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Preface.

Mobility is basic need of mankind, a necessity for the economy desired by society and providing a key to our future.

Precisely this is why the BMW Group for many years has been supporting efforts to secure mobility for the future as a whole. This means assuming responsibility where we are not directly responsible for the consequences of our activities as a car maker, but can nevertheless, through our skills, provide answers for the complex system of transportation.

Mobility in a modern society is always a compromise between different, in some cases contradictory, interests and demands. Joining forces with other parties in the government, in economy and society, the BMW Group seeks to provide a common concept and development of mobility. The BMW Group's commitment to Cooperative Traffic Management – particularly in the Munich region, but also beyond – for example, now looks back at a long tradition.

And to secure mobility the BMW Group, in its own area, focuses both on current issues of mobility involving transport and the environment as well as research issues looking at how mobility will develop in future.

As a car maker the BMW Group has a vital interest in maintaining mobility also in future. The development of sustainable mobility is therefore a key element of the BMW Group's corporate strategy, since proper maintenance of the environment is just as essential to the prosperity of society. The BMW Group willingly faces this responsibility to society also through the development of hydrogen drive serving to preserve resources and reduce emissions to a minimum.

Despite all their diversity and different aspects, the activities pursued by the BMW Group ultimately have one objective: To make sure that mobility remains a driving force for growth and development also in future – and that sheer driving pleasure is maintained also from the perspective of sustainability.

**Dr Burkhard Göschel, Member of the Board of BMW AG,
Development and Purchasing.**



The present Press Release provides an overview of the areas where the BMW Group's traffic and vehicle researchers are already active today, seeking to provide mobility solutions for tomorrow. In this context we see mobility not just as the ability to move people and goods from their point of origin to their destination, but also as an individual pleasure, as personal enjoyment in life.

Research projects and studies considering both aspects of flowing and stationary traffic and issues involving various means of transport such as road and rail transport provide answers and help to develop solutions. Intermodal aspects are of great significance in this context.

Working on numerous specific projects such as MOBINET or INVENT, the BMW Group's transport and vehicle researchers, in some cases cooperating with colleagues from other companies, have developed applications able to free traffic of its existing restraints, whilst nevertheless keeping the significantly greater volume of traffic flowing smoothly and fluidly on the road. The range of innovations in technology used for this purpose extends from multi-media information services giving the individual traveller useful information all the way to highly complex traffic guidance systems bringing us very close to the vision of uncongested motoring. And in this context the ability to network the vehicle with the traffic system is a very important aspect.

The focus, of course, is not just on road traffic, but rather on intermodal solutions networking and optimising mobility on land (road/rail), on water and in the air. This calls for interdisciplinary research pointing towards the future development of mobility and the typical behaviour of mankind in keeping mobile. This research is carried out by the Institute of Mobility Research established by BMW, with independent, non-partisan scientists and representatives of other providers of mobility such as Lufthansa German Airlines and German Railways working together.

Christoph Huss, BMW Group, Head of Scientific and Transport Policy.

Mobility – an Eternal Challenge.

Looking at evolution and the history of mankind, we quickly realise that mobility has always been crucial to the development of life and the human race. Today mobility is a key to the prosperity of modern societies; social sub-systems such as the economy or culture are no longer conceivable without the availability and use of rapid, comprehensive transport facilities. But the use of resources, burdens on the environment and the threat of our infrastructure collapsing with all its negative repercussions on economic growth threaten to restrict our mobility.

The BMW Group, as a Company offering sophisticated, high-quality mobility options, feels a clear commitment to ensure sustainable mobility also in future, thus maintaining the very fabric of society. This includes the development of innovative technologies able to optimise transport as well as new drive systems based on regenerating forms of energy. With its commitment to Mobility of the Future, the BMW Group focuses on cooperation with other companies and with the authorities. This, quite simply, is due to the fact that we need a broad consensus in order to successfully meet the challenges of the future.

Between No Limits and a Complete Standstill.

The ability to transport goods and products today is just as important as the ability to produce or process such merchandise in the first place. Distribution as the fourth production factor is therefore given the same significance as money, labour and land, the classical factors in production. Today, mobility is essential to the individual and is also an asset he enjoys in life. Each year the average German covers more than 10,000 kilometres – on foot, on his bicycle, in his car, in the air or by ship. Clearly, this is a long distance: once round the world every four years. And we spend more and more of our leisure time away from home, transport an increasing volume of goods and products to the globalised markets, and live in an increasingly complex world due to the many paths we take in this day and age of growing mobility.

At the same time, however, our urge for mobility is ambivalent: Growing mobility is forcing our transport system to the limits of its capacity. The options to expand our transport routes and parking space are limited, the fuel which gives us our mobility – petroleum – is finite. In Germany alone experts estimate that traffic congestion causes an economic loss of at least 100 billion Euro, with motorists spending 13 million hours in congested traffic on our roads day in and day out. Even the most progressive and sophisticated cars cannot set off the inadequate performance and efficiency of our transport infrastructure, bottlenecks in capacity and, as a result, environmental problems being the inevitable consequence.

Sustained Mobility.

Given this situation, the BMW Group has decided to make a contribution to sustained mobility and to the process of re-establishing mobility in the first place. Clearly, it is in the interest of a car maker to ensure individual mobility also in future.

The automobile can only guarantee mobility for the human being, transporting the driver as safely, quickly and conveniently as possible from his place of origin to his destination, if it is able to operate in an appropriate transportation environment, which means both an efficient infrastructure and an efficient process of traffic flow. In seeking to maintain mobility, therefore, one of the highlights of BMW's involvement is in traffic management: Organising transport routes and systems is a key to the optimisation of such systems and their proper operation. The BMW Group's research and development activities in this area cover a wide range, numerous innovations in the areas of traffic data acquisition, traffic information and telematics having been developed, successfully tested and implemented in recent years.

Creative Solutions for Mobility in the Future.

It is not just a question of optimising the performance and efficiency of our road network. Instead, research on new types of mobility, on intermodal solutions, and even on the avoidance of transport plays a significant role.

Looking back now at more than 15 years of transport research, the BMW Group has always sought to involve the cities, the economy and the people in transport projects. Cooperative transport projects of this kind provide a better understanding of different viewpoints and positions, harmonising individual interests and policies. Together with partners from many areas of public administration, science and industry, the BMW Group is looking for answers today to the problems of tomorrow.

One of these questions concerns the fuel which will give us individual mobility in future. Petroleum, the fuel which drives transport today the world over, is not available in infinite supply. Depending on the scenario, the world's reliably recoverable oil resources will last for just a few more decades. To provide a smooth transition to a new source of energy without any social distortion, we must look carefully for appropriate solutions now to become independent of fossil fuel, stretching our resources through the use of alternative energy. The development and introduction of future-proof, environmentally compatible solutions is therefore indispensable. With this in mind, the BMW Group is already working on the development of an alternative form of energy, boosting it to production standard: hydrogen drive. Under the "CleanEnergy" motto, hydrogen-drive BMWs prove that mobility can be maintained at the current level even after the end of the fossil energy age – thanks to the use of hydrogen without any carbon dioxide emissions (the subject of hydrogen is considered in detail on BMW's homepage under www.bmwgroup.com/cleanenergy and in the BMW Group's CleanEnergy Press Pack).

One feature all of BMW's mobility concepts have in common is that they are based in their development on creative and intelligent solutions. The results of BMW research therefore have the potential to benefit all parties concerned: Motorists as well as all other road users, the environment and, last but not least, that proverbial sheer driving pleasure BMW seeks to offer also in future.

Creating Mobility Together: Cooperative Traffic Management.

Common Research, Common Achievements – the BMW Group's Trendsetting Cooperation Project – www.mobinet.de – www.invent-online.de

Transport technology is making progress in many areas where innovative developments contribute to the mobility of tomorrow – improvements ranging from traffic guidance, information and control systems seeking to avoid traffic in the first place all the way to concepts making public short-haul passenger transport more attractive and allowing the development of environmentally-friendly vehicles. But the various solutions and concepts can only be developed, tested and implemented properly if the various players involved interact efficiently with one another.

Precisely this is why Cooperative Traffic Management has been a significant factor within the BMW Group's mobility concepts for more than a decade. The Group's involvement in various project networks enabling the transport researchers in Munich, joining forces with partners among the public authorities, in the economy, science and industry, in search for new solutions helping to solve transport problems, has already paid off today. Numerous projects conducted or supported by the BMW Group in cities such as Munich, Berlin, Regensburg, Dresden or Cologne already serve to improve the transport situation in general.

Setting Out in Inzell.

Understandably, the BMW Group's Cooperative Transport Management concept saw the light of day in the Munich area: Under the motto of "Solving Transport Problems Together", the Inzell Initiative was established in 1995 by the BMW Group and the Bavarian State Capital of Munich, seeking to work together in developing solutions for transport in the Munich area. Since then, proceeding from the highlights of the 1995 Inzell Conference, numerous traffic projects of all kinds have been implemented in the meantime ranging from general considerations on regional settlement through the pragmatic establishment of a so-called preferred network ("Red Routes") all the way to very unconventional concepts in providing parking space.

Among the policies applied to improve the parking space situation the "Blue Zone" project in Munich took on great significance. The objective of this pilot project was, by reducing the number and frequency of road signs, to improve overall clarity on the road and at the same time make road users more aware of their responsibility. Instead of a great many signs banning this or that, parking areas were marked by blue dots. Advance and follow-up studies of traffic conditions accompanying the project showed that the number of vehicles parked illegally decreased considerably in the process, just as the number of traffic offences with motorists not drawing a parking ticket or exceeding their parking time went down accordingly. In the light of these positive results, the "Blue Zone" project is to be expanded to almost the entire old city of Munich in the course of 2002.



The success of Cooperative Traffic Management speaks for itself, also beyond the borders of Germany. Accordingly, Christian Ude, the Lord Mayor of Munich, states in the report on the 4th Plenary Workshop of the Inzell Initiative that "the efforts made by the State Capital of Munich for a transport management system encompassing all providers of transport have won us the Mobility Award 2000 in Paris. The City owes this success to the constructive work done within the Inzell Initiative and Cooperative Traffic Management, where BMW has always been a major driving force in our cooperation."

MOBINET.

Forming part of the "Mobility in Agglomerations 1998–2003" initiative conducted by the Federal Ministry of Education and Research, the MOBINET project studies transport in densely populated areas. Within this project, 26 partners representing the public administration, public transport, industry, small and medium-sized companies, as well as science and research cooperate on an interdisciplinary, interdivisional basis with the support of the Federal Ministry. The focus is on developing solutions for appropriate interaction of individual transport and public transport. MOBINET therefore takes an intermodal approach in its research activities, networking and optimising various providers of transport and transport systems (www.mobinet.de).

The key to optimum interaction of all transport providers from motorised individual transport through public short-haul transport all the way to cyclists and pedestrians lies in the implementation of an overriding system of transport management. This requires a network of systems based on the exchange and interaction of data – and precisely this kind of service is offered by the MOBINET Centre with its strategic

orientation co-developed by the BMW Group. The development and implementation of the MOBINET Centre, the heart of the entire project, is indeed one out of a total of five areas of activity in this context. In the other areas the partners in cooperation focus on a wide range of issues extending from a shift in transport from individual to public providers, the optimisation of transport on main roads and the development of multi-media information services all the way to complete concepts for reducing the volume of transport.

Another activity is to evaluate the project and its results in the course of time. This evaluation and summary will indeed provide the input for deciding which MOBINET results and products are to be expanded and enhanced in the Munich city and region in future. The substantial thrust behind the project is now becoming reality step-by-step: The Munich Parking Space Management System started operation in 2001, tests along the "Red Routes", that is the network of main roads, and the establishment of a Transport Control Centre will follow in early 2003. The components of Cooperative Traffic Management developed and implemented in the context of MOBINET are therefore being integrated in an ongoing process into transport management in and around Munich.

The INVENT Research Initiative.

A study by ADAC, Germany's largest motoring club, shows that most traffic jams are caused by an accident (33 percent) or by excessive traffic volume (32 per cent). This is why in 2001 no less than 23 companies in the automotive, supplier, electronics and IT industry, as well as software providers and research institutes, joined forces to establish the INVENT Research initiative. Standing for "Intelligenter Verkehr und Nutzergerechte Technik" or "Intelligent Transport and User-Oriented Technology", INVENT seeks to determine ways and means of reducing traffic congestion and avoiding accidents (www.invent-online.de).

The INVENT Research Initiative to which the BMW Group makes a major contribution takes up the experience gained in former projects such as PROMETHEUS and MoTiV and tackles the problem from two directions: First, the focus is on the vehicle itself, seeking to develop systems which help the driver in difficult traffic situations to respond properly. This enhances traffic safety and avoids accidents. Second, the focus is on traffic as such, providing the right conditions for more efficient use of the existing infrastructure and the enhancement of road network performance. INVENT is therefore made up of three major projects: Driver Assistance, Active Safety, Transport Management 2010 and Management in Transport and Logistics within which the individual

companies focus on specific issues, depending on their particular know-how and expertise.

Within the INVENT Initiative the BMW Group is involved in the two Transport Management 2010 and Driver Assistance, Active Safety projects and is able to apply its technical expertise and years of experience in promoting the development of transport technology and driver assistance systems. Under the guidance of the BMW Group, a number of car makers and research institutes joined forces back in the '90s within the MoTiV Research Project, making a significant contribution to the introduction of enhanced driver assistance systems, some of which have already entered series production. The ACC Active Cruise Control vehicle distance assistant already available as an option in the 7 Series is an example of this positive spillover effect. Now, in the context of the Driver Assistance, Active Safety INVENT Project, the objective is to use an improved system of sensors for a new generation of assistance systems, with the focus currently on developing a traffic congestion and road junction assistant.

A number of other driver assistance systems such as the active gas pedal, the active steering wheel and Adaptive Light Control come under the general heading of ConnectedDrive. This is BMW's future-oriented concept seeking to network the driver, the vehicle and the surrounding situation on the road by interconnecting and supplementing the telematics, online service and driver assistance systems so far operating independently of one another (for further information on ConnectedDrive, see www.connecteddrive.com and, in the BMW Group ScienceClub, www.bmwgroup.com/scienceclub).

Within the four years of the INVENT Project, the partners in cooperation and the German government will be investing 76 million Euro in the development and testing of improved driver assistance systems, new navigation systems and new information technologies. The German Federal Ministry of Education and Research holds a share of 45 per cent in the project. Cooperation of all leading players in science, the economy and politics within the INVENT Initiative allows efficient use of synergies in individual areas, a consistent process of research on transport and transport safety serving not least to strengthen the competitive edge of German industry.

MobiControl.

The BMW Group plays an active role in Cooperative Transport Management also in Cologne. Within the MobiControl Project initiated in 1997, BMW Group vehicle researchers, together with the City and

University of Cologne, have developed a concept for the mobile dissolution of traffic jams in the inner city. A lot of traffic congestion in these areas is due to the fact that vehicles stopping or parked illegally obstruct the smooth flow of traffic. This in turn is because the areas actually reserved for loading and unloading are occupied by other vehicles again parked illegally.

A concept for mobile dissolution of such traffic jams has been tested over a period of 12 months on a 13-kilometre-long test route extending through the most congestion-prone main roads in the inner city of Cologne. A representative of the Public Order Authority, riding a motorcycle, had the job to keep traffic moving wherever the road was blocked and to keep loading areas free for their actual purpose. The evaluation of test results proves that this mobile anti-congestion service significantly improves traffic conditions in and around loading areas, with both the number and duration of incidents decreasing in the period covered by about 20 per cent.

Making traffic more fluid and improving the general flow of vehicles in this way, the City of Cologne has reaped both ecological and economic benefits. Now, the positive cost:benefit analysis in economic terms (travel times 28,000 hours shorter, 40,000 litres less fuel and 100 tonnes less CO₂ a year on the routes included in the study) can be further developed into a highly effective instrument of traffic management in the inner city.

Effective Transport – More Parking Space: Solutions for Stationary Traffic.

Making Better Use of Parking Space – Providing Early Information on Parking Capacities – www.parkinfo.com – Optimising P+R Systems. All kinds of demands and users vie for the “right” use of the transport infrastructure in agglomerated areas: Residents, business travellers, visitors, service providers, suppliers and people employed in the area – they all make different demands of urban transport. Often, however, such demands for mobility clash with the objective to maintain quality of life in an urban area which inevitably decreases with every increase in traffic. These conflicts of interest have to be solved without the mobility of citizens or the quality of the local economy suffering in any way.

The BMW Group has developed various concepts and action plans for this purpose and has participated in projects seeking to solve the transport conflicts encountered specifically in such densely populated areas. The focus in all cases is on both moving and stationary traffic, the latter also requiring adequate consideration from the perspective of our transport policy, since the process of parking always marks the beginning and the end of every trip we take in our cars. Any shortage of parking space, in turn, leads to an increase in traffic with more motorists looking for a parking opportunity, and any increase in traffic in general in densely populated areas inevitably has an adverse effect on mobility.

Parking Space Management.

In many urban centres and residential areas demand for parking space is greater than the supply available. Improved parking space management can make more effective use of the public parking space available and thus meet the varying demands competing with one another.

In the context of the MOBINET Traffic Initiative the BMW Group, cooperating with a number of partners in this Consortium, has developed a parking space management concept for various parts of Munich, taking the following features into account for areas and time slots defined in advance:

- Preferred parking for residents
- Restriction of parking periods

- Parking fees
- Delivery areas

This concept has been applied in the Munich-Lehel and Munich-Schwabing districts since June and, respectively, October 2001, with results being documented and recorded. And in both districts, the pilot project proves that the concept works: Parking management reduces the number of long-term parkers by almost one-half, parking space becoming available in this way being placed at the disposal of other users. With the overall utilisation of parking space being reduced in this case by 20 per cent, it is now much easier to find parking space than before. A further point is that illegal parking is down to less than five per cent, the degree of traffic obstruction being reduced accordingly. This, in turn, not only reduces the number of motorists looking for parking space and gives both residents and visitors a more attractive environment, but also improves conditions for commercial transport and, quite generally, for visitors coming to the area.

parkinfo.com – BMW Parking Information.

Receiving information in good time not only on free parking space, but also on prices, opening hours, the best way to reach parking space as well as alternative parking opportunities, motorists become more efficient in their search for parking facilities and the amount of traffic looking for parking space in agglomerated areas is reduced accordingly. The volume of such traffic in search of parking space may amount to 40 or even 60 per cent of the overall traffic volume – and in extreme cases such as on late shopping Saturdays before Christmas, the number of motorists looking for parking space may even account for up to 80 per cent of the total traffic volume.

Introducing parkinfo.com, the BMW Group has developed the first nationwide parking information system in Germany allowing the user to retrieve parking information on 2,200 car parks in 84 German cities online over the internet. This information on approximately 650,000 parking spaces including the 20 major airports in Germany supplements information already available concerning, for example, the location of car parks and their access routes (also with the help of 4,500 photos), the number of parking spaces per car park and, in some cases, current parking occupancy. This information is further supplemented by Park-and-Ride facilities within Germany's major transport networks (already implemented in the Berlin Region with integrated timetable and routing functions), making it easier to plan one's transition to public transport. This parking information is already available today as a mobile internet service in the new BMW 7 Series. In particular, this mobile service covers

the current occupancy of parking space in 18 cities with a total of 300 car parks linked to park guidance systems. Further development of the parking information system will enlarge the volume and scope of parking information and improve quality accordingly.

parkinfo.com is based on a highly efficient relational database comprising all relevant information on parking facilities in the cities involved. The system makes this data directly available to the end user able to retrieve the data he requires over the internet (<http://www.parkinfo.com>), by means of a WAP mobile phone (<http://wap.parkinfo.com>), by a palm or a compatible organiser, and in his BMW via BMW Online. The internet user is furthermore able to consciously restrict the search process by specifying the time slot in which he requires parking space, the minimum clearance height within the car park, or the maximum rate he wishes to pay for the first hour. The "Interesting Highlights" option covering sights, shopping centres, railway stations or local parks is a very helpful and pleasant facility above all for strangers in town.

Individual car parks and car park guidance centres may also be connected to the BMW Parking Information System, provided they present the current number of free parking spaces in a service management computer. In the case of individual car parks, this information is communicated and transmitted by a parking data transmitter (PDT) developed by BMW and by SMS, whilst car park guidance centres transmit standardised datasets by e-mail.

Park-and-Ride (P+R).

Thousands of commuters cover the route from their home to their job in an agglomerated area in their private cars day in and day out, trying in the process to drive into town as far as they can. As we all know, this means traffic jams on roads leading into town and parking problems in the inner city. To reduce the volume of traffic in downtown areas, the BMW Group has developed P+R concepts in the context of various projects, offering commuters an attractive alternative and supplementing the use of their private car. This promotes the intermodal networking of various means of transport: With its undeniable flexibility, the automobile offers significant advantages in large, open areas and in the transportation of goods which public short-haul passenger transport is not able to provide (and which, in particular, could not be financed in the first place). On the other hand, public short-haul passenger transport is able to convey a large number of people within very confined space on the main transport routes, thus contributing to the efficient use of resources in the inner city, where there is a great shortage of space.

Now, taking two projects as examples, the objectives and structure of the P+R solutions developed by the BMW Group should be considered in greater detail.

Park-and-Ride in the Dresden/Upper Elbe Valley Transport Area.
The objective in this project initiated in 1994 by the State Capital of Dresden and the BMW Group was to develop an effective, clearly recognisable P+R system. After determining and choosing potential P+R locations and determining the user potential, the next step in this specific case was to choose the locations for implementing the concept by the year 2004. In this context a new approach was taken in determining the potentials, in providing traffic guidance signs, and in giving P+R car parks a high level of convenience.

Park-and-Ride in the Greater Munich Area.
The Park-and-Ride project initiated as part of the MOBINET concept seeks not only to promote the introduction of P+R facilities, but also to test new price calculation models. Since August 2000 the effect of price hikes on the use of P+R facilities has been tested in seven demonstrator units to the north and south-west of Munich. The simple concept is that the price for parking your car increases the closer the P+R facilities are to the middle of town. The tests have shown that about twelve per cent of commuters switch over to public transport at an earlier point than before as a result of this price scale, choosing P+R facilities closer to their place of residence. This shortens the distance they cover in their own car to the benefit of public transport.

Well Informed on the Road: Multi-Media Information Services.

Personal Travel Assistance (PTA) – Intermodal Route Planning from Door to Door – www.bayerninfo.de – www.funinfo.de Mobility involves two aspects: the physical driving force for motion and the ability to control the process of moving from one point to another.

Many transport problems result from the fact that we are unable to use this control option properly – for example if road users are informed only inadequately or not at all of traffic-related problems or if they fail to choose the right means of transport for their trip. Researchers realised quite early on that the process of choosing the means of transport, the route taken and the time of setting out can be influenced by giving people the right information before they leave on a journey. A system offering such data would have to reach several objectives in one and the same process: The traveller should be able to plan and organise his trip individually as he requires, but at the same time the choice made should take the burden off the transport system and make optimum use of the infrastructure available.

Conducting a number of projects together with partners in industry and science, the BMW Group has compiled the technical parameters for implementing these visions and enabling the information age to successfully enter the mobility market. All of these activities are based on the technical and organisational concept of individualised, automated travel planning. The term coined by the BMW Group for this concept is Personal Travel Assistance or PTA for short.

Personal Travel Assistance (PTA).

A number of factors make it – unnecessarily – difficult to plan a journey: Using different means of transport, for example, makes the planning process far more complicated, since the traveller has to consult various sources of information such as timetables and route connections. This is the only way to choose the right sequence of points for changing from one means of transport to another, particularly on a long journey.



With an increasing volume of traffic on the road, planning the right route at the right time becomes more difficult, since the traveller has to know current traffic conditions in order to choose his route and calculate the time he will require for his journey. A further difficulty is that the traveller will have to allow for both time and money in looking for parking space, particularly in a densely populated area. This is why the BMW Group makes the following demands of such a concept of Personal Travel Assistance or Mobility Planning, as it may also be called:

- Access to information at any point and any time.
- Automatic compilation of travel itineraries, taking all means of transport in a multimodal travel plan into account.
- Travel planning specifying the travel time and cost involved.
- Observation of probable interference factors several days in advance.
- Early notification of possible interference en route.
- Personalised service taking the user's typical behaviour into account.
- Exchange of travel data using systems integrated in the vehicle.

To implement this vision of a personal, electronic "travel agency", system architectures, processes and functional components had to be newly developed from the ground up in order to establish a PTA service. Then the idea was implemented in field tests and prototype demonstrations in a number of national and international projects such as Bayerninfo, MoTiV-PTA, Infoten and MOBINET.

BayernInfo.

The BayernInfo Project initiated in 1995 as part of the Bayern Online Research Initiative and run by the Supreme Building Authority in the Free State of Bavaria was intended to provide the foundation and test environment for all ensuing projects. Joining forces with a number of partners, the BMW Group developed an up-to-date transport database users are able to reach through various modern communication media such as the internet (www.bayerninfo.de), mobile radio or videotext using a PC, mobile terminals and public touchscreen information displays.

This can only be done on the basis of an interregional traffic information system made up of a state-wide Traffic Information Centre and two Information Centres for the Munich and Nuremburg areas. These Centres compile the data on road traffic and public traffic, processing the information received and transmitting it to information services. The Centres thus take on the task of dynamic traffic analysis and forecasting, and provide up-to-date transport status reports as well as timetable

**inquiries for transport users throughout
the whole of Bavaria.**

Bayerninfo also pursues a number of other objectives: The Electronic Timetable Inquiries (EFA) system has been enlarged to provide an up-to-date inquiry service on public transport throughout Bavaria. Small portable mobility planners have furthermore been developed within the project, using mobile radio to access a PTA service then providing dynamic access to travel information prior to and during the journey.

Applying the same philosophy as the Bayerninfo project, the Infoten project provides a comprehensive database in particular for long-distance transport systems such as the railways and the aircraft also on an European level. In 1996 partners from Switzerland, Austria, Northern Italy and Bavaria got together to expand the PTA route planner in the Alpine region, including Europe-wide railway and airline timetables in the PTA service. Particularly such cooperation on an international level requires standardisation in the establishment and networking of individual databases.

MoTiV.

Proceeding from the foundation established, inter alia, by Bayerninfo, this research initiative launched by the BMW Group in 1995 together with partners in German industry and the economy in general seeks to develop new information technologies. The focus in this case is on the personalisation of travel information: As a function of his personal preferences, the user should be able to filter his ideal travel route out of the mass of all travel routes available with various means of transport.

The MoTiV-PTA project thus focuses on two objectives in particular:

- First, to develop a service with all the features and functions of an electronic agent, supporting the traveller in planning his route. Via a communication platform, this software or travel agent automatically "talks" to appropriate service providers, offering the traveller several options tailored to his requirements. In the interest of intermodal route planning, the options proposed consider not only the traveller's starting point and destination, but also optimised changing points for the transition from one means of transport to another.
- Second, to achieve a high standard of vehicle integration allowing the transmission of mobility information into and out of the car. This enables the user to transmit route data from the internet straight into his navigation system, infra-red transmission also serving to transmit data such as map cutouts from the car into portable terminals.

While the project showed that these concepts are quite feasible and can be implemented in practice, a problem was the lack of large-area service structures and basic data expensive to establish and maintain. It also became obvious that agent technology as such is certainly of interest for the future, but is not yet suitable for route planning due to the dependence on service providers and a lack of price transparency.

Multi-Media Information Services in the MOBINET Network.

The objective of the "Mobility in Agglomerated Areas 1998–2003" contest for ideas initiated in 1998 by the German Federal Ministry of Education and Research and the MOBINET Project was to ensure sustained mobility and significantly reduce the undesired effects of transport. Joining forces with various partners in research, the BMW Group started from the current status of cooperation and, taking an integrated approach, developed new strategies and solutions for a future-oriented transport system. Particular attention is given in this context to the ongoing development of Personal Travel Assistance, making allowance for progress in information technology and the use of terminals.

The second main issue is to establish an additional database in order to cater even more comprehensively for the transport user's need for mobility by providing a more effective multi-media information service. The overall scope of this new system will be demonstrated in 2003.

Fun-Info.

Leisure-time traffic in and around Munich causes considerable congestion on the road network virtually every weekend. The Fun-Info (www.funinfo.de) MOBINET project links mobility-related information on transport, tourism and environmental matters in both the Greater Munich Area and in adjacent leisure-time regions, allowing travellers to optimise their route planning in the process. Presenting attractive alternatives to the use of the automobile, Fun-Info exerts a significant, positive influence on the demand for transport and takes the burden off the transport network around Munich and in the direction of local leisure-time regions.

Proceeding from an analysis of mobility requirements in the Munich region, the BMW Group, in cooperation with various partners, has developed an intelligent data processing system allowing dynamic supervision of traffic and the weather. Information providers transmit this information to travellers by means of various terminals such as PCs, portable terminals or mobile phones.

Park-Info.

The Park-Info project closes an information gap in the PTA travel planning system showing the user where, when and at what cost he can park his car in the Greater Munich area. This information is intended to reduce the number of motorists looking for parking space and, at the same time, to promote the use of public transport in town by presenting convenient P+R options. Within the overall context of the MOBINET system, the BMW Group has for the first time developed a process which, based on calendar dates, current events and the weather forecast, provides a reliable transport forecast over a period of several days. Apart from the occupancy of car parks, the system also for the first time considers the availability of roadside parking space, since the PTA service requires all parking-related data to properly present the options for reaching a specific destination in Munich.

Urban-Info.

With service and leisure time options becoming increasingly popular and plentiful, the City of Munich itself, the surrounding areas and the Lower Alps nearby are becoming increasingly attractive destinations. With the population using these options, the "downside" is that there is more traffic in and around Munich. The partners cooperating within the MOBINET project are therefore developing the internet-based, user-friendly Urban-Info added-value service. Using PTA functions, Urban-Info provides mobility advice which, in addition to features already available (such as a list of hotels, restaurants and museums as well as a calendar of events), provides comprehensive information on how to reach the various options available. As an example, Urban-Info offers information on how the user can make his way most conveniently to a specific theatre or sports event. At the same time it offers the user public transport as an attractive alternative to his private vehicle, taking the burden off the transport network accordingly. And in the event of particular incidents such as the breakdown of an underground train line, this information is also provided to the user in a dynamic, consistently updated process.

All of these projects prove impressively that the visions and ideas of BMW's researchers in the area of multi-media information services are quite feasible in technical terms. The Bayerninfo project concluded in June 2000 created the technical foundation for the projects to follow, MoTiV providing the technologies for implementing the PTA service. It is also true, however, that the research carried out reached certain limits to its implementation: Whilst the terminals required are already available, there is still a lack of service structures and basic data required

nationwide for commercial implementation of the concept. A further necessity is to develop a business model determining and standardising the options for cooperating with various service providers. Development of such a model will take 2–5 years.

Mobility without Moving.

**Flexibility on the Job – More Freedom for the Employee –
Less Traffic in the Inner City – Telework and the Shopping Box as
Innovative Mobility Concepts.**

Mobility is far more than “just” moving from A to B – rather, mobility is also an intellectual phenomenon: Mobility starts in our heads and promotes a feature acknowledged as the decisive factor for success in global competition – flexibility.

Flexible through Telework.

Using a large number of innovative working time concepts and applying flexible working time solutions, the BMW Group has for years opened up new dimensions in flexibility in terms of both space and time for the Company and its associates – particularly through a process of consistently testing and using numerous options in teleworking.

On the occasion of the Bayern Online initiative, the BMW Group launched the TWIST (Teleworking in Flexible Structures) project in cooperation with the Bavarian State Government back in October 1995, seeking in the process to establish 300 telejobs in the Munich area by the end of 1997. When the project ended in December 1999, the BMW Group had indeed established no less than 610 telejobs, more than twice as many as originally planned. Today some 1,800 BMW associates – more than 50 percent thereof in Development, at the Technical Centre and in Production – use the opportunity to telework from their home. Each year telework within the BMW Group alone currently saves some ten million kilometres of travel between the associates' homes and their jobs at work. This alone, together with the option to use off-peak travel times more efficiently, reduces CO₂ emissions by approximately 2,600 tonnes a year.

The experience gained in this process is definitely positive for both the Company and the associates alike, as an inquiry conducted at the end of this pilot project clearly revealed. Originally one-quarter of the respondents had anticipated a negative effect on their career, but this, as they confirm themselves, has not happened. Instead, teleworkers enjoy the opportunity to structure their lives according to their own

wishes and preferences, the high standard of personal flexibility provided by teleworking, with the individuals

involved deciding themselves on their working hours and leisure time, and the time gained by no longer having to travel to work, eliminating the usual strict dividing line between family and professional life. Companies, in turn, benefit from associates more motivated in their attitude and more productive in their work.



Telework also offers benefits for society and the environment. Particularly daily commuter traffic between residential areas in the suburbs and offices or other workplaces in town increase the traffic burden in densely populated areas. Even the transition from private to public transport alone is not sufficient to consistently reduce this significant load. The telework concept, however, solves this problem by taking effect before traffic is even generated in the first place. Telework reduces the volume of professional commuter traffic and helps to protect the environment by shifting at least part of the workload from the office to the home.

Demand for further telejobs among associates and managers is undaunted and the many advantages of telework are fully acknowledged by all parties involved. With flexibility and mobility playing an even more significant role in our world of labour in future, the BMW Group will continue to consistently use the many benefits of telework.

The Shopping Box for Fewer Shoppers on the Road.

Particularly in agglomerated areas such as Munich, deliveries on the "last mile" to the customer cause ever-increasing congestion problems within the regional road network. Private shoppers in their cars looking for parking space, in turn, represent an additional traffic burden particularly for the inner city traffic network. Within the MOBINET cooperation project the BMW Group has therefore joined forces with its partners to develop the Shopping Box concept taking the burden off the road system and maintaining mobility in the process. As a result, shoppers no longer have to go shopping at the end of a – long – day at work, an experience which is not very pleasant, anyway. The Shopping Box entered a two-year test phase with the BMW Group Research and Innovation Centre in Munich on 1 June 2001.

This "Box" is a merchandise transfer system for services and goods in daily demand, saving the employees of large companies time and hassle in organising their daily shopping requirements: The employee orders

the products and services he requires, for example groceries or a cleaning service, conveniently over the telephone, by fax or through the internet. The merchandise ordered is then delivered directly to a computer-aided locker system on the premises of the company involved, where either the employee himself or an external customer can pick up the deliveries any time he likes. And depending on the products involved, there are deep-freeze, cooled, uncooled and special lockers, the latter, say, for clothes coming from the cleaner.

Payment is made by debitting the customer's account. Benefitting from this system, the employee can take care of his shopping without having to leave the company and without having to take delivery of the merchandise at a specific time or date.

The Vision of Uncongested Motoring: Intelligent Transport Solutions with Telematics.

Enhanced Methods for the Acquisition of Traffic Data –

Management of Traffic Guidance Systems –

Up-to-Date Traffic Information – Dynamic Routing –

www.invent-online.de – www.stadtinfoekoeln.de

The consistent increase in motorisation in Germany is a clear sign of prosperity and quality of life – with almost 50 million vehicles moving on German roads today. But at the same time this high degree of mobility takes its toll in terms of traffic congestion, accidents and breakdowns. In the year 2001 alone there were almost 2.4 million traffic accidents in Germany, approximately 380,000 thereof involving bodily injury. A further point is that traffic jams and congestion cost German motorists many hours of their time and cost the German economy a lot of money day in and day out.

To solve these traffic problems we need good solutions soon – future-proof solutions based on the following cornerstones:

- Immediate availability of the latest traffic information.
- Traffic guidance taking the current traffic situation into account.
- Rapid assistance in the event of breakdowns and emergencies.
- Up-to-date additional information to improve the quality of mobility.

The key lies in a combination of telecommunications and informatics – that is telematics. To ensure intelligent traffic management, the BMW Group has developed the BMW Assist and the BMW Online telematics applications comprising the following services:

- Emergency call.

An emergency call is activated after an accident either manually or automatically by the crash sensor. This guides the rescue service directly to the vehicle involved.

- Traffic info.

Using 4,000 traffic congestion sensors and many further sources of data, this service provides the latest information on traffic conditions both on German Autobahnen and in densely populated areas.

- Inquiry service.

Establishing a link to a call centre, this service offers a



broad range of local

information (local weather reports, parking information, hotels, restaurants, service stations, pharmacies and other points of interest). Simply by pressing a button, the user can download the addresses and telephone numbers of the destinations he has chosen into the navigation system target finder or the car's telephone.

- **Standby service.**

In the event of a breakdown or technical problem, the driver, simply by pressing a button, can inform the nearest BMW service station of the exact location of his car and its chassis number.

- **BMW Info.**

In this case the driver receives important corporate and product news by SMS on his mobile phone or on the screen of his on-board computer.

These BMW Assist services currently available only in Germany can be used in every BMW equipped with a navigation system (and a display) as well as a BMW telephone. These services are indeed an important feature of ConnectedDrive, the BMW Group's future-oriented concept networking the driver, the car and the surroundings (for further information on ConnectedDrive see www.connecteddrive.com or the BMW Group's ConnectedDrive Press Pack).

The BMW Group is developing a number of other telematics solutions in the context of various other projects and joint ventures, focusing on the need to sustain and consistently improve convenience for the driver and, at the same time, safety in road traffic. Extended Floating Car Data (XFCD) is a typical example in this context.

XFCD – the Vehicle Serving as a Mobile Transport and Environmental Sensor.

Within the transport system as a whole, traffic information provided in good time and with the right kind of precision enhances driving safety and comfort for the motorist. But comprehensive, all-inclusive acquisition of traffic data is required for providing the latest information on traffic conditions – and such a system for acquiring traffic data is not yet in place. Both the quality and currency of traffic information services still suffer from geographically limited and incomplete data acquisition, particularly in urban areas. The BMW Group is therefore working on future-oriented data acquisition methods in the area of transport telematics, with the vehicle itself serving as a kind of "floating transmitter" providing the services of a mobile transport and environmental sensor.

Applying this data acquisition concept also referred to as Extended Floating Car Data (XFCD), vehicles consistently collect detailed information on road conditions, the weather and the traffic situation largely from sensors already installed inside the car. The big advantage is that this allows dual use of data already available in many cars today thanks to existing on-board networks and driver assistance systems. This gives the driver the information he requires for support in difficult situations and offers vehicles following from behind an entirely new standard of traffic information. Communication facilities already in use such as the digital GSM mobile network and the GPS satellite system are also used in the process as economically meaningful basic technologies.

The basic XFCD data is processed and refined by means of suitable algorithms, then being transmitted either periodically or as a function of specific events via a mobile communication system to the data server acting as the Traffic Information Centre. Here the data received is checked and compared for plausibility with other vehicle and infrastructural data before being processed and transmitted to motorists as traffic information or a traffic warning.

In a further step, vehicles will be able in future to communicate not just with the control centre, but also directly with one another – just like swarms of birds in the sky able to perform complex manoeuvres together with all the birds “seeing” through each other’s eyes. In future, motorists will benefit from the same advantage, being connected by vehicle-to-vehicle communication and spontaneous ad-hoc communication networks and thus exchanging the latest information in the process.

NIV – Network-Balanced Individual Transport.

Mobility also gives the motorist the freedom to choose the route to his destination in accordance with his personal preferences. Apart from speed, that is how quickly you reach your destination, the reliability of the route chosen, that is when you reach your destination, is gaining greater significance in this context.

Particularly in densely populated areas, motorists choosing their route according to their own criteria often run into traffic obstructions, since the route they thought would be shortest is often congested and full of traffic. For while the driver combines his personal experience with relatively good knowledge of specific conditions such as the weather, the day of the week or special events like, say, a football match nearby, he does not always have the latest information on traffic conditions

along his route. And while researchers are making significant progress, the data currently available in navigation systems is often not sufficiently up-to-date to enable motorists to avoid all traffic jams and congestions.

This is because navigation systems these days are able to give the driver reports on traffic jams and obstructions to the smooth flow of traffic, but are not able to draw any intelligent conclusions from this information for calculating the best route.

Within the INVENT Research Initiative, the BMW Group has joined forces with various partners in the "Netzausgleich Individualverkehr" or "Network-Balanced Individual Transport" (NIV) system, looking for new options in vehicle and communications technology in order to make optimum use of the existing road network and its potentials. Using the latest information and forecasts, navigation systems should be able in future to dynamically guide road users and thus spread out the flow of traffic more efficiently and smoothly throughout the road network available. The main objective with this highly developed and sophisticated routing concept is to harmonise the individual preferences of the user with traffic management strategies pursued by the public authorities.

The fundamental prerequisite for this kind of route planning is an enhanced traffic database. Although many vehicles are already equipped with a navigation system, the traffic data provided on a digital card quickly becomes obsolete. Within the NIV Project, the BMW Group is therefore looking for new options in generating and retrieving traffic data and making traffic forecasts in order to provide the motorist with dynamic information on the current traffic situation. Using highly developed, sophisticated XFCD technologies, we are able to cover traffic data also on secondary roads and federal highways not provided by conventional methods.

After conclusion of the NIV Project in 2005, a navigation terminal based on a broad overview of traffic conditions and a comparison of individual and public transport strategies will be available. This terminal will be demonstrated as a prototype in test cars.

Fuzzy Logic Flow Optimisation.

Particularly on entrance ramps leading into the Autobahn, the concurrence of the two traffic flows from the main route and the entrance ramp may quickly cause turbulence dramatically reducing the capacity of the Autobahn or motorway as such. The result is a gradual slowdown

of traffic ultimately coming to a standstill and forming a traffic jam. To avoid this effect, BMW's traffic researchers have developed a systematic traffic control system focusing specifically on these neuralgic points within the Autobahn network, that is the entrance ramps: Adaptive and Coordinated Control of Entrance Ramps with Fuzzy Logic (ACCEZZ).

ACCEZZ applies the principle of ramp metering, traffic lights serving to "open up" the "door" whenever appropriate and thus limiting the number of incoming vehicles to an acceptable level. The biggest challenge in developing and implementing such systems is to find an appropriate control mechanism serving to dose the flow of incoming traffic in order to provide an optimum merge effect of the two traffic flows forming one consistent flow process.

The new approach for controlling ramp metering systems is based on so-called "soft computing" methods, a fuzzy controller masterminding the traffic lights. Fuzzy logic describes a computer method which, unlike conventional, "sharp" logic, does not define a specific value as merely "yes" or "no". Instead, Fuzzy logic uses terms from human language and thus also applies values which may be "so and so". The first step in the Fuzzy logic process is to "fuzzify" data measured along the road – in other words, such data is described in "human" terms such as "low", "medium" or "high". Then, applying an "if that's the case, then this will happen" algorithm, the data is converted into "hard" control factors. The final step is "defuzzification", with the "uncertainty" within the system being cut back again to one specific factor controlling the duration of the individual traffic lights.

A fundamental aspect of ACCEZZ is that it improves algorithms in a "genetic optimisation algorithm concept". Like in natural evolution, various solutions are subjected to the principles of selection and mutation in an ongoing process not only ensuring "survival of the fittest", but also passing on the fittest features to the next "generation". This adaptive control concept may be applied to the entire road network including problem areas and for specific control functions.

ACCEZZ has already proved its performance impressively in a simulated evaluation test: Simulation of highly congested Friday afternoon traffic on the A9 Autobahn near Munich shows that metering only three entrance ramps with ACCEZZ serves to improve traffic conditions enormously. Both the time of traffic congestion and the length of traffic jams were reduced drastically in this way. Indeed, this intelligent metering concept was able to cut back overall travel times by up to 24

per cent, maximum waiting times at the metered access ramps being just slightly over two minutes.

These impressive results will be followed by a practical test, various versions of ACCEZZ being examined in autumn 2002 within the MOBINET Project conducted by the German Federal Ministry of Education and Research. In this test the algorithms used will be able to prove around the Olympic Grounds Junction on the Mittlerer Ring in Munich that evolution gives us the ability not just to generate traffic, but also to make it more fluid through our know-how and skills.

COMPANION – a Real Helper.

Traffic jams and accidents are often caused by motorists driving at the wrong speed, by adverse weather conditions and, quite simply, by human misconduct. Dedicated to the enhancement of traffic safety, the BMW Group joined forces with RUETZ Traffic Systems and other partners in industry and science in 1996 to create the COMPANION traffic warning system. Using light signals emitted by electronic roadside markers, COMPANION seeks to warn road users in good time and at exactly the right point of possible dangers and critical situations he would otherwise be unable to see (or at least would not see properly).

COMPANION incorporates three components:

- A sensor system compiles data on the flow of traffic on a certain stretch of the Autobahn.
- An incident management system at the Traffic Control Centre evaluates the data received, analysing traffic conditions with the help of predefined algorithms and, as a result, automatically – that is without human intervention – activating an appropriate reaction. The defectdetection software used for this purpose is an in-house development by BMW.
- A warning system, finally, activates the lights in the electronic roadside markers. Both light intensity and the length of the warning period may be varied as required, flashing frequency increasing the closer the driver gets to the danger spot. A further point is that the “warning zone” may move along with the “danger zone” if, say, the end of the traffic jam changes or moves up, the area in which COMPANION is active thus changing accordingly.

The first 9-kilometre-long pilot stretch of the A92 Autobahn between Munich Airport and the Neufahrn Autobahn Junction to the north of Munich entered operation in February 1996. Since 1998 COMPANION

has also been tested near Verona in the north of Italy and near Edinburgh in Scotland as part of a Europe-wide research initiative. In the meantime COMPANION has consistently proven its excellent qualities and safety effects – making drivers reduce their speed and adjust their style of motoring – in all three countries. And while the annual accident figures are still not very meaningful since the automatic traffic impairment function on the A92 Autobahn near Munich only became available at a relatively late point in time, it is very interesting to note that during activation of COMPANION there has – quite unlike general experience – not been one single accident.

The test routes in both Italy and Scotland show very positive results: On the A4 Serenissima near Verona drivers now adjust their behaviour much better particularly in foggy weather, road speeds dropping on average by ten percent on routes monitored by COMPANION. On the Scottish test route near Edinburgh the number of accidents involving bodily injury is down by 38 percent and there have been no severe accidents at all.

COMPANION is most impressive in its practical operation and, thanks to its clear, intuitive effect, has the support of the authorities in both countries. In Italy the decision has already been taken to extend the routes already covered by COMPANION and further extensions are planned in both countries.

Stadtfokoeln.de

Intermodal operation and less traffic congestion – these are the objectives of the stadtfokoeln.de project launched in 1998. Cooperating with a number of partners, BMW has developed an all-round information and service option for collective and individual terminals in the Cologne area, interconnecting the various means of transport. And in the process both existing and newly developed features are combined to form one all-round system.

The major elements of stadtfokoeln:

- Parking information from 35 affiliated car parks with about 30,000 parking spaces as well as, for the first time, online occupancy data covering approximately 3,500 parking spaces along the roadside networked by 145 meters issuing parking permits.
- Reservation of parking space in car parks.
- e-Ticket, the electronic parking ticket for intelligent management of parking space in the suburbs.
- Dynamic routing now available for the first time in urban areas, taking traffic data such as general traffic conditions, construction sites,

weather conditions on the road, diversions, etc into account.

- P+R information including an electronic timetable inquiry function for public transport (PT).
- A consistent, all-inclusive navigation function even routing pedestrians after they have left their cars.
- A comparison of travel times and the cost of travel (IP, PT).
- Utilisation of the entire range of information and other services iBMW research vehicles, using mobile terminals and the internet(www.stadtinfoekoeln.de).

The project therefore encompasses all types of transport, all reasons for using the transport system and the overall traffic scenario both in the city and the surrounding region. Indeed, only this complete coverage incorporating the various sub-systems is able to generate a genuine synergy effect for the overall transport system in the greater Cologne area.

Transport Research – the BMW Group as an Advisor in Matters of Mobility.

**Reliable Data on the Development of Traffic Providing the Input
for Every Forecast – www.ifmo.de – Congestion and Confusion –
Mobility Studies.**

Only very few areas of human life are as controversial and full of emotions as the subject – or we might even say, the phenomenon – of mobility. Meeting various demands for mobility in society often leads to conflicts of interest between politics, the economy, the environment and technology. We therefore need a consistent public debate on the structure and orientation of mobility ensuring a genuine consensus within society.

The BMW Group has been conducting traffic and mobility research for more than 15 years, providing the foundation for this debate, presenting relevant issues and interconnected points in our transport policy, and ensuring greater transparency in our discussions. This expertise makes the BMW Group a truly outstanding car manufacturer not only with the technical know-how for developing useful, environment-oriented technologies and innovations, but also providing a significant initiative in the establishment of a sustained mobility concept. Precisely this is why the BMW Group has not only commissioned a large number of studies, but has also established its own competence centre for all issues in the context of mobility.

Institute of Mobility Research.

The Institute of Mobility Research (ifmo) established in Berlin in 1998 is one of the BMW Group's research initiatives. Researchers at the Institute examine all kinds of mobility phenomena and the various options involved – mobility on water, on land or in the air, mobility under one's own power or with the help of technical functions.

In particular, this research seeks, in cooperation with representatives of science, politics and the economy, to take up issues involving problems still not solved or effects still not clear. These issues are presented in a transparent and straightforward style to the public and placed in their overall context, each issue being considered from an all-round perspective including human, technical and organisational factors. This

may be done in public panel discussions and conferences and in workshops where external experts on mobility focus on a specific issue within a small group of interested parties.

In its work, ifmo is supported by a Board of Trustees comprising independent scientists and representatives of other mobility enterprises such as German Railways or Lufthansa German Airlines. Particular highlights in this context are the intermodality of transport systems as well as the general conditions and parameters affecting national and international mobility. These include interfaces between providers of transport as well as the quality and quantity of the existing infrastructure and the infrastructure required, the cost of individual mobility, and the desired/undesired effects of mobility on society and the environment. The question of sustainability and reasons for the mobility behaviour of both individuals and groups are regarded as general, overriding issues.



The Institute of Mobility Research intentionally maintains only limited in-house research capacities – simply because the large number of research disciplines required to properly deal with the many issues in the area of mobility would exceed the framework of such an institute. Cooperating with renowned external experts also has the advantage of ensuring an absolutely non-partisan focus in dealing with the relevant issues and provides greater independence in the presentation of results.

The research activities conducted by ifmo are intended to establish a regular dialogue with players in the world of mobility, creating greater sensitivity to future developments in society, showing the need for action and improving the foundation for decisions to be taken (for further information, see www.ifmo.de).

Study: Assessment of Losses to the Economy Caused by Road Traffic Congestion.

One of the reasons for the traffic density which we already observe today and which will grow further in future, as well as the traffic problems experienced as a result, is the discrepancy between the mileage covered by the population and the expansion of our transport infrastructure. To offer assistance in choosing among various road routing options by way of a cost:benefit analysis, BMW AG compiled a study in 1997 examining the direct effects of traffic congestion on the economy and at the same time presenting possible action improving the efficiency of the traffic network.

In this study the traffic researchers came to the conclusion that traffic obstruction costs the German economy alone about 4.7 billion hours of working and leisure time each year. Time spent in traffic – that is “lost time” in terms of work not done and transport efficiency reduced to a lower level – therefore adds up to about 100 billion Euro a year as the cost of traffic congestion in Germany, commuter and professional traffic alone, at 32 per cent of the overall mileage covered in passenger cars, accounting for approximately 37 billion Euro. In the study the traffic researchers also presented a wide range of possible countermeasures including coordinated and/or on-demand traffic light control, the elimination of bottlenecks, and the introduction of traffic management systems.

The study shows that passenger cars cover approximately 150 billion kilometres (93 billion miles) a year on German Autobahnen, at an average speed of 95 km/h or 59 mph. The conclusion is that with less traffic congestion, without motorists trying hard to drive faster, average speed would increase to 115 km/h or 71 mph, saving 275 million hours in the process. In consideration of these and many other results, the suggestion was made by the traffic researchers to further improve the infrastructure of our roads and to install traffic guidance systems on Autobahnen and federal highways.

Study: Congestion and Confusion – a Comparison of German Transport Infrastructure with other Countries in Europe.

This study compiled by the BMW Group in 2002 focuses on the entire transport system and its three cornerstones – inland shipping, the railways, and road traffic. Proceeding from the fact that the road infrastructure in Germany is rated below average within the European Union at the time of the study and is continuing to deteriorate due to the lack of investments, the study reveals significant need for action if the German road network is to hold its own in a Europe-wide comparison.

Although road traffic has been the dominating means of transport in Germany for many years, the researchers determined growing deficits in capacity and excessive wear and tear on road surfaces and bridges. Related to transport mileage in the respective countries, Germany's road capacity ranks right at the end in a European comparison. This is attributable to the interplay of several factors, only a few of which shall be mentioned here: Bottlenecks in capacity are created, first, by the slow and sluggish improvement of existing roads often only starting when the traffic overload has already become critical or has even exceeded the critical limit. The second point is that capacities are often only planned to meet merely current – and not future – requirements.

The study also confirms that money spent on shifting part of this transport volume to the railways fails to offer an appropriate benefit. Lacking its own niche in the transport system and restricted by inadequate flexibility in its operations, the railway system clearly shows the lowest growth rate of all means of transport in the last 50 years. In consideration of these facts and also considering that passenger car road traffic will continue to grow by the year 2015 at a stable pace of 25 +/- 3 per cent, the traffic researchers conducting the study demand not only modernisation of the railways in Germany, but also and above all a significant improvement of our road infrastructure. The objective must be, using all technical facilities available, to establish a high-performance infrastructural system in Germany supporting the development of the economy and offering modern solutions suitable for exportation to other countries.

Study: Leisure-Time Mobility in Bavaria.

Year in and year out, the population of Germany covers almost 470 billion kilometres or 290 billion miles on German roads in pursuit of their leisure-time activities. Such activities therefore have the biggest share in overall passenger transport, clearly representing the No. 1 reason for using the transport system. With this in mind the BMW Group "commissioned the Mobility '97" survey in 1997, studying leisure-time mobility in Bavaria and determining which factors influence such activities. Some 2,000 individuals in almost 1,000 households were interviewed for this purpose by the Weihenstephan Research Centre of Munich Technical University, asked about their households, their personal data and their mobility behaviour analysed inter alia by means of an activity and travel diary.

The survey sought among other things to study leisure-time mobility in the context of everyday mobility in general, focusing in particular on whether socio-economic factors affect a person's leisure-time behaviour. The study showed that the mileage covered per individual increases with that person's level of school education and professional training, as well as his or her disposable household income. The inquiry also showed that men travel more on average than women and that the number of daily excursions and short journeys increases as a function of the level of school education and household income. And the automobile clearly comes first in terms of daily excursions, short and longer journeys, being used in 56-73 per cent of all cases.

The study also shows that more than half of all leisure-time transport is committed to social activities, leisure-time mobility depending largely on the need for social interaction – which is why scientists tend to call

leisure-time transport the “social cement which keeps society together”. This factor is of particular significance considering that public debates focus time and again on saving leisure-time mobility on the part of private households as a potential for cutting back the volume transport in general. And the fact that leisure-time transport is difficult to plan and organise within a firm scenario clearly presents great challenges for public short-haul passenger transport.

Outlook: We Must Decide Today on the Quality of Mobility Tomorrow.

The maintenance and expansion of our transport infrastructure require substantial funds and long periods of implementation. In addition, it often takes many years or even decades until innovative technical concepts for reducing emissions in our cars, aircraft and railways are introduced and implemented on a broad scale. These are just two examples clearly showing that politicians and representatives of the economy must take decisions today involving the mobility of tomorrow in order to set the standard for the future in good time. This may mean anticipating a foreseeable development early enough to be properly prepared or to take appropriate action ensuring that an undesired development does not become reality in the first place. The transport capacity of all modes of transport has increased in recent years. But the transport infrastructure has not grown in the same process and to the same extent.

The maintenance and expansion of our infrastructure has trailed behind the lack of funds and the long-lasting approval and licensing processes.

There are many opportunities and options for mobility in future. And while we experience an increasing number of debates on the pros and cons of transport or the establishment of an appropriate transport scenario, these discussions are often characterised by an atmosphere of confrontation and not so much by a non-partisan, straightforward search for acceptable compromises.

The objective of sustainable transport must be to provide appropriate mobility meeting the needs and requirements of the population and at the same time reducing or to the greatest possible extent even avoiding any negative phenomena. It is therefore essential to consider the issue of mobility in all its facets. Mobility is an indispensable feature of a world growing together, a world in which economic development and the development of transport capacities still depend on one another.

Considering our objective to maintain or improve the standard of living in Germany and Europe, we must realise that this will most probably only be possible in future with an increase in the volume of transport. In other words, we will face the challenge also in the decades to come to provide

options for mobility and at the same time reduce or totally avoid any negative phenomena encountered in the process.

Precisely this is why our Institute of Mobility Research has started a systematic dialogue with renowned experts focusing on the ongoing development of the most important parameters affecting mobility in future.



With competent experts from various disciplines taking a regular look into the future, we will be able to provide a more transparent view of the overall picture. The most important factors influencing the development of mobility will be identified and discussed regularly, showing what projections we can expect in the next 20 years. Moreover, we will be able to estimate in that case what consequences for mobility there would be in Germany.

The results obtained in this way will be discussed by decision-makers in politics, the economy, science and within associations and federations. Taking this approach, we seek to show the need for action and prevent counterproductive decisions harmful to the development of mobility in future. This is a major objective of our activities. Walter Hell, Director of the Institute of Mobility Research.