Günter Halbritter
Rainer Bräutigam
Torsten Fleischer
Sigrid Klein-Vielhauer
Christel Kupsch
Herbert Paschen

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Options to relieve the transport network and to shift road traffic to environmentally sounder means of traffic

Summary

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SUMMARY

In March 1993 the Committee for Research, Technology and Technology Assessment of the 12th German Parliament commissioned TAB to implement a TA project on the effectiveness, the implementation conditions and the consequences of measures and technologies to ease the burden on the transport network and shift road traffic to environmentally sounder forms of transport. On the basis of an in-depth problem analysis TAB developed a study concept for this subject that was approved by the Committee in autumn of 1994. In line with the request of several Members of Parliament following the constituent assembly of the 13th German Parliament, a renewed debate was held on the study concept, focussing on the issue of the parliamentary relevance of the planned study. As a result of this debate, and with the agreement of the parliamentary rapporteur for TAB, TAB project staff modified several items in the study concept. As of mid 1995 TAB placed commissions with external experts; the last commissions were placed at the end of 1996. All expert reports had been presented to TAB by the beginning of 1998.

It is undisputed that a functioning transport system is a crucial prerequisite for the functioning and efficiency of highly-developed societies. Equally, it is indisputable that the adverse impacts of transport – for example, air pollution, noise, accidents and efficiency losses from traffic jams and bottlenecks – constitute constraints on social and economic development. In view of the continuing rapid growth of traffic and transport volume (particularly road traffic) the priority goals in this TA project of relieving the burden on the transport network and shifting road traffic to environmentally sounder means of transport are acquiring increasing importance and acceptance. These goals are also critical elements in the German Federal Government's concept for transport policy.

While there are concrete ideas for the future shape of transport policy at the level of goals, there is much less clarity at the levels of strategy and measures. In recent years various pieces of fundamental work have been presented on the problems of transport and possible solutions. These include a wealth of recommendations for action, although generally do not consider in more detail the conditions for their implementation and consequences. The focus of the TAB project is accordingly on analysing the feasibility, effectiveness and consequences of selected measures for achieving specific transport policy objectives. In this sense, the TAB project regards itself as a continuation and operationalisation of existing studies.

The central initial assumptions of the TAB project include the assumption that the desired relief for the transport system and shift from road transport to environmentally sounder means of transport should not involve either constraints on mobility nor significant cuts in the present quality of travel or transport. This results in the need to develop other forms of mobility than the current »automobility«. In addition there are over twenty million adults who do not have private cars and need public transport which is as attractive as possible.

Both theoretical studies and experience with transport policy show that attempts to affect transport demand effectively through individual measures have little prospect of success. The TAB project accordingly assumes that the goals of relieving the transport system and shifting from road transport to environmentally sounder means of transport can only be achieved through packages of measures (which are coordinated as far as possible). Based on the existing extensive studies (for example by the Enquete Commission on Preventive Measures to Protect the Earth's Atmosphere« and »Protecting the Earth's Atmosphere« or the Council of Experts on Environmental Issues) for the future development of transport and the associated environmental problems, on the available instruments of transport policy and the possibilities for shaping transport policy offered by the new information and communication technologies together with newly commissioned studies, the TAB has studied the effectiveness, conditions for implementation and possible consequences of three options.

> Using information and communication technologies to improve traffic information and traffic guidance based on existing codes (in short: improving traffic information).
> Using information and communication technologies for traffic management in road passenger and goods transport together with using various pricing measures (in short: pricing measures in road transport)
> Improving the attractiveness of local public transport.

»IMPROVING TRAFFIC INFORMATION« OPTION

The focus of the first option »improving traffic information« is on possible uses in the transport sector already considered for the new information and communications technologies, which – not least in the basic transport policy statements of the German Federal Government, for example in the strategy paper »Telematik im Verkehr« (»Telematics in transport«) – have been given the role of a path-breaking solution for implementing transport policy goals. Possibilities are studied for configuring existing concepts for the use of information and commu-

nications technologies in transport in such a way that they can contribute not only to optimising road transport flow but also to reducing traffic volume and shifting road traffic to environmentally sounder forms of transport. Reference is made here to experience already gained from selected pilot projects in German cities.

Despite major qualifications regarding the representative nature of the data acquired, the summarised experience with the use of information and communication technologies makes possible some initial statements on the technical readiness for use of these systems, on their effectiveness in terms of relieving the transport system and shifting road traffic to environmentally sounder forms of transport and on suitable forms of organisation for using the new technologies.

An estimate made in the course of scenario studies in the STORM project of the extent to which journeys in motorised individual traffic can be shifted to public transport through the use of telematic services showed very low transfer values below 2%. Comparable analyses carried out in other research projects arrive at similar figures, again of the order of only a few per cent. It is probable that even if synergetic effects of implementing further measures are taken into account, a strategy based solely on improved information provision cannot achieve any degree of transfer which is satisfactory in terms of more environmentally friendly transport, given the continuing high rate of growth of individual motorised traffic.

More important than the shift of road traffic to public transport systems is the contribution of telematics services towards improving traffic flow and hence relieving the road system. This is expressed e.g. in the clear gains in journey time shown in empirical surveys in the course of the pilot projects or through simulations, both for vehicles equipped with individual dynamic traffic guidance systems and for vehicles not so equipped. The use of individual dynamic traffic guidance systems leads to higher throughput rates in the road system. The use of telematics here primarily results in reducing peak loads, primarily by shift the timing and routing of journeys. Effects on driving performance are currently difficult to quantify.

One focus of the industry's development interest is the use of individual traffic guidance systems for motorised road transport. The introduction of such systems involves a range of problems. The maximum freedom of service for private sector telematics services for individual traffic guidance systems which is politically desired can substantially impact on the transport policy concepts of local and regional authorities. The expected use of such systems in major

conurbations prompted the expression of concerns that the recommendations for routing would not only guide traffic into the primary road network but also through housing areas with traffic restrictions. This would materially affect or even run contrary to the transport policy goals of many local authorities. The umbrella organisations for local authorities are also pointing to the growing conflict of goals of local authority traffic planning concepts and the anticipated effects of widespread use of individual dynamic traffic guidance systems. Contractual agreements for an equalisation of interests between the public and private sectors are accordingly seen as necessary, not only to govern the use of the public infrastructure but also more generally the modalities of using dynamic traffic guidance systems in conurbations.

The mere use of telematics services in the road system leads to growing appeal of individual traffic or road freight transport. The competing public transport systems already reveal drawbacks for most transport purposes and will slip further behind unless telematics applications are developed and implemented on an equal or greater scale to enhance their appeal and improve their efficiency. Here, the Federal, Länder and local governments will all face increased demand in future, not least to secure the attractiveness of transport companies which are primarily owned by them and so contribute towards improving their efficiency and the services of more environmental friendly forms of transport.

Within the debate on the use of information and communications technologies in the transport sector, there is a repeated call or desire to integrate all these forms of transport and link them intelligently. Information and communication technologies can reduce or eliminate the system drawbacks of so-called broken journeys through improved provision of information. However, as the organisational structures for intermodal journeys or an integrated global transport system are still in their infancy, there is a danger that the development and application of new technologies will not be adequately intermodal. To prevent this, the organisation of data management covering all forms of transport should be the first step.

The technical possibilities of the new information and communication technologies would make it possible to implement new traffic management strategies which also make feasible new instruments to relieve the transport system and shift road traffic to environmentally sounder forms of transport. The implementation potential of traffic management strategies is closely linked with the intended intensity of guidance. While solely information-oriented strategies must be regarded as largely politically feasible, the feasibility of systems involving intervention for management purposes must be regarded as considerably more

problematic. Studies concluding that the existing interest groups and institutional conditions in cooperative federalism together with the high degree of fragmentation of responsibilities in the Federal Republic of Germany constrain the problem-solving capacity of traffic telematics systems, although they fail to recognise the possibilities available to the Federal legislature in terms of »exclusive« and »competing« legislation and the adoption of outline regulations.

»PRICING MEASURES IN ROAD TRANSPORT«

The present tax and levy models offer only relatively general and globally applicable instruments of pricing policy. Modern information and communications technologies offer entirely new possibilities for using pricing measures strategically to guide traffic. However, substantial objections are being raised to this. A major objection relates to the efficiency of guidance, particularly in view of the costs associated with the use of these measures. Another objection is the social imbalance of these measures. To reach a better evaluation of the effectiveness of these measures and their consequences for private households, companies and the self-employed, the Deutsche Institut für Wirtschaftsforschung carried out sample calculations on a commission from the TAB for road passenger transport and road freight transport.

Sample calculations for private transport show substantial effects of pricing measures on traffic volume. The underlying pricing scenarios concentrated primarily on the instruments of road use fees and petroleum taxes. Levels were assumed for the fees and taxes in the individual scenarios which differ significantly both from the current situation and from each other, to ensure that the analyses of effectiveness and consequences do not produce quantitative assessments merely of a shaded version of the status quo but of significantly differentiated and different transport policy concepts. It should, however, be expressly noted that the assumptions made to not have the nature of political recommendations for action. The goal of the study was rather to identify the groups particularly affected by such measures and to estimate the degree of impact and possible responses to measures. These analyses could then be used to debate the acceptability and political feasibility of these measures or packages of measures.

The studies on the impact on passenger road traffic of pricing measures show that measures on the lines of those assumed in the price scenarios analysed justify expectations of responses by private households in terms of transport efficiency, shift and avoidance. A central feature of the price scenarios is the announcement effect, intended to enable long-term adjustment of behaviour to changed cir-

cumstances. The measures in the scenarios are to be implemented over a 15-year period in order to have adequate time for these adjustments.

The anticipated adjustments by private households (assumed for the effectiveness of the measures in the price scenarios) consist first of vehicle-related responses, such as buying smaller vehicles or vehicles with new and more economical engines, and traffic-related responses, such as a shift from journeys using cars to journeys using other forms of transport, avoiding journeys, changing destinations and higher vehicle occupancy.

Depending on the scenario, reductions are expected in motorised individual journeys of between 8.8% and 25.6%. The improved vehicle occupancy means, however, that the reduction in traffic is only between 5.7% and 17.1%. Calculated reductions in journeys need not be associated with reductions in mobility, given that private households can adjust over the long term to the changed circumstances. A particularly notable feature is the anticipated substantial reduction in fuel consumption by 36.5% to 59.3% and the associated reduction of similar magnitudes in transport-related CO_2 emissions. The most striking reductions are associated with a drastic increase in petroleum tax. For companies and self-employed persons the effects of additional costs are significantly lower than for private households, as in the case of companies in particular car journeys are generally inputs in connection with production and are insignificant within the framework of the production process. There is a serious problem in the case of sharp increases in petroleum tax from the possibility of evasion (filling up in other countries) if one country takes action alone.

If the posited adjustments by private households are made to the extent assumed, the anticipated burdens on private households would be lower than simple extrapolation would initially indicate. The pricing measures assumed for the study lead to an average additional monthly cost of around DEM 50 per household. The costs per vehicle-km rise by c. 20% to 48%, in 1994 values, while total spending on transport rises by 8–12%. The additional cost of car transport due to the assumed pricing measures would lead to additional revenue of over DEM 30 billion a year.

An analysis of the consequences of pricing measures on motorised individual traffic as a function of income shows that these measures have very different effects on the financial situation of households with cars. Around 10% of households with cars (c. 2 million households with c. 5 million household members) would have their mobility significantly restricted by the pricing measures. Around 25% of households with cars would be able to meet the additional costs from their

own funds, although their response to the increases would be relatively strong. For c. 65% of households with cars the pricing measures would have but a little impact on the household financial situation.

In view of these results, a minimum standard of necessary transport for the income groups particularly hard-hit could be ensured by appropriate compensatory measures. The necessary funds should be available from the additional revenue. Such compensatory measures should, however, be focused on providing alternative forms of more attractive public transport in terms of price, time and comfort. The expansion of public transport also has the advantage that it benefits those households that do not have a car. In any case, pricing measures are likely to be accepted only if they maintain and ensure mobility in the long term.

The sample calculations on the effects of pricing measures on road freight transport showed that even very drastic increases of c. 50% in the costs of long-distance road haulage and up to 30% in local road haulage would only reduce truck transport volume by c. 10%. In the case of local road haulage the decrease would be only a few per cent, although this rises for long-distance transport to c. 20%. While the limited alternatives offer little potential for further reduction in traffic in the case of local road haulage, further reductions should be possible in long-distance road haulage if further improvements in the rail services and accompanying measures, such as geographical and temporal bans on driving and bans on overtaking by lorries were implemented.

The main cause of the relatively minor impact of even drastic price increases for road freight transport is the low sensitivity of product prices with respect to changes in transport prices. The shares of road transport costs in the production value of individual industries – even taking into account indirect transport costs – is generally below 5%, with the only notable exception the sector »extraction of construction materials« at c. 11%. The sectoral price effects of the truck transport cost increases studied are accordingly very low overall, with the average increase in prices of goods less than 1%.

The introduction of road usage fees accompanied by steady increases in petroleum tax could offer effective incentives in long-distance road haulage to relieve the burden on the road system and shift from road transport to environmentally sounder forms of transport without significantly increases the prices of goods. The technical facilities required to levy road use fees have been tried, tested and are available. To prevent avoidance through rerouting these fees would have to be introduced on selected Federal highways.

»IMPROVING THE ATTRACTIVENESS OF LOCAL PUBLIC TRANSPORT« OPTION

TAB studies show clearly that well-organised and attractive local public transport can do much to improve the traffic situation in conurbations. Some successful models, such as the transport concept of the city of Zurich, are the result of consistent application of regulatory measures. Local public transport measures become particularly attractive if, as in Zurich, they are linked with new organisational concepts for using individual forms of transport, e.g. car sharing.

The »Karlsruhe model« case study shows that a convincing service policy in local public transport can also succeed. Here, the success resulted from a large number of coordinated measures, such as the integration of all forms of public transport in the Karlsruhe catchment area, the coordination of the timetables of the individual forms of transport as part of coordinated scheduling, a uniform, clear and attractive fare structure, the use of modern vehicles and comprehensive information for the population on the integrated transport system. The involvement of the local and regional authorities in the operating cost shortfall also leads to a favourable reaction in that the public transport system is taken into consideration in local planning and financing. The regulatory and pricing measures taken at about the same time although independently of the introduction of the »Karlsruhe model«, e.g. restrictions on parking and increase in parking fees, have certainly contributed to the effect.

The number of journeys in the local transport corridor studied between Karlsruhe and Bretten rose significantly by 50%, with a total increase of c. 2.5% in the overall number of journeys, while there was a slight decrease in the number of car journeys. A particularly surprising feature was the heavy demand at weekends, which made it necessary to add services. This shows that local public transport can also play a role as an attractive means of transport for the increasingly important leisure sector. However, there was only a limited shift from motorised individual traffic to local public transport. Estimates showed that there were c. 2,000 car journeys per working day that were transferred to local public transport in the corridor, representing a shift of c. 5% in car traffic. More significant than the number of transferred journeys is the impact on traffic – and hence the environment – of the shift achieved in terms of the journeys or traffic shifted to local public transport. Overall, just under 10% of the total traffic in the corridor of c. 460,000 car-km/day was shifted from motorised individual traffic to local public transport.. This is due particularly to the fact that relatively long journeys were shifted to the urban rail system. Traffic in motorised individual transport fell from c. 570,000 to c. 510,000 car-km/day. It also emerged that part of the shift to local public transport was at the expense of pedestrian and cyclist traffic.

However, attractive local transport concepts also induce additional traffic. The surveys on the reference route showed growth of c. 11%, with over half the new journeys for the purpose of »work and education« (the rest were for leisure and shopping).

The shift achieved from road transport to the local public transport system led to substantial reductions in emissions. Even more substantial is the improvement in immissions in the corridor concerned, as the resulting emissions for electricity generation for the urban rail system are discharged from high power station chimneys and accordingly make a minimal contribution to immissions in areas of human habitation. Substances contributing to carcinogenic hazards such as diesel soot, polycyclic aromatic hydrocarbons and benzene, are generated in comparatively minimal amounts if at all in electricity generation. Another important environmental benefit is that the urban rail system encourages axial growth of settlement, involving less land use and substantially less disruption of landscapes than the dispersed settlement pattern encouraged by motorised individual transport.

The »Karlsruhe model« is also successful in terms of covering costs, meeting over 80% of the operating costs of local public transport – an above-average performance. The shortfall per passenger is only around one-third of the average shortfall for public transport corporations. However, a special role in this was played by the fact that operators do not pay the permanent way fee charged by Deutsche Bahn AG for the route but have leased the entire route, which involves significantly more favourable costs.

This case study offers a range of suggestions for improving the political and legal framework for securing the long-term existence of attractive local public transport models.

> Taking into account the needs of development favouring local public transport in zoning through amendments to the Building Code BauGB.
> Compulsion to comply with prevailing local transport plans in zoning through amendments to the Building Code BauGB.
> Greater consideration of motorised individual traffic in local public transport plans, or creating a global transport plan as an institutionalised instrument.
> Increased force for local public transport planning in terms of overall master-planning.
> Uniform regulations for drawing up local public transport plans for regions with integrated transport systems extending across Land boundaries.

> Improving control of consistency and absence of conflict in goals of various plans at higher planning levels.

The options developed by the TAB are primarily oriented towards (different) »initiative« measures which can be expected to have a direct impact on transport and a direct influence on transport-related decisions by corporations and individuals in terms of their goals. As the measures studied – in line with the initial assumptions of the study – involve neither constraints on mobility nor significant reductions in the current normal standard of travelling or transport quality, flanking measures must also be taken into account in addition to the initiative measures in order to ensure mobility and preserve it in the long term. This means e. g. that the use of pricing measures to influence individual decisions in terms of shifting from road transport to environmentally sounder forms of transport must always be accompanied by measures to secure mobility, such as expanding and enhancing the appeal of local public transport systems.

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Büro für Technikfolgen-Abschätzung
beim Deutschen Bundestag
Neue Schönhauser Str. 10 · 10178 Berlin
Telefon: 0 30 / 28 49 10
Telefax: 0 30 / 28 49 11 19
e-mail: buero@tab.fzk.de
Internet: www.tab.fzk.de