
Check-in behaviour	Online (PC and smartphone)	Online (PC and smartphone)
Smartphone availability	100 %	90 %
Internet connection abroad	50 %	60 %

Table 2: Business traveller groups

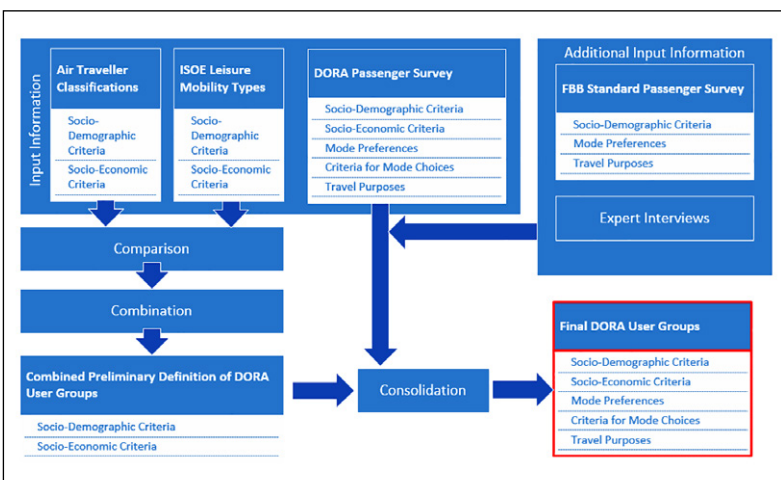


Figure 4: Main Approach to the Definition of DORA User Groups

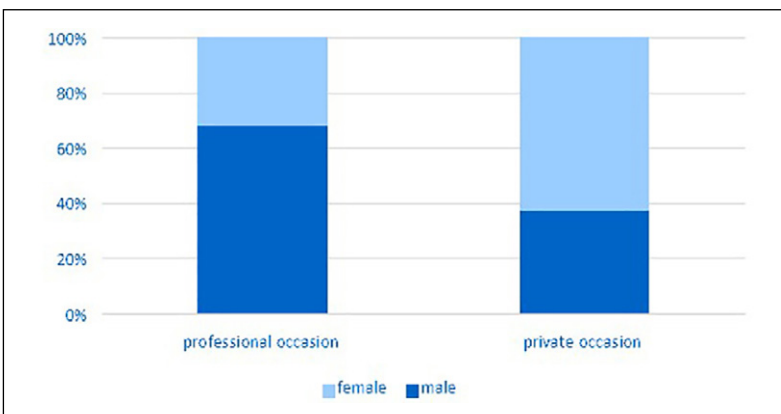


Figure 5: Sex of business and leisure travelers; DORA Berlin Airport Survey 2015 (n = 195)

These initial groups were then further consolidated by a deeper analysis of selected variables of the dataset provided by the project partner FBB (Flughafen Berlin Brandenburg GmbH) which consisted of around 20,000 cases collected at the airports of Tegel and Schönefeld during their standard passenger survey. In addition an in-depth passenger survey with 419 usable cases was designed and carried out by the project partners ETRA (Grupoetra), Aena (Spanish Airport Operator), FBB (Airport operator Berlin) and TUB (Technische Universität Berlin). The main purpose of the quantitative analysis was to connect transport mode choice, check-In behaviour and socio-demographic characteristics of existing classifications.

The initial group profiles were then reviewed by/reshaped based on the results of five expert interviews with experts from the field of tourism research, airport operators, mobility research.

This resulted in a final definition of traveller groups in the segment of leisure travellers (table 1):

- Young travellers,
- Family travellers,
- Middle-aged travellers,
- Senior travellers.

This overview shows that the main distinguishing criteria are age and income. Regarding the transport mode choice it can be stated that the shares of public transport rise until the age of 40 and then start to decrease again. The main reasons for the use of cars of younger and older travellers is that they are mostly being brought by relatives or friends. For older people barrier-freedom especially when travelling with heavy luggage is the most important criterion for not choosing public transport. The transport mode choice of family travellers does not follow the general trend of all travellers regarding the public transport use. This seems to be mostly related to the luggage that has to be brought to the airport for all family members. Thus most of the family travellers are reaching the airport by car.

The defined traveller groups in the segment of business traveller shown in table 2 are:

- Business travellers below 35 years of age,
- Business travellers over 35 years of age.

For the business traveller groups the main distinguishing criterion is the age.

The typical business traveller is by majority male, as figure 5 illustrates, and very time critical and on average travelling more often than the leisure traveller.

Since the business traveller is not traveling with heavy luggage he / she prefers the Online Check-In and is usually later at the airport than the leisure traveller, as figure 6 illustrates.

Regarding the mode choice it can clearly be stated that younger business travellers mostly reach the airport by public transport while older business travellers prefer to drive by taxi. This can also be related to company specific policies.

Moreover it has to be mentioned, that the presented user group profiles are also based on site (Palma and Berlin) specific interviews and surveys. The mode choice

already differs between both airports due to different available options and connectivity.

For both, leisure and business travellers it can be stated that the younger the travellers the more smart-phone affine they are. Nevertheless most of the people questioned indicated to use homepages and web portals of airlines, airports and public transport providers as the main sources to access information related to their travel. Thus a service like DORA would help to bring still segregated information together and make travel planning easier and more effective.

Research gaps

The investigation carried out revealed significant research gaps related to the processes of trip planning during the air travel phases of forerun and follow-up movement. A deeper cluster analysis of the FBB passenger survey of Berlin did not lead to a definition of an sufficient number of groups being shaped by group specific similarities in matter of socio-economic, socio-demographic, transport mode choice etc. characteristics. For Berlin the different ways of mode options to the airports of Tegel and Schönefeld alone lead to different mode choices of eventually comparable individuals. Other important factors could be flight times, target destinations, airlines, seasons, booked holiday package with organized transfer etc. Reaching a more consolidated definition of air traveller groups would require a in matters of survey design, timing more advanced and comparative study putting more emphasis on the isolation of other influential factors.

DORA field test – test users wanted

With the help of the defined User Groups different use cases have been defined that found direct entrance into the further specification of the technical set-up of the DORA service.

In early June 2017 a first version of the DORA App – starting screen shown in figure 7 – and the related DORA trip planning website will be launched.

The App version will provide the full initially described functionality for the test connection between Berlin and Palma and will be available for test purposes as an installation file for Smart Phones.

During several iterations the App will be evaluated for one year. Since the number of 500 test users has to be reached, individuals who take part in the initial expert and later live test are welcomed throughout this period. ■

For more information, please check the DORA homepage:
<https://dora-project.eu/page>
 Mail: contact@dora-project.eu.

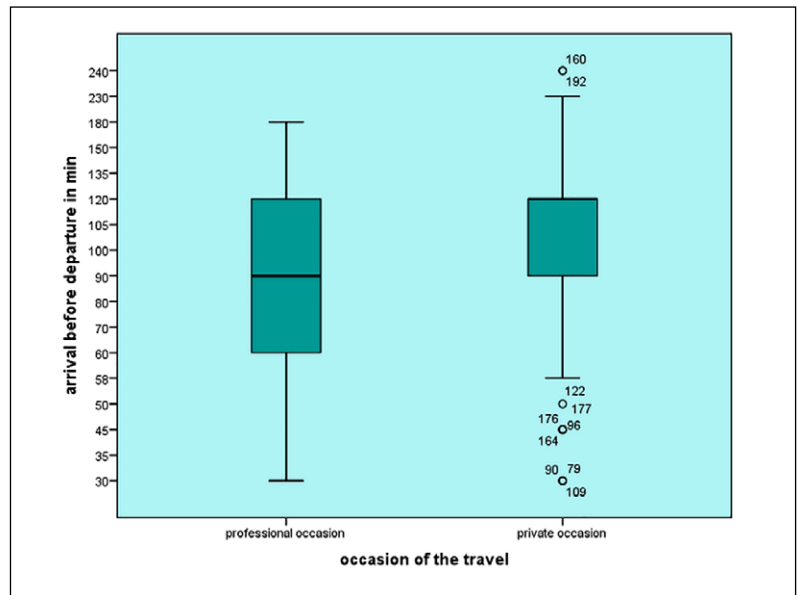


Figure 6: Boxplots regarding arrival time before the official departure of professional and leisure travellers, DORA Berlin Airport Survey 2015 (n = 195)

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Figure 7: DORA App Starting Screen



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The British way of long distance transport

Coach, Intercity, Franchise, Long distance transport, Deregulation

Similarities and fundamental differences – both diagnoses are appropriate comparing the British and German long distance land transport sectors. Whereas the British rail franchising system is unique in Europe, the coach sectors have converged in a remarkably short period since the deregulation in Germany in 2013. Learning from the British case is instructive – particularly in the light of a proposed Long Distance Passenger Rail Act.

Philipp Schneider

In the decades after the war railways were huge, state-owned companies. They retained a more or less unrivalled position in the long distance markets, while coaches did not play an important role. The rise of the car and later of aviation changed the big picture: governments started to reorganise their transport industries. Starting with the British coach sector in the 1980s the long distance transport markets were gradually liberalised. The railways followed in the 1990s, and in 2013 the German coach sector was deregulated – a few years earlier almost non-existent, the coach has already begun to strongly compete with the other modes of transport.

In this article the development and structure of the British long distance rail and coach sector is described. At the end conclusions from the British case for Germany are drawn.

British coach market

The recent history of the British coach sector can be divided into two parts: the first part lasts till the deregulation and privatisation respectively in the 1980s, the second part since then until today is affected by an open market and the continuing domination of the largest operator National Express.

From 1969 on, as a result of a merger, the market was dominated by the state owned National Bus Company (NBC), which itself controlled 93 bus companies and 21,000 vehicles [1]. Since the 1970s NBC used the common brand name ‘National Express’ increasingly for their intercity services. In Scotland the Scottish Bus Group (SBG) had a similar position. For both NBC and SBG competing with British Rail (BR) proved to be difficult, as they could not easily adjust fares or timetables due to the regulatory regime [2].

After winning the General Election in 1979, the Conservative Party promptly implemented their neoliberal manifesto and deregulated the coach sector with important legislative acts in 1980 and 1986 [2]. NBC remained in public ownership till 1988, when it was eventually privatised and split into several small companies, one of which was National Express [3]. This period of management-buyouts and mergers culminated in an oligopolistic market for local buses, whilst National Express became by far the biggest player in the coach market.

In 2009 an EU report called the British coach sector “the most liberalised of any large member state” [4]. This claim leans more on the few existing barriers to entry and the regulatory arrangement than on the plurality of operators, as National Express today still holds a dominant position. It is by far the largest operator with the exception of Scotland, where Scottish Citylink has a similar dominant position. However, it is difficult to express their dominance in distinct market shares, because data is hardly available and in statistics coach and bus services can often not be easily distinguished. It is estimated that National Express has a market share of about 60% and its most important competitor Megabus some 10% [3]. National Express is the only operator which runs a nationwide network, serving 1,000 destinations or so. Thereby 80% of the services are operated by contracted third-party companies [1].

Megabus, a Stagecoach subsidiary, has established a comprehensive network all over Britain as well, albeit less extensive and with lower frequencies. The company follows a no-frills low-cost strategy, targeting mainly low income but internet savvy groups, so that distribution channels are mainly located online. With its distinct yield management techniques Megabus achieves a comparatively high load factor [5].

The British coach network is concentrated on the main centres, as services have to be commercially viable. Non-business travel purposes, i.e. holiday, leisure and ‘Visiting Friends and Relatives’, can be held responsible for 92% of all journeys. Accordingly, the key segments of the coach operating companies are people who

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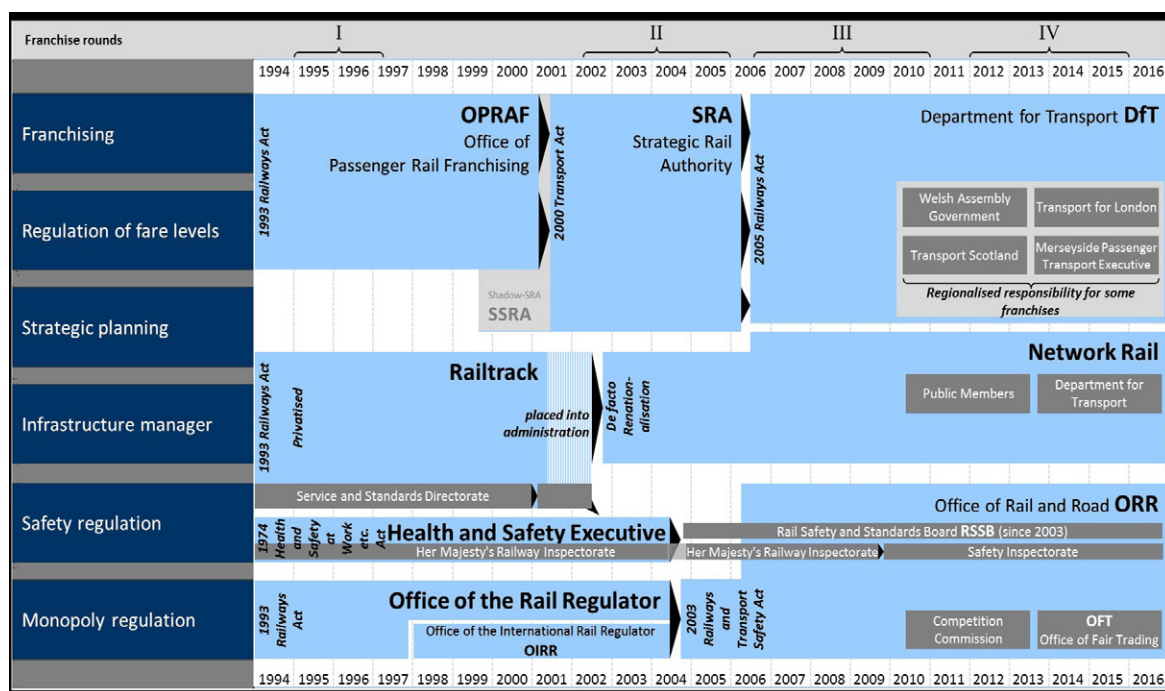


Figure 1. Development of British railway sector

are too young for a driving license, students and senior citizens [3].

The coach sector implements virtually no regulations: Operators can start services without any foregoing notification, as long as they fulfil the qualitative licensing requirements [6]. However, there are barriers to entry in operational terms, although they do not seem to be specific to Britain: Operators need a large customer base, as most customers use to travel infrequently with coaches. This leads to high marketing costs.

The deregulation has made market access for new companies easy. The downside is that incumbents can react to emerging competition very quickly as well, as National Express demonstrated time and again. A problem of decreasing (but still relevant) importance concerns the distribution channels: In the 1980s one of National Express' main advantages over its competitors was its widely spread ticket outlets [3].

The access to coach terminals can constitute a barrier to entry as well, especially because some coach stations are in possession of National Express. A key issue here is how slots are distributed in case of capacity restrictions. Regarding the case of the publicly owned Victoria Coach Station, the major coach station of London, there frequently occur capacity restraints in peak periods; operators have to apply for slots every year – thus, there are no grandfather rights. However, Victoria Coach Station offers volume discounts of up to 54%, which inevitably constitutes a barrier to entry for entrants, as they usually cannot profit from the maximum discounts [4]. Some operators avoid the main coach stations in order to get closer to their target group or because of lower costs.

The British coach market represents a substantial share of mobility and is likely to grow overall. However, the prospects for small independent operators to successfully enter the market are limited, despite the regime being based on market initiative.

Long distance trains in Britain

Controlled by a state-owned monopolistic company, BR, the British railway sector developed quite similarly to virtually all of its European counterparts until the beginning of the privatisation process in 1994. However, a remarkable political incoherence led to the contemporary structure: starting with modernisation and rationalisation processes in the post war era, followed by the high speed train program in the 1970s, the sectorisation in the 1980s and an utterly radical deregulation and privatisation scheme in the 1990s, which had to be reformed several times since as figure 1 shows. [7] This has been subject to many disputes and investigations henceforth and shall not be further discussed here. It implemented, however, one important feature: the franchising system.

Basically, a franchise is a geographical restricted and limited concession for passenger services, competitively tendered. Profitable franchises are let to the bidder offering the highest annual premium, unprofitable franchises to the bidder with the lowest need for subsidies [8]. There are also some open access operators, although market entry outside the franchising system is seriously restricted and to date there are not many success stories [9]. The exclusivity of the franchise operators widely restricts 'competition in the market', but causes an intensive 'competition for the market' – supported by the fact that the Train Operating Companies (TOCs) were privatised without significant assets. Rolling stock ownership is centralised within specialised companies, the staff has to be transferred from an inferior company to its successor [10].

Out of initially 25 franchises 5 were emphasised on long distance services, which implies comparatively long journey distances, high average operating speeds and high passenger volumes [10]. The composition of the franchises has been altered frequently with the overall number being reduced to 17. However, the long distance franchises have largely stayed untouched (current oper-

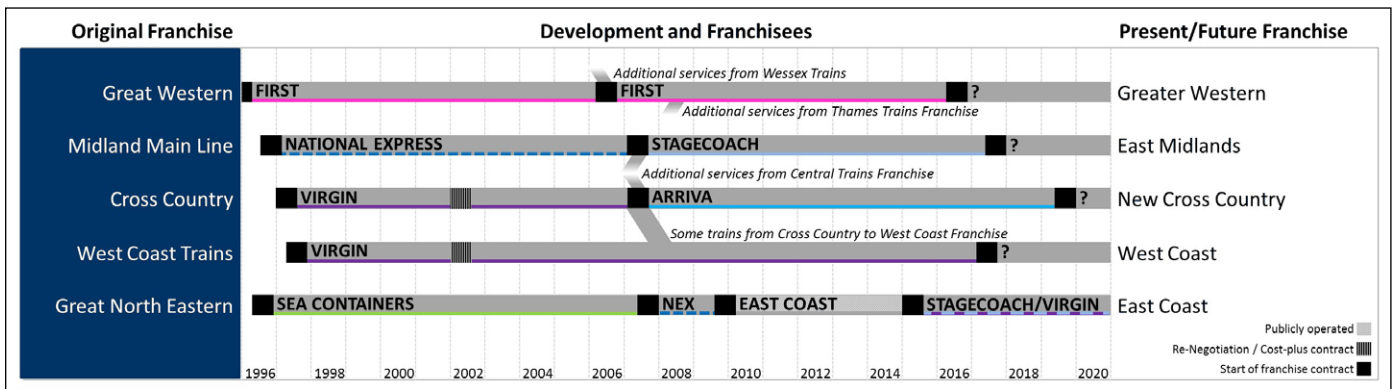


Figure 2. Development of the long distance franchises from 1996 on

ator in parentheses): Greater Western (First), East Midlands (Stagecoach), New Cross Country (Arriva), West Coast and East Coast (both Virgin and Stagecoach). Figure 2 illustrates their development.

One outstanding case of the recent franchising past was the take-over of operations by Directly Operated Railways (DOR) on the East Coast franchise. DOR is a publicly owned ‘operator of last resort’, whose only purpose is to run train operations transitionally in case of franchisee failures [11]. The other case was the successful legal challenge of Virgin to the award of the West Coast franchise to First in 2012, which was caused by faults inside the Department for Transport (DfT), costed more than 55 Mio. GBP and caused the stop of all ongoing franchising procedures [12].

Summing up, Britain faces an intensive competition for the market with more than two applicants in almost every tender so far. Number and composition of TOCs in the long distance sector changed over the years. Open access is distinctly restricted, so that today only two commercial operators offer their services. Interestingly, Britain is one of the only countries which tender long distance services.

Summary and lessons to learn

The coach industries of Britain and Germany have converged at terrific speed since the deregulation of the German coach sector in 2013. At the outset of this process Britain was decades ahead, as the first steps of deregulation occurred no later than 1980. Today, with a market share of over 90% (based on timetable kilometres [13]) Flixbus has gained a market leadership position, which might make even National Express slightly jealous.

Thereby Flixbus relies on a huge number of independent operators and acts as a planning, pricing and marketing network – as well as active and former competitors, of whom no one owns or operates a bus fleet independently. [14]

In terms of market share, doubts about the competitive sustainability of the wild first years in the German market turn out to have been legitimate [15]. In these years, German passengers could enjoy low fares, high frequencies and a level of service, which has been partly superior even to the glamorous ICE trains (cf. Wi-Fi standards). With respect to the market share of Flixbus,

the future development is uncertain. However, the market leader has already started consolidating its network; DB Fernverkehr on the other hand have has increased the amount of discount tickets considerably, whilst successfully improving punctuality and travelling comfort.

Thus, so far both rail and coach have benefited from competition in terms of passenger numbers [16]. Plus, the British case might be relieving: Although market leader for many years, National Express fares are still low, especially compared to the railways. This could indicate the presence of a contestable market, which would require e.g. the absence of sunk costs, standardised products and the impossibility of an incumbent to react to a market entry, before the entrant can costlessly exit.

Especially the latter aspect is controversial concerning the British coach market, as National Express proved repeatedly their swiftness in fighting actual or potential competitors. Besides, market entry requires high marketing costs, as companies need a large customer base [3]. However, intermodal competition could ensure efficiency in the sector anyway [17].

In addition to possibly decelerating intramodal competition in the German market, uncertainties for the sector can be found in a shortage of trained bus drivers, deficiencies in the terminal infrastructure and a possible integration of coaches to the HGV toll scheme.[14].

AUF EINEN BLICK

Die Deregulierung des deutschen Fernbusmarktes 2013 hat zu einer rasanten Angleichung an die Verhältnisse in Großbritannien geführt, wo der Markt bereits in den 1980er Jahren geöffnet wurde: Hier (Flixbus) wie dort (National Express) hat sich ein klarer Marktführer etabliert. Im Schienenpersonenfernverkehr (SPFV) sind die Unterschiede hingegen fundamental: Der britische Fernverkehrsmarkt ist einer von wenigen, in denen SPFV-Leistungen wettbewerblich ausgeschrieben werden. Diesem Franchising-System steht ein freier Marktzugang in Deutschland gegenüber, der jedoch seit der Bahnreform 1994 zu keinem nennenswerten Wettbewerb geführt hat und der Deutschen Bahn einen Marktanteil von 99 % beschert. Vor- und Nachteile des britischen Systems sollten bei einer möglichen Neuausrichtung des SPFV, beispielsweise im Rahmen eines jüngst vorgeschlagenen Schienenpersonenfernverkehrsgesetzes, in Deutschland berücksichtigt werden.

A completely different situation can be observed in the rail industry. Both countries initiated a reform process in the first half of the 1990s, with Britain's franchising system on the one side and a mixed system in Germany on the other: competitive tendering for regional passenger rail services and open access in the long distance sector. Regarding the latter, a market share of 99 % for the incumbent DB Fernverkehr is the result of 23 years of (no) competition, neglecting HKX (Hamburg – Cologne) and Locomore (Berlin – Stuttgart) as drops in the ocean. [18] At the same time there is no dominant player in the British market, but an intensive 'competition for the market'.

As a matter of course, the British Franchising system has its very own flaws, well documented in the Brown review and elsewhere, whilst positive impacts like growing passenger numbers can be hardly attributed to the franchising system but mostly to exogenous conditions. Exemplary problems of the franchising rounds to date are declining competition, strategic bidding and an ambiguity about the objectives, the contract length or risk distribution [19].

If there is ever going to be a Long Distance Passenger Rail Act in Germany, as suggested in December 2016, these defects are to be avoided. The British system leads to significant transaction costs, which might be even higher in the German case, e.g. due to federalism and network length. System transition would take a long a time, as a coordinating body at federal level had to be implemented and potential entrants would need preparation time. Handling of DB's rolling stock in upcoming tenders would have to be discussed, as well as cases of integrated long distance and regional passenger rail services, e.g. Stuttgart-Zürich or Bremen-Norddeich, to avoid struggling for competences between regional and federal authorities. International services would have to be reorganised, as they are to date usually built upon bilateral alliances.

Positive experiences from tendering regional passenger rail services make the British approach charming, even more regarding the opportunity of controlling the supply with long distance services. Technically this is asked by the German constitution since 1994 (Article 87e(4)) but has never been implemented, although many cities and whole regions lost their long distance connection in this period. Sometimes those services have been replaced by publicly funded regional rail services. Besides, international services are partially insufficient (especially to Germany's eastern neighbours). Of course, a better supply would cost additional money: EUR 100 to 500 million, according to the initiators [20]. ■

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Photo: Pixabay.de

Carsharing in rural areas

Challenges and potentials for managing public transportation at local government level

Carsharing, rural areas, local governance, local commitment, sustainable mobility

This article illustrates the concept of car sharing in rural areas, in particular the role of the municipalities. The qualitative study describes the state of research followed by the methodical approach and the results of the analysis which are visualized using a logic model. The results show that car sharing has further potential for growth in rural areas. In particular, municipal support, civil engagement and supra-regional subsidies play a key role in increasing the potential of this form of mobility in rural areas.

Ann-Kathrin Seemann, Sebastian Knöchel

Mobility is a basic element of everyday life and a necessary requirement for any economic interaction. In recent times, significant changes in personal, as well as commercial, transport have been witnessed. Alongside the progression of electric mobility and the development of autonomous driving it is especially innovative mobility services and new business models often based on increasing digitalization that show the biggest potential for optimization. In this regard, rural areas are the most challenging due to low population density and the inherent need for covering larger distances between destinations [1]. According to Wagner et al., declining passenger numbers are the main impediment of a cost-effective public transportation system, such that long-term maintenance of appropriate public infrastructure could pose a serious problem in the foreseeable future [2, 3]. Rural

regions often provide only limited local public transport and in many cases secondary lines with lighter traffic are facing cancellation for cost-cutting reasons.

This makes an obvious need for carsharing activities in rural areas. However, the development of car sharing cannot be triggered by the free-market alone but requires proactive political intervention [4]. In addition to the European Union (EU) and the federal and state governments, it is most notably the municipalities that play a major role in the reshaping of traffic behaviour and local carsharing initiatives. For this reason, Cohen and Kietzmann investigated which forms of collaboration between local authorities and carsharing associations are the most fruitful to advance sustainable mobility [5]. A well-developed carsharing infrastructure clearly makes for a decisive advantage in communal incentive competition. Canzler finds that cities in which

motorised private transport has been repressed are considered more attractive compared with those with higher car traffic [6]. In this view, car sharing represents a vital tool for local governments in competing to attract businesses and private households specifically in rural regions so as to prevent gradual depopulation [7]. Neu and Nikolic find in the theoretically similar constructs of resilience and subsistence a chance for municipalities to compensate infrastructural deficits by civic engagement and thus become overall less dependent on state, federal or EU funds [8]. Following Kopatz, local sustainability projects are exploiting their full potential only if they are systematically supported by the local authorities [9]. For obvious reasons, the local context is highly relevant here, as it strengthens identification possibilities with the agenda.

This study focuses on rural areas in Baden-Württemberg, Germany, and includes only municipalities that meet the OECD definition for rural regions [10]. To ensure a representative and reliable result, we conducted 20 semi-structured expert interviews with 10 carsharing providers and 10 local authorities about alternative mobility concepts over a period of four months (Sept. – Dec. 2015).

Results

Rural regions

Carsharing providers consider rural areas as difficult business segments compared with urban regions. Both a well-developed infrastructure as well as a notable population density are necessary conditions that need to be met to ensure the long-term economic success of carsharing companies. In rural areas, however, one or both of these criteria are often not satisfied. Facing such conditions, mobility providers run the risk of not being able to maintain the quality they are known for from urban environments. Therefore, companies fear reputational damages that could do permanent harm to their business model.

Local mobility services as a chance

All interview partners endorse the view that car sharing as a local mobility service could, in fact, help to close existing gaps in the local public transport market. Establishing mobility hubs in specific rural areas, for example, could ensure a seamless transition between public transport and carsharing vehicles and thus make intermodal mobility possible. In the same way, car sharing could also be combined with other mobility services like bus-on-demand or citizen buses to substitute underutilized regular service. A combination of these custom-tailored transport solutions can, therefore, help to reduce the cost of public transport by a considerable amount as resources are applied more effectively.

The consulted experts concur that the goal of expanding the carsharing principle to rural regions is to complement the public transportation system with additional mobility services and thus offer a broad range of highly integrated means of transportation. This in itself contributes to increasing the overall attractiveness of a municipality, but it also helps in reducing the saturation of roads, which implies preventing congestion, improving traffic flow as well as restricting detrimental effects on health and safety. Ultimately, this objective is fully achieved when citizens can reach any point within the region indi-

vidually without having to rely on their own personal cars. In conjunction with sophisticated IT applications, this can form a highly effective mobility service that again can be integrated into a transregional transportation network. Technological developments aid in further promoting the concept of sharing and to exploit existing potentials. Hereby, the smartphone interconnects the different traffic carriers and acts as a central interface to coordinate the local mobility chain successfully.

Local authorities' support of car sharing

The analysis of the interviews revealed that both the implementation and financial support of car sharing in rural regions are strongly politically motivated. Municipalities mostly serve as key drivers for these particular projects. Therefore, it is obvious that local authorities play a major role in the development of carsharing services as they function as an essential decision-making body. If the governing mayor has a positive attitude towards car sharing and recognizes its potential, this will also influence its local development accordingly in so far as the authorities will be able to secure the funds needed to push the implementation forward. This confirms the findings of Hull [11] and Daley et al. [12]. On the other hand, if the mayor is not inclined towards the concept, the interviewed experts see little chance to operate successfully in those specific communities.

Furthermore, the experts are unanimous that local partners are urgently needed to put appropriate and people-oriented mobility services into practice. Only intensive co-operation between authorities and local business partners can keep the costs down and assure user-oriented distribution of costs while using the carsharing concept to its full potential. Hence, it is evident that the resulting mobility services are not simply transferable to other areas, but are highly individual instead. As a matter of fact, the interviews yielded a broad variety of possible partners for joint ventures: local firms, municipal partners like municipal utilities ('Stadtwerke') and savings banks ('Sparkassen'), regional public transport enterprises, cultural and sports associations, as well as social institutions and other actors, have come up as integrated partners in actual carsharing programs. This means that employees or members can either use the offered services free of charge or at preferred rates, or they have predetermined time quotas for the use of single vehicles, both of which ensure a minimum utilization rate and can contribute to a reduction of staff motor pools as well. The interviews indicated that persons holding a public office often decided in favour of using the carsharing alternatives for on-duty use rather than insist on the official cars that they were in fact entitled to have in their positions. This can result in a significant cost reduction for public offices.

The surveyed carsharing operators point out that the same principle could indeed also be applied to corporate use, such that expenditures on cost-intensive company car fleets could be eliminated completely. Therefore, they not only see great potential for growth in that regard but also suggest that this could enhance the overall attractiveness of a region in terms of locational competition. As a result, more businesses might settle in the area, which again has positive effects for local residents,

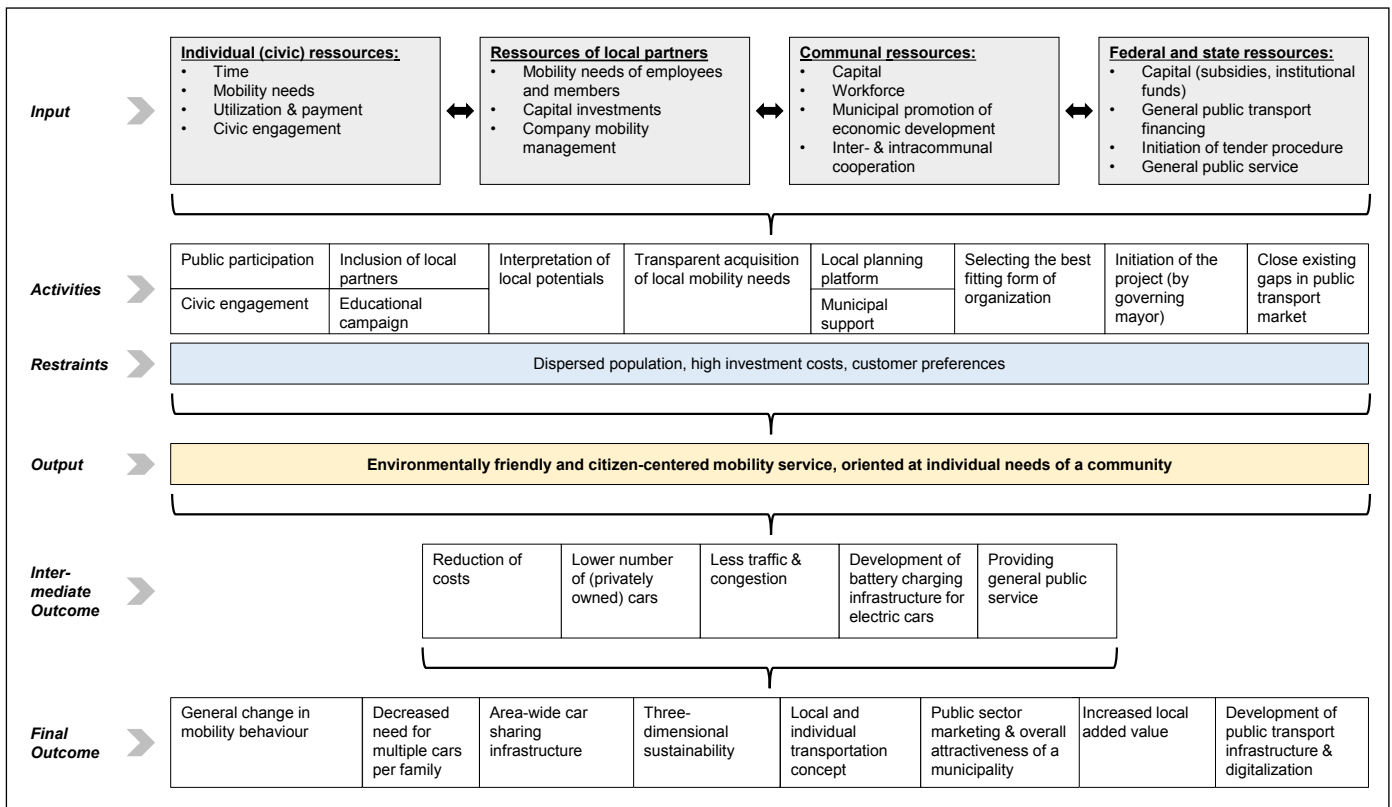


Figure 1: Results of this study diagrammed in a result-oriented logic model

in that the number of local jobs increases. This is not only favourable from an economic point of view but can also improve the quality of life due to shorter everyday commutes (resulting in increased leisure) and less adverse effects on the environment.

Apart from transferring the entire mobility service to external partners, there are also several other forms of organization in which municipalities can play a role. Some authorities, for example, organize car sharing on their own and only rely on a provider's car fleet. However, the interview partners had divided opinions regarding this approach. They particularly criticized a lack of flexibility on the part of their project partners and tedious maintenance processes of the car pools, which prevented an appropriate and undisturbed operation. They propose that local partners would be desirable as this would not only guarantee more flexibility but also maximize local added value. However, the interview results show that smaller companies often struggle with the high investment and maintenance costs of a fleet. Some municipalities, therefore, decided to set up their own carsharing programs, for which they co-ordinate the sharing, provide the car fleet and are responsible for maintenance and repairs.

Conclusion

The results indicate that the carsharing principle offers great potential for growth not only in urban but also in rural areas. However, successful implementation requires that local authorities and local communities act in concert. In addition, supra-regional subsidies are needed in most cases given the capital-intense nature of such projects. Civic engagement primarily comes from a distinc-

tive desire for environmentally friendly and citizen-centred mobility services to close existing gaps in public transport. On the other hand, the development of car sharing in rural areas is also politically motivated as it offers cost-saving potentials in terms of public spending and improves the overall attractiveness of the region. In particular, the analysis of the interviews has shown that governing mayors play a key role in the initiation of car-sharing projects because their attitude towards the car-sharing idea is a crucial factor. Moreover, it is evident that the success of a project is dependent on the intended type of use (private, public, corporate or a combination) because cost-effective operation is only possible for a certain threshold level of utilization. In practice, this means that an in-depth assessment of potential demand is required to find the best-fitting form of organization. That is, local companies must be included both for their demand and participation possibilities to recognize and exploit regional potentials individually. To win local communities over, it is recommended that carsharing providers raise awareness about the advantages of car sharing, especially in the context of electric mobility. Finally, it is important to clarify the mobility behaviour of the locals so as to break that mental barrier of habit and convince them that they are actually not dependent on a car of their own.

In figure 1, the results of this study are diagrammed in a result-oriented logic model. All municipal stakeholders (that is, citizens, local companies, local authorities as well as federal or state governments) are involved in a carsharing project. All actors provide their own inputs and thus do their part in the development process of the project. The resulting activities can be considered as individual components for the further planning process and its

implementation. Aside from these activities, there were also restraints identified. Circumstances like particularly high investment costs and geographical factors among others represent major challenges for the establishment of sustainable carsharing systems in rural areas. If interference with those factors can be minimized, the resulting output is an environmentally friendly and citizen-centred mobility service that is oriented at individual needs of a particular community. This output again implies intermediate and final outcomes. Intermediate outcomes thereby denote short- and medium-term effects of the carsharing launch that is, for example, the reduction of privately owned cars and better allocation of resources. Final outcomes, on the other hand, describe the ultimate goals and long-term consequences of car sharing, namely the altered mobility behaviour or positive public sector marketing. Provided it is feasible to include all actors and their individual resources, the concept of car sharing holds a lot of potential for rural regions and can bring several positive synergetic and secondary effects. ■

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Projects in a nutshell

Overview of selected mobility research projects

Will grass become the new gasoline?

In the quest of more sustainable fuel types, scientists at Ghent University (Belgium) have developed a way to turn grass into biofuel. Will we soon drive on 'grassoline'?

"Until now, grass has mainly served as feed for animals. But apart from that, grass can also be used as biofuel. Due to its vast abundance, grass is the perfect source of energy", scientist Way Cern Khor tells us. During his PhD research at Ghent University he investigated methods that can disintegrate and treat grass until it can be used as a fuel.

Turning forage grass to aviation fuel

To improve its biodegradability, the grass is pretreated at first. Then enriched bacteria

are utilized to convert the sugars in the grass into lactic acid and its derivatives. The lactic acid can already serve as an intermediate chemical to produce other compounds such as biodegradable plastics (PLA) or fuels. In this case, the lactic acid is converted into caproic acid which was further converted into products such as decane. And that is where the process ends: decane can be used as fuel, for example for aviation. This is very important: while cars are turning electric, planes are not – and they will not do so in the coming two decades at least.

Although it might sound revolutionary, there's still a lot to do before this becomes reality. Right now the amount of biofuel that can be made from grass is still limited to a

few drops. The current process is very expensive, and engines should be adapted to this new kind of fuel. "If we can keep working on optimizing this process in cooperation with the business world, we can come down on the price. And maybe in a few years we can all fly on grass!", Khor concludes.

More information: www.ugent.be/en/news-events/news/from-grass-to-grassoline.htm



Making lithium-ion batteries lighter, safer, more efficient

Researchers from Universidad Carlos III de Madrid and the Council for Scientific Research (initialed CSIC in Spanish) have patented a method for making new ceramic electrodes for lithium-ion batteries that are more efficient, cheaper, more resistant and safer than conventional batteries.

Currently, lithium-ion batteries are the main electrochemical storage systems in electronic devices and the area of transportation. "What we have patented are new ceramic electrodes that are much safer and can work in a wider temperature interval," explained Professor Alejandro Várez, one of the inventors from the UC3M Materials Synthesis and Processing research group.

It is a method of making ceramic sheets by way of a thermoplastic extrusion mold. "This technique allows making electrodes that are flat or tube-shaped, and these electrodes can be applied to any type of lithium-ion battery," said Várez. Moreover, the cost of production is relatively low, and, according to its creators, it is easy to adapt to the current process of production, so the next step to industrialization would be immediate.

These ceramic electrodes consist only of active material, which reduces the risk of degradation and inflammation at high tem-

peratures (greater than 100 °C). "This is especially important in the case of electric vehicles, because if there is an accident and fire, conventional batteries can catch fire, and it is very difficult to extinguish," said Jean Yves Sanchez, another inventor of the patent and UC3M CONEX researcher from the Université Grenoble Alpes (France). "These new solid electrodes can't burn, which contributes to improving the safety of the batteries," he added.

When there are major electrical consumption peaks, commercial lithium-ion batteries tend to overheat and, in some cases, even explode. The reason is that the electrolytes normally used contain organic liquid solvents that can ignite, like the additives used for the fabrication of electrodes. "With our technology, however, solvents are not used during the fabrication process," said Sanchez. "In addition, if you compare them with conventional electrodes, the ones we obtain with this fabrication process are very hard and can't be cut, which contributes to improving the solidity of the battery."

Another advantage of batteries that integrate these new electrodes is their efficiency, according to tests done by the researchers. These tests show an increase of specific capacity that is nearly triple the



Photo: UC3M

capacity of commercial electrodes with the same density. And as this technique permits the fabrication of high-density electrodes (between 450 and 1000 microns), the storage capacity by area increases up to ten times the capacity of current technology.

Further information in English: www.uc3m.es/ss/Satellite/UC3MInstitucional/en/Detalle/Comunicacion_C/1371231022939/1371215537949/Lighter_more_efficient_safer_lithium-ion_batteries



Spanish video with subtitles: https://youtu.be/Z_lxsLbXL88

A new take on aircraft takeoff and landing

Aviation research has long dreamed of building aircraft that require little takeoff and landing space rather than long runways and enormous surface areas. One enterprising effort in this direction was the EU-funded project SOAR (Distributed open-rotor aircraft), based on a novel concept of an open-fan wing aircraft. This represents one of the latest aircraft technologies that blends fixed-wing aircraft and helicopter, offering stable short takeoff and landing (STOL) capabilities and possibly hovering capabilities.

The technology is based on propulsion from a fan that is fixed on top of the wing structure and that can create a vortex to lift the aircraft. To achieve its aims, the project combined efforts of the German Aerospace Centre (DLR), FanWing Ltd. of the United Kingdom, the Belgian Von-Karman Institute (VKI) and Germany's Saarland University.

Together, the project partners made great progress in advancing the propulsion



Source: FanWing

and fan drive system. This included calibrating different components, installing necessary sensors, and completing required wind tunnel tests to select the best materials, blade pitch angles and speeds. Various wing shapes with different tail lengths and high-lift devices were also tested. The newly developed synchronous motor is capable of generating 45 Nm in high angular speeds.

A key advantage of STOL aircraft is the reduced noise during takeoff and landing,

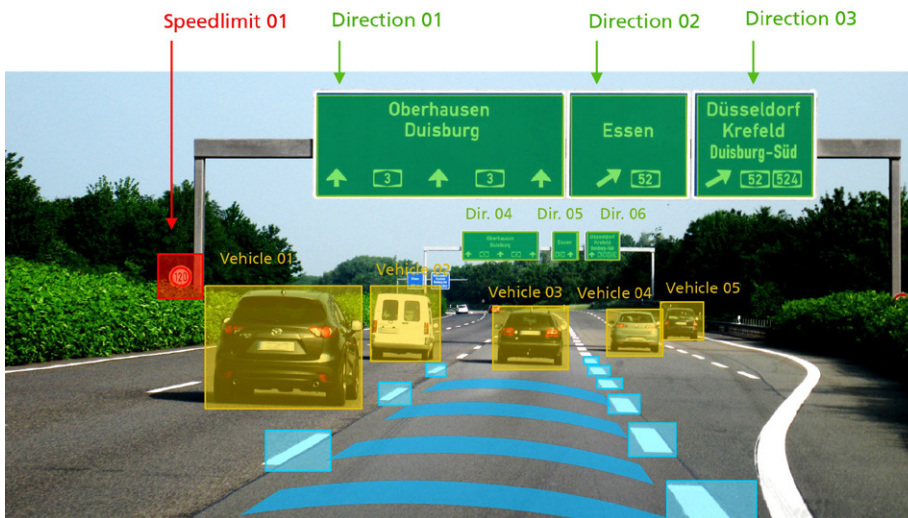
enabling it to fly at any time of day and within city limits. Apart from transport, such aircraft could potentially be used for crop dusting, surveillance, logistics, fire-fighting and a number of pilotless operations.

Overall, the expected stability, hover capability, modest fuel needs, reduced runway length and increased safety could help revolutionise the industry. Lastly, a reduction in maintenance, construction and certification costs will contribute to making STOL aircraft leaner, more efficient and more environmentally friendly.

More information: www.soar-project.eu



Safe navigation even on construction sites



Source: Fraunhofer IAIS

Automated vehicles have to be able to reliably detect traffic signs. Previous systems, however, have had problems in understanding complex traffic management with different information about speed or the course of the lanes, as mainly occurs on construction sites: driving lanes generally narrow, traffic jams develop old and new road markings overlap, and limiting beacons and traffic cones are difficult to detect by the sensors. The signs contain different information about the permitted speed or the course of the lanes.

Fraunhofer researchers are developing technologies for the real-time interpretation of such signs. “Our technology enables a system to read signs of this kind with a high degree of accuracy,” says Stefan Eickeler, who is responsible for the subject of object recognition at the Fraunhofer Institute for Intelligent Analysis and Information Systems IAIS in Sankt Augustin, Germany. The information is processed semantically, understood in terms of content and made available for further processing. “With Deep Learning – a key technology for the future of the automotive industry – we

teach the software to recognize the classic patterns more quickly and efficiently.”

Via the interplay between navigation equipment and on-board computers, it will be possible in the future for differently designated highway exits on construction sites to be correctly identified, for the distances to other vehicles to be kept optimally, and for the speed to be adjusted in a timely manner. “What in the short term could be able to promote relaxation and increased safety when driving by means of assisted driving is intended to work all by itself in the long term: Automated vehicles will then react independently,” Eickeler explains.

An automotive camera is used which currently delivers 20 to 25 frames per second. Directly during the trip, these pictures are analyzed and information about signs, lane information or LED traffic signs are identified and processed. A future vision is that this camera will be able to function as a primary interface, making a large number of sensors redundant.

Further information:

<https://www.iais.fraunhofer.de/en.html>



A novel method helps reducing noise problems produced by road traffic

Scientists from the universities of Granada (Spain) and Southampton (UK) have designed a new method to reduce noise problems caused by road traffic, which is said one of the main environmental impacts of roads with important effects on people’s health and their physical and psychological well-being.

The application of the European Environmental Noise Directive by various public administrations of the European Union member countries in relation to road traffic noise has generated, in recent years, a significant number of Noise Action Plans (NAPs) by the different administrations responsible for the infrastructures. However, said directive does not establish a regulated process that allows choosing the most critical road stretches which require some action

and, once chosen, choosing the most suitable option against the noise. In fact, the critical study of the noise action plans published in Spain shows the general lack of methodologies and criteria taken into account in the decision-making on the problem of prioritizing the actions included in them.

The research, carried out by Spanish-British scientists, proposes a practical methodology based on exclusively technical criteria using available data from the organisms responsible for the infrastructures. This methodology, called PATRON (Prioritizing AcTions against Road Noise), consists of two stages. The first stage consists of defining and weighing, in an objective and reasoned way, the main criteria used to prioritize the road stretches included in a plan. In the second stage, the main criteria and

choices to be taken into account are defined, and the appropriate options are chosen for each of said stretches. In addition, weights are obtained for each of the criteria, which allows to assess their relative importance in each problem.

The final product is a method that any entity can easily implement and which helps in decision making by choosing the most suitable alternatives for the reduction of the exposure to the noise.

More information: sl.ugr.es/ruido_traficoEN



Unmanned cargo vessels – more sustainable maritime transport

An EU initiative has developed an idea for unmanned shipping that involves designs for various modular on-board systems for ship control, sensing and communication, plus onshore stations. For environmental reasons, oceanic cargo ships are travelling more slowly, thus increasing the ship population. At the same time, numbers of available mariners are declining. The solution may lie in partially autonomous cargo vessels, which also offer commercial and environmental advantages. The EU-funded Munin (Maritime unmanned navigation through intelligence in networks) project worked to develop a technical concept for such ships and assess its feasibility.

Project partners developed a technical concept for the operation of an unmanned merchant vessel during the deep-sea part of its voyage. The ship is autonomously operated by new systems aboard the vessel. However, the monitoring and controlling functionalities are performed by an operator on land. They also assessed the concept's technical, economic and legal feasibility.

The Munin team developed prototypes for the subsystems, including both on-board and onshore modules. The systems are not

intended for use in harbours or congested shipping lanes. An advanced sensor module automatically looks out for traffic, obstacles and weather conditions surrounding the vessel by continuously combining sensor data from existing navigational systems with modern daylight and infrared cameras. A shore control centre continuously monitors and controls the vessel (see figure).

Other units include an autonomous navigation system with a predefined yet flexible voyage plan, and an autonomous engine and monitoring control system. The latter monitors and controls all engine room components and serves as a transceiver for the shore control centre.

Thanks to Munin, autonomous shipping is technically feasible. The development should yield cost savings, reduce opera-



Source: EvrenKalinbacak, Thinkstock

tional expenses and environmental impact, and avoid the problems of mariners being at sea for long periods.

More information:

www.unmanned-ship.org/munin



Wider application of new materials for lighter and greener trains

The implementation of new lightweight materials for trains has been slow due to the lack of suitable certification procedures. An EU initiative paved the way for the certification of new materials such as composites. They can help to build lighter rolling stock that will consume less energy and reduce emissions. While such materials are being used in the manufacturing of rolling stock parts, there is no way to certify a rail vehicle built mostly or entirely from non-metallic materials. The existing regulatory framework must be re-examined in order for the sector to recognise what changes are needed.

With this in mind, the EU-funded REFRESKO (Towards a regulatory framework for the use of structural new materials in railway passenger and freight carbody-shells) project set out to provide recommendations and the information needed to adapt

the regulatory framework of railway carbody structures to the introduction of new materials.

Work began by benchmarking the most promising new materials available to railway and other sectors, and examining rail certification processes and standards to identify gaps which need to be filled ahead of implementing new materials.

Project partners studied fire, smoke and toxicity properties of resins, the noise, vibration and harshness of composite materials, and the advantages and disadvantages of composite materials concerning electromagnetic compatibility. They investigated existing standards, and characterised and modelled procedures for the new structural materials. This was done to understand the structural requirements for issues arising from the replacement of metal with high-performance composite materials in rail carbody shells.

The team examined the crashworthiness of rail vehicles and parameters of the manufacturing process that influence final material properties. It proposed optimal prognostic, health management and non-destructive methods for new materials in rail carbodies.

Lastly, recommendations were proposed for modifying current railway standards in order to enable the safe introduction of new materials in train carbodies.

Detailed information:

www.refresco-project.eu/deliverables



World's first test site for autonomous vehicles opens



Kongsberg autonomous vessel

Photo: Idun Haugan/NTNU

Norway's Trondheim Fjord will be the world's first technological playground for pilotless vehicles that move below, on and above the water's surface: Snake robots, underwater drones, unmanned ships, and flying drones will soon be seen on Norway's third-longest fjord located in the west-central part of the country. The area is being established as a test lab for autonomous technology, which could replace the crews on ships, among many other possibilities.

"As far as I know, this is the first test site of its kind in the world," says Professor Asgeir Johan Sørensen, Director of the Norwegian University of Science and Technology's Centre for Autonomous Marine Operations and Systems (NTNU AMOS).

Good news for the environment

Autonomous technology is being used in advanced automated systems with human operators – for example in a car's cruise control and collision avoidance systems or the autopilot on a passenger plane. Autonomous functions are also found in unmanned systems where people are not physically

present – such as on a pilotless vessel, or oil and gas installations. These often involve remote control of the vessel or installation with varying levels of autonomy, using for example satellite communications. Control is then moved from the bridge on the ship or the control room of the installation to a centre on land.

Today, autonomous unmanned vehicles are used to perform tasks in so-called unstructured environments with complex, unpredictable and sometimes dangerous areas, or for surveys and mapping of geographical areas. What is now happening with full force is the development of larger pilotless vessels that can transport cargo and maybe passengers. And the environment can actually benefit from that.

Slowly sailing vessels use less fuel. In the future, the speed of freight traffic could be adapted more precisely to the cargo on board. Some products must get there fast, but for others, speed is less important. This is better for the environment, and cuts operating costs. "Unmanned vessels can also be built in ways that make them less vulnerable

to attack – from pirates, for example. However, cyber security will be an issue," Sørensen adds.

New rules and standards needed

The Trondheim Fjord is highly suitable as a test site for autonomous vessels. The fjord is clear and open, large and wide, almost like a small sea – while it is demanding enough to create challenges for humans and technology to tackle. Another factor is that shipping traffic is relatively low. Most important of all, however, is the cluster of expertise near the fjord, which includes research institutions, business and industry with long traditions of research and development in autonomous systems, vessel concepts, aquaculture, mineral extraction and robotics. Now these players will have a test laboratory on their doorstep, but the test site will also be available for other players who need to test autonomous vessels. Kongsberg Seatex, Marintek, and Maritime Robotics have joined forces with NTNU to launch the test site initiative. Other industrial players such as Rolls-Royce Marine are involved as well.

Sørensen notes that the rapid development of autonomous systems creates completely new demands for dealing with risk and management of risk. Qualification of new technology and operations will call for an approach that focuses more on function and risk. The bottleneck for further development of the technology lies here, he believes.

More information: NTNU Centre for Autonomous Marine Operations and Systems – www.ntnu.edu/amos



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The car of the future: Digitized, connected and driving autonomously

Preview: 05–06 July 2017 – ConCarExpo 2017, Berlin (DE)

The automotive industry is undergoing a transformation. The growing digitization lays the foundation for future vehicle generations to be able to communicate with each other, with the driver and their environment. In light of this, digitization is considered the key on the way to fully automated and connected driving. Vehicles continue to become safer, smarter and more comfortable. What are the technical and infrastructural obstacles that still need to be overcome and how do these changes revolutionise mobility as such? These are the main topics at the international Trade Exhibition “ConCarExpo 2017” taking place from 05 to 06 July 2017 at Estrel in Berlin.

The “ConCarExpo” is Europe’s biggest international trade exhibition in the field of connected car, automated driving and IT security in the vehicle. Under the headline “Connected Car & Mobility Solutions” more than 100 exhibitors will be presenting their technical solutions and new business models.

As part of “ConCarExpo” four specialist conferences will be held in parallel where more than 100 international trade experts will be speaking about automated driving, man-machine interfaces, IT security as well as digital infrastructure:

4th International VDI Conference – Automated Driving

Automated Driving is one of the megatrends that are going to have a large-scale impact on the automotive sector in the years to come. Major changes are imminent that will affect the use and design of vehicles and

shape new infrastructure concepts. At the conference all these topics will be subject of discussion amongst the leading minds of the automotive industry with the focus clearly being placed on “Automated Driving”.

4th International VDI Conference – Automotive HMI & Connectivity

The man-machine interface goes beyond the mere connection of driver and vehicle. It includes the driver being linked up to the environment. By continuously pushing the advancement of driver assistance system technology, which measures the alertness of the driver and reaches as far as linking up to mobile devices, driving will be more comfortable and safer by introducing new technologies.

3rd International VDI Conference – IT Security for Vehicles

Digital networking and automation in vehicles are considered groundbreaking future trends. Be it a GPS connection or online controllable infotainment, all these convenient features pose at the same time a security threat. How to mitigate harm arising from this threat and which new measures are in place to protect automotive information technology will be subject of a discussion conducted by experts at the conference “IT Security for Vehicles”.

International VDI Conference – Digital Infrastructure and Automotive Mobility

The implementation of digital innovations like automated driving in real life calls for

fundamental preconditions to be laid down that are geared towards a comprehensible, reliable and swift vehicle-environment information exchange. For this purpose, appropriate information and communication structures have to be arranged and implemented, to establish a digital infrastructure. What this will look like and how unresolved financial matters will be clarified, will be discussed at the conference “Digital Infrastructure and Automotive Mobility” by experts with an automotive, telecommunication and IT background.

To benefit from an even wider range of topics and make use of ample networking opportunities, conference participants may attend any of the four VDI conferences that will be run simultaneously with their ticket. In addition, conference participants will have free access to the trade exhibition “ConCarExpo”. However, an exhibition ticket for the trade exhibition “ConCarExpo” does not entitle the holder to attend any of the VDI conference that are held in parallel.



Exhibition and conferences will be held in English. Further informations, registration and programme:

www.concarexpo.com
www.vdi-international.com
wissensforum@vdi.de,
 Phone: +49 211 6214-201

TEN-T road network development – Experiences of the last 25 years



Preview: 08–09 June 2017 – XV. European Transport Congress and X. Budapest International Road Congress, Budapest (HU)

The Hungarian Scientific Association for Transport (Közlekedéstudományi Egyesület, KTE) organizes a two days congress with both well-esteemed international scientific presenters as well as several technical visits and touristic tours.

The intention of the jointly held 15th European Transport Congress and 10th Budapest International Road Congress is to discuss the experiences of the last 25 years of TEN-T road network development. The conference gives an opportunity to the professionals and experts of the Central and

Eastern European region to share their results and lessons learnt to each other and to present their challenges, findings and innovations.

The EPTS platform was formed in Vienna in 2001 by the scientific organizations and associations for transport of Austria, Croatia, the Czech Republic, Germany, Hungary, Macedonia, Italy, Poland, Slovakia, and Slovenia with the aim of encouraging the political, scientific and economic dialogue in the European transport sector. It is the goal of the association to promote sci-

entific education and research (to support especially the young researchers), and to develop a European level cooperation with the scientific institutions. The EPTS member states organize international conferences at annually changing sites. After 2007 and 2012, the Hungarian Scientific Association for Transport hosts the event for the third time.

Further information:

www.epts2017budapest.eu – www.epts.eu

New Mobility World



NEW MOBILITY WORLD

Preview: 14–17 September 2017 – New Mobility World at IAA 2017 “Shaping the Future of Mobility across Industries”, Frankfurt am Main (DE)

New Mobility World is the B2B event at the 67th International IAA Cars Motorshow where the mobility of tomorrow begins. Supported by the Federal Ministry for Economic Affairs and Energy and the Federal Ministry of Transport and Digital Infrastructure, New Mobility World will take place from September 14 to 17. At New Mobility World, innovators, digital pioneers, start-ups and the automotive industry come together to build the future of e-mobility and discuss five main topics: Automated

Driving, Connected Cars, Urban Mobility, Mobility Services, and E-Mobility.

With the formats “Hall”, “Forum”, and “Parcours”, New Mobility World provides a platform for presenting, discussing, and experiencing the e-mobility of tomorrow. In the “Hall” area, theme parks bring together young and established players who work in the e-mobility field. In terms of content, the “Forum” will be the meeting place for pioneers and innovators with its high class talks, discussions and panels. At the “Par-

cours” demonstration areas and test tracks the future of e-mobility can be experienced today.

New Mobility World provides an ecosystem for disruptors and innovators to be at the forefront of future thinking – to change the way in which we will move from A to B in the future.

<https://newmobility.world/en>

EVS30 – Electric Vehicle Symposium & Exhibition

Preview: 9–11 October 2017, 30th Electric Vehicle Symposium & Exhibition, co-located with BATTERY+STORAGE and f-cell, Stuttgart (DE)

The largest trade fair and conference event for electric mobility will be held in Stuttgart in 2017 – the “Electric Vehicle Symposium & Exhibition” (EVS). Every 12 to 18 months, researchers, government representatives and industry experts from around the world gather to get the latest picture of all forms of electric mobility, its technologies and other issues, such as battery and fuel cell drives, and discuss new trends. The event venue rotates between North America, Europe and Asia.

In Stuttgart, manufacturers, users and decision-makers can get the latest picture of

all forms of electric mobility and discuss new trends and possible uses of electric power transmission.

Following the motto “Industrialization and market – the sustainable path to electromobility”, the conference will highlight latest research projects, technological advances, market development strategies and innovative business models for e-mobility concepts.

In addition to the focal areas e-mobility, system suppliers, components and accessories for the automotive industry, charging infrastructure, and production technologies



the exhibition will present special vehicles from the construction sector and agriculture, regulations and standards, energy management systems, and software solutions for networked and autonomous driving.

Further informations, registration and programme:

www.messe-stuttgart.de/en/evs30

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Dear Readers,

In the current issue of *International Transportation* 1/2017, we address some questions that have increasingly attracted attention worldwide, for example: How can public transportation systems be maintained, expanded, and optimized in order to meet rapidly growing transport needs? And how should this all be financed?

The contributions in this issue make it clear that both political will as well as goal-oriented strategies are needed to meet such complex challenges. From a technological perspective, addressing these issues becomes even more imperative, especially because increasingly shorter cycles of innovation generate new, often cross-sectoral technologies. An urgent task for the immediate future is to implement laws and regulations so that these technologies can be fully utilized.

In this regard, there are currently many topics that need to be considered, for example, making use of highly automated transport vehicles, creating environmentally sustainable driving systems, providing mobility services in various nearby areas, ensuring the safe transport of passengers and goods, and maintaining data security.

One thing you can be sure of: These topics will also be dealt with in depth in the upcoming issues of our magazine. If you would like to submit a contribution, please contact us. Author guidelines and a submission form can be found at our website: www.internationales-verkehrswesen.de

Alternatively, you may contact me directly per e-mail: eberhard.buhl@trialog.de
I look forward to hearing from you!

Sincerely,

Eberhard Buhl, Managing Editor

CALENDAR OF EVENTS

15 May 2017 to 19 Oct 2017

15-17 May 2017

Montreal (CA)

62. Global Public Transport Summit

LEAD the TRANSITION

Organization: UITP, International Association of Public Transport

www.uitpsummit.org

17-18 May 2017

Düsseldorf (DE)

Polis Convention - Urban Development

Organization: polis convention GmbH

Contact: +49 202 248 36-22, kontakt@polis-convention.com

www.polis-convention.com

31 May-02 June 2017

Leipzig (DE)

International Transport Forum - 2017 Summit

Governance of Transport

Organization: International Transport Forum, Paris

Contact: +33 1 45 24 19 80, paula.dunne@oecd.org

<http://2017.itf-oecd.org>

08-09 June 2017

Budapest (HU)

XV. European Transport Congress & X. International Road Congress

Organization: European Platform of Transport Sciences (EPTS) and Hungarian Scientific Association for Transport (KTE)

Contact: Eva Schmidt, Assistant to Secretary General EPTS, schmidt@econex.de, www.epts.eu

www.epts2017budapest.eu

13-14 June 2017

Venlo (NL)

Smart Logistics Expo & Cargo & Logistics Innovation Congress

First Global Multimodal Unmanned Cargo Systems Event

Organization: Jakajima b.v., Eindhoven

www.cargoinnovationconference.com

21-22 June 2017

Karlsruhe (DE)

Parken

Planning, construction and operating of parking areas

Organization: Mesago Messe Frankfurt GmbH

Contact: info@mesago.com

www.mesago.de/en/Parken/home.htm

05-06 July 2017

Berlin (DE)

2nd New Mobility World

Shaping the Future Mobility across Industries – at IAA

Organization: NMW project office, Dirk O. Evenson, +49 30 7262 199 71, newmobilityworld@evenson.de

<https://newmobility.world/en/>

14-24 Sept 2017

Frankfurt am Main (DE)

IAA Cars 2017

67th International Motor Show 2017

Organization: German Automotive Industry Association (VDA), Berlin, +49 30 897842-0, www.iaa.de

www.iaa.de

09-11 Oct 2017

Stuttgart (DE)

EVS30 „International Electric Vehicle Symposium & Exhibition“

Host: World Electric Vehicle Association (WEVA),

European Association for Battery, Hybrid and Fuel Cell Electric Vehicles (AVERE)

Organization: Messe Stuttgart, info@messe-stuttgart.de

Congress organisation: Sandra Bilz, Tel.: +49 711 656960-5704,

sandra.bilz@messe-sauber.de

www.messe-stuttgart.de/evs30/

17-19 Oct 2017

Munich (DE)

eMove360° Europe

2nd International Trade Fair for Mobility 4.0: electric – connected – autonomous

Organization: MunichExpo Veranstaltungen GmbH

Contact: info@munichexpo.de

<http://www.emove360.com>

For information on additional events go to
www.internationalesverkehrswesen.de

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