



ESSENTIAL

FREUDENBERG SEALING TECHNOLOGIES
THE MAGAZINE – ISSUE APRIL 2014

UNDERSTANDING TRANSPORTATION

Dr. Barbara Lenz, a professor and head of DLR
at the Institute of Transport Research in Berlin,
investigates solutions for future mobility.

THE TRAFFIC JAM RESEARCHER

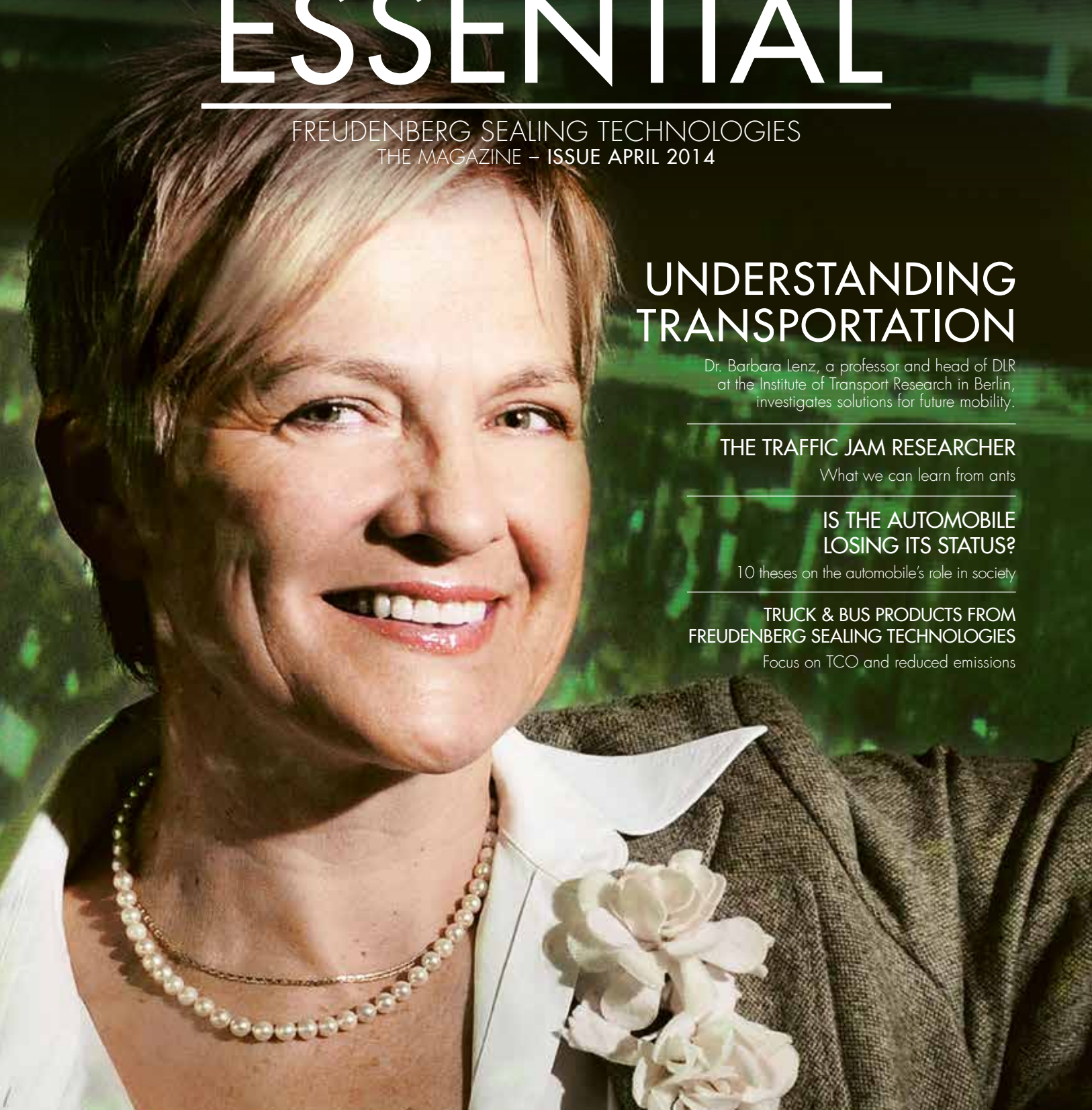
What we can learn from ants

IS THE AUTOMOBILE LOSING ITS STATUS?

10 theses on the automobile's role in society

TRUCK & BUS PRODUCTS FROM FREUDENBERG SEALING TECHNOLOGIES

Focus on TCO and reduced emissions





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ADDED VALUE THROUGH DIVERSITY

The Reichelsheim-based Global Special Sealing Products Division sees itself first and foremost as a problem solver. A profile of General Manager Kurt Ziminski.

#1

THE SHIFT IN EMPHASIS SEEMS INEXORABLE

Development in the Far East will primarily drive the global growth that experts expect in the commercial vehicle market. The share for Asian countries is already nearly 50 percent, and the global market leader has come from China since 2009. But customer requirements in “emerging markets” are different from those in the classic industrial countries. And, depending on the country, legislation defines different focuses and requires strategies that vary from region to region.



©
EVERYTHING
ON THE MOVE

#2

GLOBAL HARMONIZATION

By 2020 at the latest, experts expect to see global harmonization of limits for soot particles, CO₂ emissions and nitrogen oxides – and it is clear that turbo diesel engines remain the top choice. Particulate filters, high-pressure injection systems and exhaust gas aftertreatment (SCR) will thus become standard equipment worldwide.

#3

THIS TECHNOLOGICAL REQUIREMENT IS
GROWING EVERYWHERE

Emissions reduction is becoming a global task that no truck or bus manufacturer can avoid. While manufacturers have managed to sharply reduce the pollution coming from modern commercial vehicles, there is still much to do. Strong growth rates are intensifying emissions problems in expanding urban areas. Ever-shorter cycles for new emissions limits, even in the emerging markets, require new solutions – which still vary from region to region.



EMISSIONS
IN FOCUS
WORLDWIDE

#4

PRIORITY ON TCO

Throughout the world, truck and bus customers agree on one thing: Tough competition in the transportation sector is increasingly shifting TCO, or total cost of ownership, to center stage. This involves more than just purchase price. Efficiency and uncompromising reliability are of central importance to low TCO.

#5

FEWER EMISSIONS – DESPITE MORE VEHICLES

2013 was a record year with 83 million new car registrations.

To keep climate goals front and center, emissions scenarios are becoming more demanding – and the tasks more difficult – around the world. While a compact car weighed less than 800 kg 30 years ago, growing comfort and safety needs have driven this figure to 1,200 kg. As a result, efficient lightweight construction is high on the list of measures to cut emissions.



**DIVERSITY
UNDER THE
HOOD**

#6

MORE THAN JUST ONE SOLUTION

“Downsizing” and intelligent engine management systems are raising the classic internal combustion engine to new levels of efficiency. But the future is diversity. In addition to gasoline and diesel engines, various powertrain technologies, energy sources and energy carriers are establishing themselves – based on customer requirements, intended use or market conditions. The spectrum ranges from alternative fuels, to pure electrically propelled vehicles, all the way to fuel cells.

A CONVERSATION ABOUT GLOBAL TRENDS IN THE COMMERCIAL VEHICLE MARKET, THE ASIANS' STRATEGY AND THE SECRETS OF SUCCESS OF A GLOBAL SEAL MANUFACTURER.

① THE GLOBAL MOMENTUM FOR GROWTH WILL COME LARGELY FROM THE FAR EAST IN FUTURE. HOW IMPORTANT WILL THE CORE MARKETS OF THE SO-CALLED TRIAD CONTINUE TO BE TO FREUDENBERG SEALING TECHNOLOGIES? High growth rates naturally attract the attention of the public. But we cannot let the white noise of the media influence our business decisions. The fact is that we do more than 40 percent of our global business in the "triad" markets. That is more than all the BRIC states put together and is crucial for our long-term success. In coming years, we even expect demand to continue growing in Europe and North America.

② THE WORLD'S LARGEST MANUFACTURERS OF TRUCKS AND BUSES NOW COME FROM CHINA. BUT THE ESTABLISHED MARKETS CONTINUE TO SET TECHNOLOGICAL TRENDS. IN YOUR OPINION, WILL THAT CHANGE? The Asian commercial vehicle manufacturers are only active in their domestic markets and primarily serve them with low-cost products. That can be seen in the example of Dongfeng in China and Tata in India. But the interest in expanding into the global market is unmistakable. A look at the passenger car market reveals what course the trend could take in future. The purchase of faltering European manufacturers, Geely (with Volvo), Tata (with Jaguar/

③ ALTERNATIVE FUELS AND POWERTRAIN TECHNOLOGIES HAVE SO FAR PLAYED A SECONDARY ROLE IN COMMERCIAL VEHICLES. WILL THIS CHANGE IN THE FUTURE? For heavy-duty trucks, there will be no alternative to the further optimized internal combustion engine for the foreseeable future. Drivetrain electrification in the form of hybrids will, however, flow into the series-production of commercial vehicles.

But we will always have to deal with conflicting objectives: The additional weight from batteries or hydrogen tanks reduces vehicle payload – and payload is naturally the top priority for many customers.

We therefore expect to see a variety of alternative powertrains in the van and city cargo fields. Everything is conceivable – from natural-gas propulsion to purely electrical vehicles. But the longer the distances, the greater the tendency to stay with diesels – which incidentally still have considerable potential for development.

④ IN YOUR VIEW, WHAT FACTORS ARE CRUCIAL FOR SUSTAINED SUCCESS IN THE TRUCK AND BUS MARKET? A global presence is the most important basis for our success as a seal manufacturer. The truck business is very sensitive to changes in economic conditions. Here it is important for us to be able to offset declines in struggling markets with solid earnings from stable markets. That has worked out well for us in the past.

Our second secret of success is our consistent focus on total cost of ownership (TCO). If there is a theme that unites all of the world's truck and bus markets, it is overall

"A GLOBAL PRESENCE IS THE MOST IMPORTANT BASIS FOR SUCCESS"

Land Rover) and more recently Dongfeng (with PSA) have all mapped out how Chinese and Indian companies can transform themselves into technology pioneers in no time at all. They purchase the know-how at a low price and then create an environment that offers enough space, time and financial resources for further innovation.

This certainly does not apply to trucks to the same degree in light of the consolidation that has already taken place. But one strategy that we might continue to see in the truck and bus market in coming years is the alliance option.

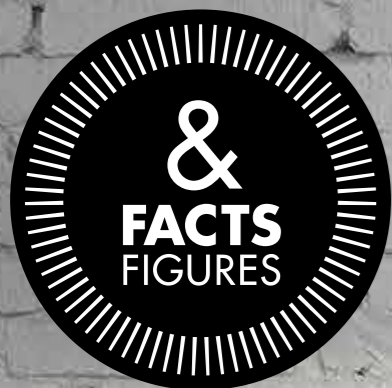
economic efficiency. The factors of "absolute operational reliability" and "exemplary efficiency" are decisive attributes of low TCO levels. Our job is to anchor these issues in the perception of our customers.



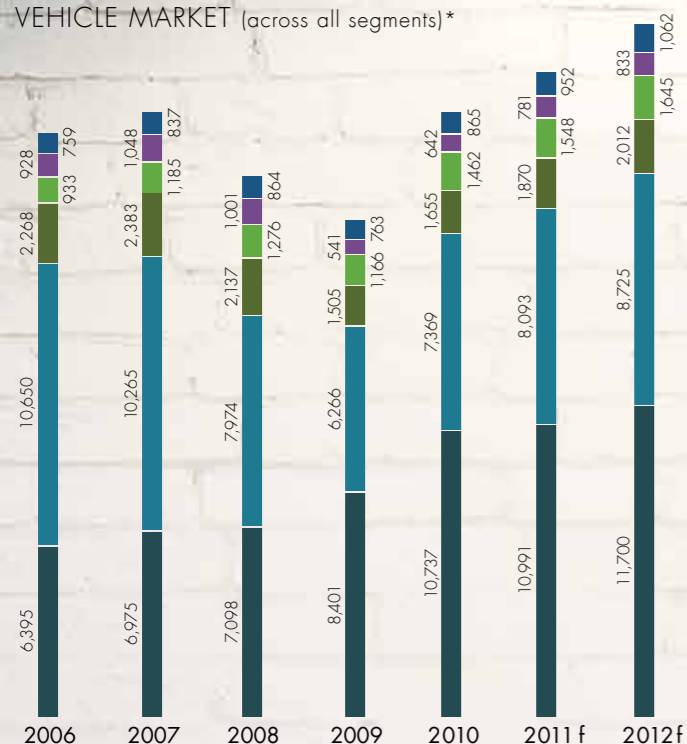
TORSTEN MASCHKE

President Automotive Sales & Marketing





DEVELOPMENT OF THE COMMERCIAL VEHICLE MARKET (across all segments)*



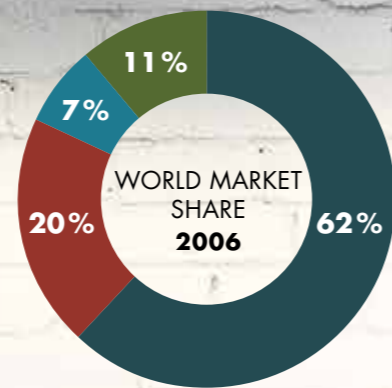
ASIA
NORTH AMERICA
WESTERN EUROPE
SOUTHERN AFRICA
EASTERN EUROPE
RoW

Source: IHS Automotive, KPMG International
f = forecast
*Light commercial vehicles up to six tons + heavy commercial vehicles over six tons

TRUCKS ON TRACK FOR GROWTH

The economic crisis has had only short-term effects. Since 2010, the global market for commercial vehicles has again been registering strong growth rates. Across all weight classes, annual registrations of **33 million new commercial vehicles** are expected **by 2015**. The share of heavy and medium-duty trucks will be about 10 percent.

DEVELOPMENT OF WORLD MARKET SHARE BY MARKET CLUSTERS



● TRIAD North America, Western Europe, Japan
● BRIC Brazil, Russia, India, China
● NEXT ELEVEN (No data available for Nigeria, Bangladesh)
● REST OF THE WORLD

Source: IHS Automotive, KPMG International

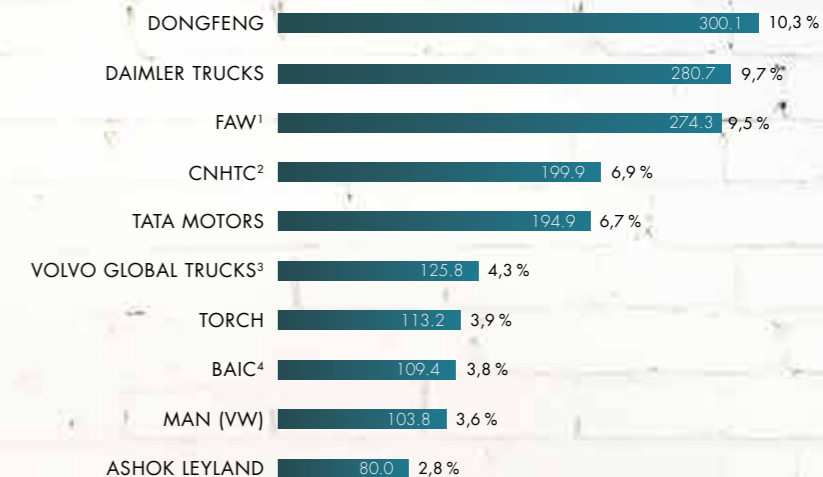
BRIC NATIONS IN HOT PURSUIT

Since 2006, BRIC nations (Brazil, Russia, India, China) have managed to nearly double their share – **from 20 to 38 percent**. The share for the triad (North America, including Mexico and Canada, Western Europe and Japan) has declined from 62 to 43 percent in the same timeframe. That puts the triad and BRIC markets at almost the same level.

THE UNKNOWN GLOBAL MARKET LEADERS

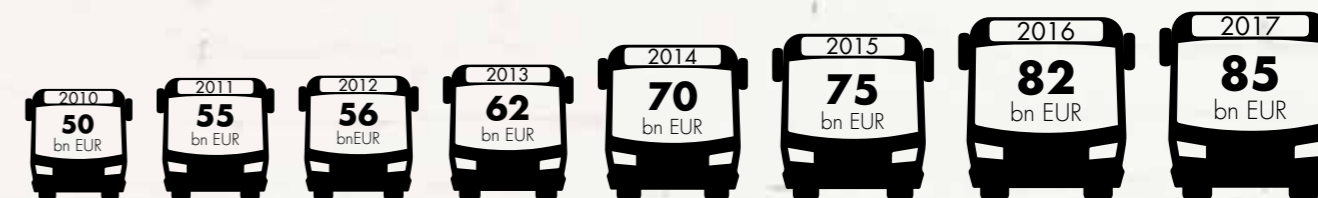
With **more than 300,000 vehicles**, Chinese manufacturer Dongfeng has been the global leader in the heavy-duty truck segment since 2010. There is just one non-Asian company – Daimler Trucks – among the top five. With nearly 200,000 vehicles, the Indian manufacturer Tata is a member of this group, along with FAW (First Automotive Works, China) and CNHTC (China National Heavy Duty Truck Corporation).

INTERNATIONAL KEY PLAYERS IN HEAVY COMMERCIAL VEHICLES IN 2010 (GVW > 6 tons)



¹First Automotive Works, ²China National Heavy Duty Truck Corp., ³Volvo, Renault Trucks, Mack, ⁴Beijing Automotive Industry Corp.
Source: IHS Automotive, KPMG International

WORLD BUS MARKET 2012-2017 in billions of euro (nominal, incl. inflation)

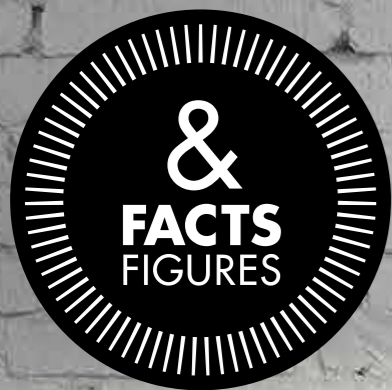


BOOMING BUS MARKET

Through 2017, the global bus market will show steady growth at an annual rate of 5.2 percent, according to a study by consulting firm SCI Verkehr. Annual production is expected to rise to 600,000 units by then. Emerging markets are the engine for growth here as well. Even today,

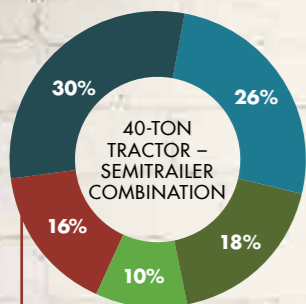
one bus in three is registered in China. The global market leaders also come from this country: **Yutong and King Long are the world's largest bus manufacturers**. Daimler follows in third place and MAN in sixth.

Source: SCI Verkehr



TCO – THE MOST IMPORTANT ISSUE

OVERVIEW OF TRUCK TCO IN WESTERN EUROPE



1% Tires, 2% Interest
2% Road Tax
5% Repair & Maintenance
6% Vehicle Insurance

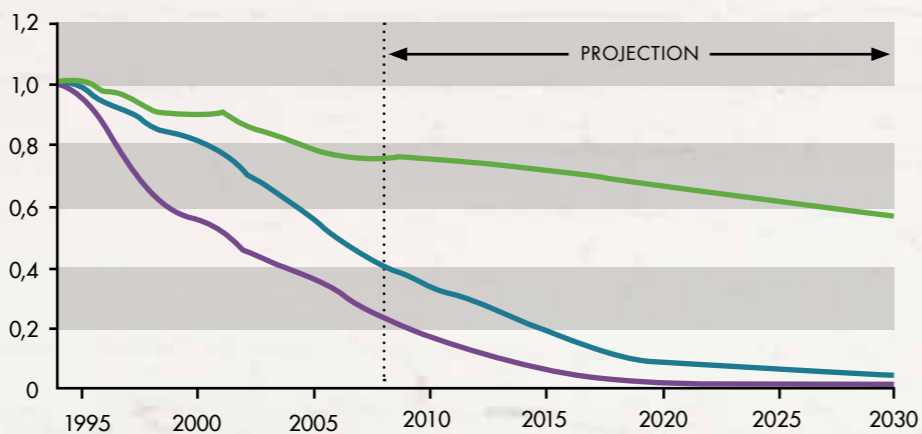
FUEL WAGES
DEPRECIATION OVERHEADS

Source: Commercial Vehicles and CO₂, ACEA/IVECO, 2011

CLEANER AND CLEANER

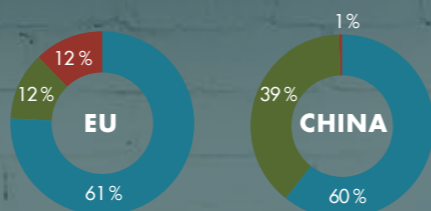
In terms of their transport volume, trucks and buses are becoming cleaner and cleaner. Between 1995 and 2010, manufacturers managed to reduce their CO₂ emissions by more than 20 percent. Nitrogen oxide emissions have declined by 60 percent and soot particulates by nearly 80 percent. But there must be further dramatic reductions – especially in nitrogen oxides and soot particulates – to ensure that growing inventory does not jeopardize past gains and that focus remains on the goal of lower pollution in metropolitan areas.

DEVELOPMENT OF COMMERCIAL VEHICLE EMISSIONS (per tonne-kilometer)



CO₂/tkm NO_x/tkm SOOT PARTICULATES/tkm Source: TREMOD-VDA (2010)

FROM THE RAILS TO THE ROADS



Source: BRICS Joint Statistical Publication 2011, National Bureau of Statistics of China

At the start of the 21st century, Chinese rail transportation had a 69 percent share of all goods transported. In 2010, just a little less than **40 percent was transported by railway** – and more than **60 percent on roads**. The overall transportation level increased by a factor of 2.5 over 10 years. In the EU, the share of transportation on roads has been rising for decades. Factors such as the eastward expansion of the EU have sharply increased goods traffic. The share held by truck transportation is currently 76 percent – and rising.

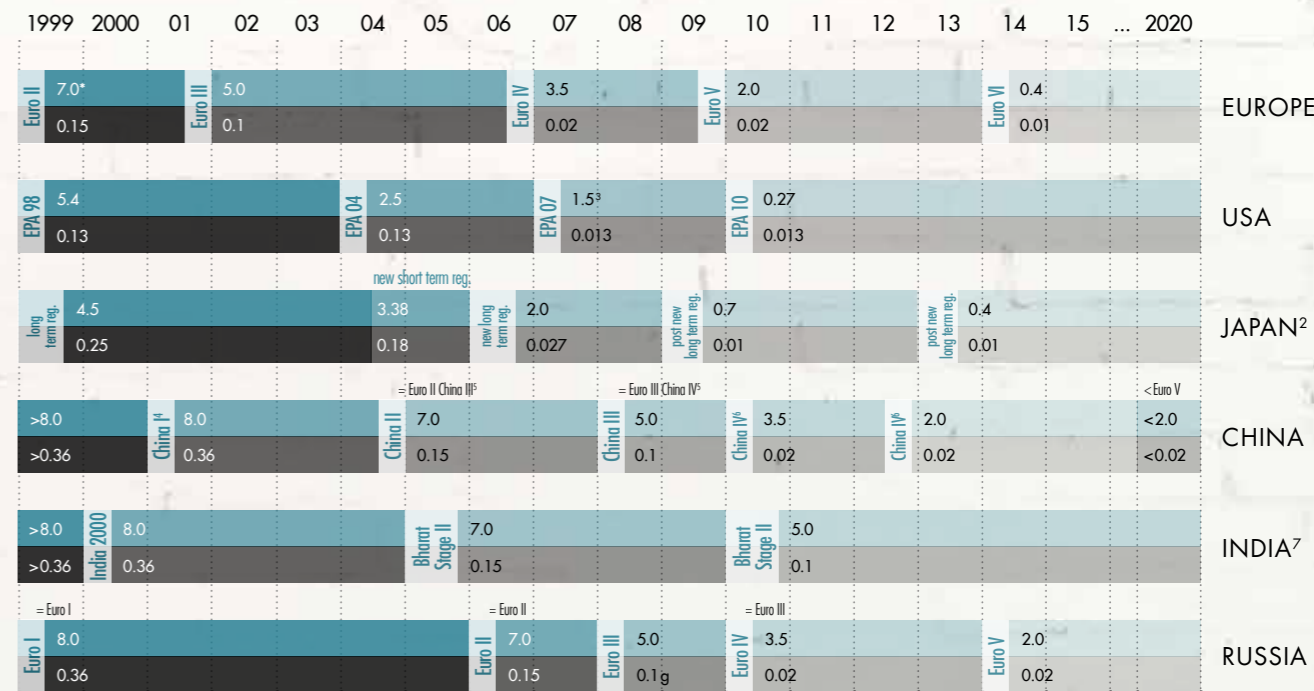
GLOBAL GOAL – DIFFERENT PATHS

Emissions standards are becoming global: The emerging markets are rapidly catching up. To avoid local climate collapse, regulatory emissions cycles are becoming shorter and shorter. The replacement

of old vehicles – an important growth driver – should improve the quality of air and life. As global as the goal may be, the paths to it are often diverse. Global harmonization is not expected to start until 2020.

EXHAUST LIMITS VALUES FOR COMMERCIAL VEHICLES BY REGION

*All figures in grams/kWh



■ NITROGEN OXIDES ■ SOOT PARTICULATES

¹ Relates to the introduction of the regulation for all vehicles (new registrations), ² Date of introduction for vehicles >12t, ³ Only 50% of group unit sales must meet NOx standards, starting 2010 100%, ⁴ Introduced in Shanghai in 1999, ⁵ Introduction in Beijing region, ⁶ For all domestic commercial vehicles, ⁷ Only for metropolitan regions

Source: Dieselnat, state websites/Institut für Automobilwirtschaft, KPMG International (2010)



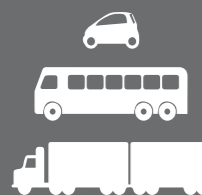
UNDERSTANDING TRANSPORTATION

PROF. DR. BARBARA LENZ, HEAD OF
THE INSTITUTE OF TRANSPORT RESEARCH AT
THE GERMAN AEROSPACE CENTRE (DLR)

PROF. DR. BARBARA LENZ

THE MOBILITY OF THE FUTURE

In Berlin's up-and-coming Adlershof district, 35 scientists at the German Aerospace Centre (DLR) are working on a mega topic: How can the people of the future move stress-free from point A to point B? Dr. Barbara Lenz has held the top job at the DLR Institute of Transport Research since 2007. The professor's philosophy: "We have to improve links between different modes of transport." And this applies to every region of the world. The highly experienced expert says policy-makers have an obligation to deal with this mega task.



RESEARCH FOR REAL LIFE

The **German Aerospace Centre** has long been involved with more than just the next ISS or Mars mission. As a research center for the Federal Republic of Germany, its activities were expanded back in the 1990s into energy technology, transportation, and safety in both applied and fundamental research. Three institutes deal with transportation issues under the DLR umbrella. At the Centre for Science, Business and Media in Berlin-Adlershof, the focus is on applied transportation research. **“We are interested in the question of what users actually do with transportation technologies,”** says Dr. Barbara Lenz, describing her institute’s mission. “In the process, we are not just dealing with the transportation of people, but increasingly with goods transportation as well.”

Anyone traveling in Chad needs strong nerves and plenty of time. The central African country, covering about 1.3 million square kilometers, is around four times larger than Germany, but it has no rail network and just 270 kilometers of asphalt roads. After long civil wars, the country’s infrastructure has deteriorated and, as a result, the rural population has been migrating to its cities. In the capital city of N’Djamena alone, the number of inhabitants has doubled to more than one million in recent years. The problem is that this growing city has no organized public transportation whatsoever.

Nonetheless, the city is constantly in motion. Its citizens, masters of improvisation, have taken its organization in hand themselves. “Minibuses and motorcycle taxis provide the basic services,” says Barbara Lenz, head of the Institute of Transport Research at the German Aerospace Centre in Berlin. “They are operated by small private entrepreneurs – without fixed pricing, reliable routes or uniform schedules.” But how does a system work that is almost exclusively based on informal services? Lenz, a professor of transportation geography at Berlin’s Humboldt University, would like to learn more about the topic. That is why she launched her own project on the subject in 2013. It is one more tile in a large mosaic that her team of 35 sci-

entists from various disciplines would like to make as precise as possible: What will the personal mobility of tomorrow look like?

This much is certain: In developing countries, “informal transportation” plays a major role. That is how the researchers describe a system that is overwhelmingly privately organized and avoids the impact of government regulation – the primordial soup of transportation, so to speak. For example, there are several thousand bicycle taxis in Bogotá, Colombia’s capital. They are not legal but they are the indispensable feeders for the city’s express buses (see box).

SURPRISINGLY CONSISTENT WORLDWIDE: STAGES OF MOBILITY DEVELOPMENT

Around the world, the Berlin researchers again and again identify various stages of mobility maturity that are surprisingly similar despite being in different regions. “Informal transportation” with mopeds and minibuses is followed by “organized bus transport.” This often takes the form of Bus Rapid Transit (BRT), with its own travel lanes for faster progress. This is the case in Cape Town, South Africa, and Jakarta, Indonesia. The system may be inferior to a metro or subway

in the number of people transported, but it requires much less investment. Global development proceeds in a certain sequence. “It is only when all the opportunities for buses are exhausted that people turn to rail – including underground in many cities,” says Lenz.

MOBILITY IN MEGA-CITIES: SINGAPORE AS THE MODEL

Personal mobility develops in parallel with public transportation services. It is Lenz’s view that, in the absence of government intervention, mega-cities

soon risk transportation chaos or gridlock. But this is not inevitable. “As we see it, Singapore can serve as a global model. Nowhere in the world has the problem of excessive individual transportation been identified so early and countered in such an appropriate, systematic fashion,” she says. So-called transportation management measures have controlled entry into the city center since 1975. There are traffic lanes reserved exclusively for passenger cars carrying at least four persons. Other measures are steep road tolls, taxes on the purchase of private passenger cars and a nearly perfect local public transportation

system, into which nearly 25 billion euros will flow between 2010 and 2020.

The comprehensive measures have had an impact: Singapore is not stuck in traffic – it is constantly in motion. Statisticians count more than 11 million trips per day – in cars and buses and on the rails – with a remarkably low share of the traffic jams that condemn many other cities in the world to gridlock. The average speed of a passenger car is 27 km/h in Singapore instead of the 11 km/h in Tokyo – despite the 570,000 cars on its 710 square kilometers. In contrast, the current preference for automobiles

TAPAS – SIMCITY FOR SCIENTISTS

In a computer model, **TAPAS (Travel and Activity Patterns Simulation)** simulates the transportation behavior of the 3.4 million residents of Berlin. TAPAS can calculate how mobility behavior changes if the cost of fuel or public transportation rises – or if bus lines change their routes. The detailed data sets take a variety of different life situations into consideration. For example, they differentiate between users of company cars versus privately owned vehicles, for whom the impact of higher fuel prices varies. The model includes different vehicle types, meaning that an SUV generates different costs than a smart.

This complex model assesses the entire course of an individual’s day, taking into consideration the consequences of decisions made. If an avatar decides on an athletic commute on a bicycle in the morning, he can no longer count on a comfortable return trip with the car after a long workday – because his simulat-

ed car is at home and the bike has to be brought back. Even adjustments to new realities are par for the course. Bike and car-sharing models have been integrated to check the effect of new services in the simulation. Even the development of e-mobility and the impact of comprehensive power availability from charging stations can be forecast. The TAPAS structure resembles that of computer games such as SimCity. **The goal is to create medium and long-term scenarios for transportation development.** Among other things, this will make it possible to evaluate which measures could help achieve climate protection goals by 2030.

The architecture will also be transferred to other regions. TAPAS has already been used to calculate demand for passenger transportation in the Hamburg, Mecklenburg-Western Pomerania, Brunswick and Main-Rhone regions for 2030.

in many Chinese mega-cities has already led to chaos – with the potential to become a trigger for social unrest.

TRANSPORT AS AN ECONOMIC AND SOCIAL DIMENSION

There is no shortage of research work for Lenz. She makes the case for situation-based mixed-mode transport; she is also happy to ride her bicycle to work at the institute “because it is more convenient and healthy to do so.” One thing is clear: efficient, reliable and safe transportation connections are a prerequisite to meet the needs of industry, trade and private individuals and cause an economy to prosper. At just under 1.2 trillion euros, the transportation sector represents about 10 percent of the European Union’s gross domestic product and secures nearly 11 million jobs – not counting the manufacture of vehicles or the construction of transportation infrastructure. According to Lenz, another aspect is involved as well. “Aside from its economic component, transportation has a social dimension. Without accessible and affordable transportation, we are cutting off entire population groups from life in society. This especially applies to developing countries, but it is also becoming an important research theme in industrialized countries in light of aging populations.

NEW CHALLENGE: DRAMATIC RISE IN THE TRANSPORTATION OF GOODS

In addition to personal mobility, the institute’s recent focus has increasingly been on the transport of goods. “We are facing a dramatic development in Germany,” says Lenz. A study by the German Transportation Ministry

assumes that goods transport will rise by up to 71 percent by 2025 compared to its level in 2004. This development will put further pressure on rail transport unless countermeasures are taken. A roads network that is already deteriorating and overburdened in many places would have to bear the additional load – realistically, a near impossibility. As a result, current research projects such as nighttime deliveries with electric vehicles (see sidebar) or the replacement of city vans with electric delivery bikes have a higher priority.

FUTURE OF MOBILITY: WITH ONE ANOTHER INSTEAD OF AGAINST ONE ANOTHER

But where does Lenz see mobility’s future? Her philosophy is “To achieve high-performance transportation, we have to link the various modes of transport more effectively with one another.” According to Lenz, “In Chad, it starts with a reliable schedule. In Bogotá, it goes further: bus tickets for the TransMilenio should be valid for the feeders as well. In highly complex mobility structures like those in Western Europe, it takes another step: fast, precise information searches on the Internet incorporate all modes of transport. Ultimately, however, it is mainly up to policymakers everywhere to prevent transportation collapse with balanced planning and the right measures.”

The Stuttgart native has significantly changed her mobility behavior in Berlin. “I certainly do not want to do without an automobile, but every means of transportation has its rationale and we should allow alternatives and think about which vehicle we use for which route.” Her goal in coming years is to research the complex interdependencies between transportation

supply and demand. “It is not enough just to understand transportation. It is important rather to explore how you can manage to reduce the negative environmental impacts of transportation with the help of technology or behavior.”



SMART APP FOR METROPOLITAN AREAS

“Molecules” seeks to link all modes of transport at a high level. It is a project being launched simultaneously in Berlin, Barcelona and Paris, starting in fall 2014, with an Internet platform to make the use of e-mobility as easy and convenient as possible.

To accomplish this, all the services are combined in a convenient app – from an electric car in a car-sharing system to an e-bike. The app also contains the entire schedules of all public buses and rail systems. In the ideal scenario, the user would receive information while in the subway directing him to the station with the nearest available e-bike or to a car-sharing spot for the continuation of his trip. The app even provides information when a passenger seat is available in an electric car on the way from Berlin-Spandau to Berlin-Adlershof. A crucial consideration for high acceptance is a tariff and billing system that is easy for all users to understand and that covers diverse mobility needs with a single payment process.



NANU! – ELECTRIC MOBILITY IN CITY LOGISTICS

Project NANU! – nighttime deliveries with electric commercial vehicles – deals with sustainable urban logistics, and a number of companies and organizations are taking part in it: they include Castellan AG, the Fraunhofer Institute, Hüffermann Transportsysteme, Logistic Network Consultance, TU Berlin and shipping company Meyer & Meyer. The core question is, “Can a low-emission electric truck in nighttime and 24-hour use be used so efficiently that it not only replaces a diesel truck, but also makes trips during the day superfluous?” After all, inner-city deliveries cause bottlenecks and dominate local peak loads for key pollutant concentrations.

In an earlier project, researchers first gained practical everyday experience with electrically powered 7.5t trucks. Two main problems quickly materialized during the project: the charging time for the batteries was much too long and there was a lack of acceptance for the short swap body. The NANU! project is based on a 12t truck with a standard swap body, which the participants and their partners are converting for operation with replaceable batteries. That should solve the charging time problem and facilitate the usual deliveries for customers such as wholesale electronics markets or fashion chains. The electric trucks could then be used around the clock – even at night – which would not be conceivable with diesel trucks due to noise restrictions. Efficient use by day and night could crucially improve the overall cost-effectiveness of electric medium-duty commercial vehicles.

But for it to reach that point, the partners have to solve many complex problems. In addition to the construction of the electric truck, they face the challenge of developing a replacement battery system, including charging infrastructure. They have to develop a device allowing the driver to swap the 200-kilogram batteries on his own. Initial plans for two exchange stations are also new territory.

The development of software is another key part of the project. Its purpose is to control the charge management system that takes optimum account of the scheduled routes. The charging device must always know how full it should charge the battery for the next routes. Intensive customer care is also required: after all, a delivery must still be possible at three in the morning.

TRANSPORTATION AS A FACTOR FOR SOCIAL STABILITY

The long-term impact of mobility projects in developing countries is at the center of “MoMo,” a multimodal mobility project. One exciting example project is a railway cable car service in Medellín, Colombia. Since 2004, this unusual means of transport has connected an illegally built hillside ghetto community with the city center, leading to numerous positive results.

- ▶ Social permeability between the city districts has increased substantially.
- ▶ Crime rate has declined since the cable car has been in operation. As a side effect, the cable car has brought some public order into the slum.
- ▶ For the first time, inhabitants of the district can reach the city center comfortably and easily and thus gain access to better job opportunities in the city center.

The cable car has generated so much interest among city planners around the world that the World Urban Forum is being held in Medellín in 2014.

Major progress in city transportation services can be seen in general across South America. Santiago de Chile has completely renovated its bus and rail system. And in Bogotá, the TransMilenio express buses, traveling in reserved lanes, have reduced the north-south trip through the city from three hours to 50 minutes. But to accomplish this, hundreds of small bus companies had to merge into transportation associations. Previously, the small companies with just one or two vehicles and no coordinated schedules and routes battled with and against each other for customers. For people from the poor southern district, this has meant better access to job opportunities in the city’s prosperous north. In addition to the TransMilenio plan, the city administration’s transportation strategy includes a newly laid-out network of bicycle paths, new green spaces, pedestrian zones in the city center and twice yearly car-free days.



TRUCK FICTION

TO SOLVE FUTURE CHALLENGES IN GOODS TRANSPORTATION, QUESTIONS MUST BE ASKED DIFFERENTLY AND OLD THINKING SCRUTINIZED. TWO RESEARCH INITIATIVES SHOW WHAT THE FUTURE OF THE TRUCK MIGHT LOOK LIKE.

eHIGHWAY

In the middle of the province of Brandenburg, a heavy-duty truck travels nearly soundlessly on a well-developed country road. It takes a second look to see the large pantograph behind the truck's cab. Like a locomotive, the electric truck draws its energy from an overhead line. The ENUBA project is investigating how electric mobility can be used for long-distance transport.

Since 2010, engineers have been working with TU Dresden researchers on the eHighway, on which electric cars are fed electricity via overhead lines. The idea behind the project is

to provide the electric car with limitless range. But equipping roads with overhead lines is expensive and not feasible everywhere. That is why the concept combines proven Siemens streetcar technology with the flexibility of advanced hybrid trucks. Swedish commercial vehicle maker Scania joined the project in March 2013. A smaller, more economical, low-emission diesel engine is used on roads that lack overhead lines. It functions with a constant rotational speed in the most fuel-efficient range and powers an electric motor, which in turn transfers power to the truck axles. Where overhead lines are already installed, the truck runs on electricity alone.

Scanners detect the lines. If the data is right, the pantograph deploys and connects accurately with the line. Alternatively, the driver can trigger the process manually at the touch of a button. Connection to or disconnection from the lines also takes place automatically during overtaking or evasive maneuvering. This makes the use of eHighway vehicles just as versatile as conventional trucks. But the overhead-line hybrids are significantly more fuel-efficient and environmentally friendly.

This forward-looking project already functions superbly under simulated everyday conditions. That is the conclusion following a major trial at a test

facility near Berlin. The trial began in 2010 and will run into mid-2014. The German Ministry for the Environment, Nature Conservation and Nuclear Safety is sponsoring the project, which is continuing with a heavy-duty semi-trailer truck and a bus.

It is now a matter of assessing outcomes during normal operation. "We are examining a number of parameters," says Dr. Arnd Stephan, a professor at TU Dresden's Transportation Science Department. "They include contact and wear behavior of the pantograph, protection and safety issues, maintenance questions, all the way to legal planning feasibility." When the evaluations are completed, it should be possible to make an authoritative statement on the economic viability and eco-balance of the overall system.

Based on the research results, Holger Sommer, manager of the Siemens eHighway program, is confident that "new types of vehicles will emerge that could travel highly efficiently on the eHighway in future." The long-term goal is the construction of an economically sustainable electric infrastructure for the movement of goods and public passenger transportation.

"MONSTER TRUCKS"

No goods transport project has been the subject of as much heated debate

in Germany as the use of oversized road trains. The controversial mega-transporters are described alternately as "monster trucks" or "eco-trucks." The correct technical term is "EuroCombi" truck and the vehicles have been stirring up emotions since 2006. Advocates, such as the German Association of the Automotive Industry, point to their greater efficiency, with up to 50 percent increases in payloads and usable volume, as well as more efficient use of the road network. Haulage companies calculate that two 60t giga-liners can replace three conventional 40t road trains, reducing fuel consumption and CO₂ emissions by up to 20 percent per unit of transport.

Critics from the political world, associations, unions and environmental organizations fear that they will inflict costly damage to an infrastructure that is already deteriorating in many places. Another contentious issue is the heavier loads on bridges. Neither traffic lights nor roundabouts, rail-road crossings nor rest stops are prepared for the oversized road trains. The police union points to potential hazards while overtaking and in tunnels. Furthermore, there are fears that these trucks, measuring up to 25 meters long, will promote the transfer of transport from rails to the road.

A major test commissioned by the German Federal Transportation Industry has been underway since 2012,

albeit with the participation of just 60 instead of the expected 400 long road trains. Their total authorized weight was restricted to 44t, down from 60t. The first analysis by the Federal Highway Research Institute was published in late January 2014, but included only 37 EuroCombi road trains from 21 companies. Accordingly, the results must be cautiously assessed.

Nevertheless, early trends can be identified. Drivers were able to handle the oversized road trains surprisingly well and there was not a single accident. Moreover, the long truck trains exclusively replaced traditional trucks and did not draw freight volume away from the rails. According to the analysis, "The first experiences of the companies have been consistently positive. The long truck trains have been traveling on the roads accident-free, safely and inconspicuously."

Many European countries can only smile wearily at the ongoing debate. The use of oversized trucks has long been routine in the vast expanses of Finland. In Sweden, 90-meter road trains following Australian examples are being debated. The Netherlands and Denmark have also given the green light to large EuroCombi rigs.

LOW FRICTION – MAXIMUM DURABILITY

It might seem like squaring a circle, but it's all in a day's work for Freudenberg Sealing Technologies: achieving reliable sealing with minimum friction. The two aspects are equally important as ways to keep maintenance costs as low as possible. Low friction results in decreased operating costs. Absolute reliability and durability extend operating cycles. This makes it possible to reduce inspection and maintenance costs and avoid downtime.



CASCO

The **CASCO** is a perfect example of the combination of perfect sealing characteristics, friction optimization and maximum durability. At the housing output for the crankshaft, the axially positioned seal lip protects against contaminants and extreme environmental influences, as well as oil leakage. In a test covering 1.6 million kilometers, it was shown that the **60 percent reduction in friction¹** cut fuel consumption. In a heavy truck driven 200,000 kilometers a year, CASCO saves up to 225 liters of diesel fuel².



MILEMAKER

MileMaker also combines long service life with excellent friction characteristics and significant savings potential. Wheel and axle hubs in light and heavy commercial vehicles are typical areas of application for cassette sealing rings. With friction reduced by more than 50 percent, a semi-truck equipped with MileMaker can **save more than 1,000 liters of fuel²**. At the same time, MileMaker still seals reliably at high temperatures and dependably protects the hubs from the penetration of dirt and moisture.



DIAPHRAGM
ACCUMULATORS

The highest quality standards, a sure mastery of processes and a zero-defect philosophy are vital in brake development. Operational reliability is an absolute must – so that even heavyweights unfailingly come to a stop. With its state-of-the-art analysis and calculation methods, Freudenberg Sealing Technologies is a valued development partner for seals in pneumatic brake systems. Diaphragm accumulators for chassis are another core competency. The necessary hydraulic energy is stored in a **diaphragm accumulator** and made available very quickly when needed. In this way, a hydraulic pump with a relatively low flow volume can be used. Energy consumption is reduced thanks to a more compact overall design.



PLUG & SEALS

Ingeniously simple solutions do not merely save time and money during installation. Where a separate O-ring in metal tubing once sealed an oil or water circuit, the patented Plug & Seals now solve several problems. The self-sealing connectors can be installed mechanically without producing distortions. This reduces production costs while facilitating maintenance and repairs. Plug & Seals from Freudenberg Sealing Technologies are significantly more resistant to high pressures, contribute to acoustic and mechanical decoupling, and are substantially better at offsetting axial tolerances. And the best part is that **Plug & Seals** last much longer and thus make a key contribution to lower maintenance costs. With integrated pressure and temperature sensors, they also offer further potential for optimized engine and transmission control.



¹ Compared with a conventional PTFE or spring-loaded seal lip. ² Internal calculations.

LESS WEIGHT – GREATER FREEDOM

Substituting plastic for metal not only offers weight savings of up to 50 percent in many products from the Schneegans-Freudenberg portfolio. For example, 3D molded plastic tubes – such as tubes for oil dipsticks or oil filler necks – also allow free-form geometries that could hardly be designed for metal tubes. As a result, optimum use is made of installation space in the engine environment. Plastic components also offer greater potential for the integration of additional functions or parts, such as local reinforcing elements or holding brackets.



HOUSING COVERS
MADE OF PLASTIC

Lightweight design combined with high load-carrying capacity – these are the key advantages of **housing covers made of plastic**. They allow the integration of still more parts and functions. The innovative 2K module features a silicone seal integrated into the cover, as well as a PTFE seal optimized for friction.



BLUESEAL SEAL RING

Increasingly stringent emissions limits require a broad range of measures – from fuel injection to exhaust aftertreatment. The **BlueSeal seal ring** is especially suited to use in high-pressure pumps. This patented technology offers **weight savings of 25 percent** compared to a conventional seal and requires only half the installation space. The additional metal carrier has been shown to be mechanically resistant to high pressures, while the PTFE material of the seal lip gives the cold shoulder to aggressive substances.



VALVE-STEM SEALS
WITH BACK-PRESSURE
SEALING LIP

New engine generations are improving their emissions performance with particulate filters and increasing their braking power with retarders. At the same time, their specific power is rising thanks to new turbocharger technologies and “downsizing.” All these measures increase the pressure levels in inlet and outlet tracts. But high exhaust back pressure can cause the seal lip in conventional valve-stem seals to lift up. That enables combustion exhaust gases to penetrate into the valve guide, causing the lubricating film to break down. The new generation of **valve-stem seals with back-pressure sealing lip** is designed to prevent this blow-by effect and to guarantee optimal sealing performance and thus the full output capacity of the engine.



MULTIPOLE ENCODERS

Multipole encoders provide precise data on rotational speed and rotation angle that are indispensable for engine control systems designed to reduce emissions. But Freudenberg Sealing Technologies has not only developed radial and axial encoders for use in crankshafts; it has developed them for the chassis area and transmission management as well. The new aspect is that these compact data suppliers now have the capacity to determine the angular position of the camshaft. Their high signal precision makes it possible to optimize fuel injection based on timing and quantity, increasing efficiency while simultaneously reducing emissions.





ADVANCING INTO NEW TERRITORY TOGETHER

IT WAS THE POSITIVE EXPERIENCE FROM THEIR LONG COLLABORATION THAT LED VOLKSWAGEN AND THE FREUDENBERG SEALING TECHNOLOGIES (FST) GLOBAL LEAD CENTER ENGINE TO ADVANCE INTO NEW TERRITORY TOGETHER. IN 2008, THE WOLFSBURG AUTOMAKER ENTRUSTED FST WITH THE DEVELOPMENT OF AN ENGINE COMPONENT, EVEN THOUGH FST HAD NOT HAD THE LEAST EXPERIENCE WITH IT. TODAY THE COMPONENT, WHICH IS ABOUT TWO-THIRDS LIGHTER THAN ITS CONVENTIONAL COUNTERPARTS, IS NOW USED IN THE VOLKSWAGEN GROUP'S MOST IMPORTANT ENGINE - THE EA 288 BASE DIESEL WITH 1.6 TO 2 LITERS OF DISPLACEMENT. IT HAS ALREADY DELIVERED PERFECT SEALING PERFORMANCE A MILLION TIMES OVER.

"It actually made us somewhat queasy at the start," says FST Project Manager Dominique Lutaud. "After all, the requirement that Volkswagen presented to us in 2008 was absolutely new territory for us." Europe's largest automaker was then developing a new diesel engine generation for its modular transverse matrix platform. Today, a majority of the Group's models are based on it. That makes the new diesel – with the internal reference EA 288 – the Group's most important engine. It covers an especially broad spectrum, with displacements ranging from 1.6 to 2.0 liters and outputs from 90 to

190 horsepower. It is found in all the volume models of the Group's Audi, SEAT, Skoda and Volkswagen brands. Among other components, Freudenberg Sealing Technologies delivered the front crankshaft Simmerring for the engine's preceding generation, the EA 189. Volkswagen was extremely satisfied with it and wanted to have FST on board for the next generation. The sealing ring on the EA 189 is in an aluminum crankcase cover, which in turn is equipped with a static cover gasket. The three components were supposed to become just one in the EA 288. "Functional integration was the cru-

cial key word," Lutaud recalls. "The requested part was supposed to replace three conventional parts and handle three functions simultaneously." To increase efficiency even further, the specifications set substantial weight savings as a high priority. Lutaud can easily explain why the automaker selected sealing specialist FST for the development and production of the innovative engine-cover gasket. "When you look at all three functions, the task of dynamically sealing the crankshaft is certainly the most demanding." VW simply called on the supplier that was best able to solve the most difficult problem.



TWO THIRDS WEIGHT SAVING

The team at FST'S Lead Center Engine considered the main challenge to be the development of the very first plastic cover for an engine casing. The component had to be made of this material in order to meet the weight-reduction requirements – that much was certain from the start. So the team first undertook a targeted search for an appropriate plastics specialist – and quickly found one. In scoping the project, it helped that development and manufacturing was to remain in FST's hands. "We had to develop the product and its production process simultaneously," says Lutaud, the project manager. "So there was no classic division of labor. We all pulled together from the beginning." Thanks to simultaneous engineering, the engineers were also able to react extremely quickly to changes and

shorten the development time – another justification for client VW. "During the development process, VW made repeated changes to the engine case. We naturally had to respond immediately and modify our component accordingly," says Carl-Josef Testroet, describing an exciting and sometimes very dynamic process. Thinking back, he finds two other aspects of the project remarkable. "Without specific plastics expertise, it was a bold decision to develop this kind of part and build a completely new assembly line for it," says Testroet. "This shows the considerable backing that we received internally. But Volkswagen's trust, based on our long-time cooperation, was at least as great." Four years after the project's start, the results are immediately impressive. The innovative plastic cover handles

its triple task perfectly, can be mounted more easily and fully automatically and weighs just 193 grams. With the previous design weighing in at 616 grams, the bottom line is weight savings of more than two-thirds. Production on the totally new assembly line began smoothly in January 2012. In 2013, more than half a million covers "made by FST" left the line, with volumes rising. But the potential is far from exhausted. Testroet is convinced, "The weight savings are helping our customer reach its CO₂ goals. When functional integration can be achieved with such impressive results, other projects will certainly follow."



BUSY, BUSY, BUSY

GERMANY IS BECOMING A LAND OF LONG-DISTANCE BUSES. JUST A LITTLE MORE THAN A YEAR AFTER THE LIBERALIZATION OF SCHEDULED INTERCITY SERVICES, THE COLORFUL LONG-DISTANCE BUSES ARE ALREADY A FIXED FEATURE ON THE COUNTRY'S ROADS. THERE IS STILL NO END IN SIGHT FOR THE BOOM. CHEAP PRICING IS PROVING ATTRACTIVE TO YOUNG CUSTOMERS IN PARTICULAR.

BACKGROUND

LIBERALIZATION OF INTERCITY TRANSPORTATION IN GERMANY

On January 1, 2013, the more than 70 year-old railway monopoly came to an end. According to the old law, no scheduled bus service could be approved if a parallel rail route was available. Now there is open competition; only local public transportation is protected, which is why intercity bus companies may only offer connections between cities that are more than 50 km apart. It is only in individual cases – when the availability of local public transport is insufficient – that intercity carriers can be approved for local routes. District offices and government steering committees are responsible for the approvals.



Other sectors can only dream of these growth rates. Trips on Germany's intercity buses have increased a full 230 percent in just a year. The business is humming. Since the liberalization of the long-distance bus market on January 1, 2013, the number of trips has risen from 1,540 per week at the start to 5,100. At the peak period leading up to Christmas, more than 100,000 passengers per day traveled by long-distance bus. Strong growth continues to be the trend. Since early 2013, the number of regularly operated lines has doubled from 62 to 138 and the number of companies soared to more than 40. Even discounter Aldi has a presence. Market leader "MeinFernbus" transported about 2.5 million passengers in 2013.

The trend has accelerated so rapidly that the Federal Association of German Bus Companies (bdo) commissioned three market studies from the

Berlin mobility consulting firm IGES in one year. "The liberalization of the intercity bus market shows how mobility needs can be met without public funds," says Christoph Gipp, area manager for mobility at the research and consulting institute IGES. The market researchers quickly came up with the figures: New companies are forcing their way into the market at a fast clip, hoping to get a piece of the pie. Accordingly, revenue expectations for 2014 are inexact – forecasts fluctuate between 300 and 600 million euros.

REGIONS WITH POOR INFRASTRUCTURES BENEFIT, TOO

Another of the researcher's findings is that the main beneficiaries are mid-sized cities in states like Baden-Württemberg and Bavaria and regions with

weak infrastructures such as rural Lower Saxony, where travel options have been in short supply.

Customers have no choice but to be thrilled with the growing competition. It is keeping prices low, punctuality high, and service (still) accommodating. Ticket prices, starting at 8 euros for a one-way trip, are enticing. The tiered pricing model, based on day of booking and demand, has long been familiar to travelers thanks to no-frills airlines. So it's no surprise that comparison portals have already sprung up on the Internet (busliniensuche.de, bussuche24.de and checkmybus.de). And the first discounts have already arrived – at carnival time, ADAC Postbus is offering 11.11 percent on all trips. The favorable pricing is not at the expense of safety. The buses are new; none are more than three years old. Equipped with numerous driver assistance systems, they are technologically up-to-date.



INTERCITY BUSES AROUND THE GLOBE

The biggest disadvantage is that travel times are much longer than those for all other means of transport. Travelers must have the time and know how to occupy themselves. That is just fine with the main target group, students and the young employed. Members of the "smartphone and laptop" generation have their friends with them wherever they go. They can also make good use of their travel time preparing for their next job – assuming their batteries hold up; 220-volt outlets are rare on buses. Different business models are trying their luck: Market leader "MeinFernbus" (39.7 percent market share) doesn't actually own any buses. It merely arranges the trips. Execution is handled by an association of midsized bus companies that can throw their long experience in the bus business into the balance. The ADAC is cooperating with Deutsche Post, and Deutsche Bahn is expanding the supply of its Bahn buses.

THE BOOM ALSO CREATES PROBLEMS

Supply will continue to grow significantly in 2014. "The potential of the intercity bus market is far from exhausted," says Alexander Edenhofer of ADAC Postbus. "We are sure that there are still many more travelers who are still riding on trains or driving cars, but who will choose intercity buses."

The boom also has its downside: Parking spaces are already scarce in many large cities. Due to major construction at its central train station, Baden-Württemberg's state capital Stuttgart has transferred intercity buses to suburban Zuffenhausen. This may be nice for Porsche customers picking up their new 911s at the main factory, but unfortunate for the majority of travelers who would rather arrive at the city center.

Christiane Leonard, managing director of bdo, is calling for changes: "In future, it will be important for intercity buses to have suitable terminals." In the bdo's view, this includes good connections to local public transport, protection from the weather, rest rooms, ticket and food sales and a supply infrastructure for the intercity buses.

The Warentest foundation has responded rather critically to the long-distance bus euphoria. "Only a portion of the operators offer snacks and drinks," according to the testers' first summary. "The rest rooms are very cramped." The seating distances are generally between 74 and 85 cm, which is less than on the train. But here is something much more important for the young, still limber clientele: Buses often have free WLAN access. Passengers can easily book their return trip online and, on the ADAC Postbus, those with a WLAN-capable device can even use the onboard media center to watch films or listen to audio files. Then time really does fly.

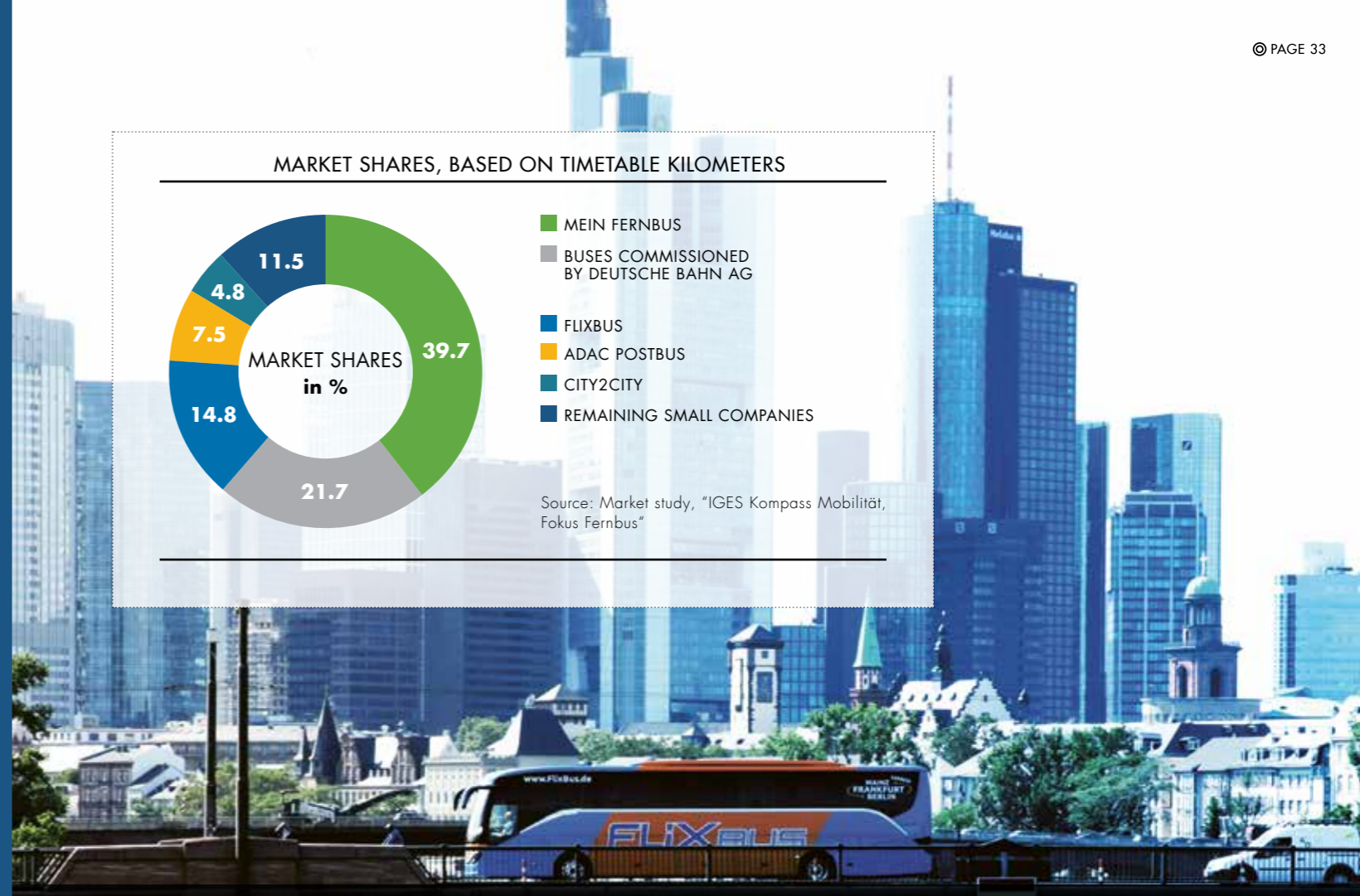
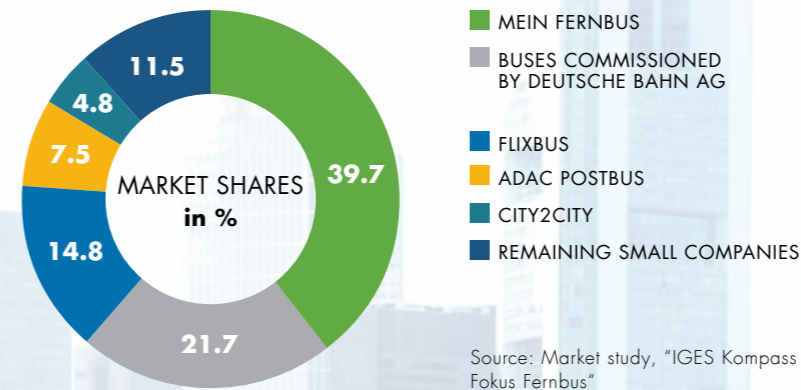
In the UK, Sweden and the U.S., intercity buses have been part of the normal street scene for decades. Since the Swedish and British transportation markets were liberalized in the 1980s, intercity bus lines have firmly established themselves in the transportation systems of these countries. Intercity buses have also been able to gain large market shares in Eastern Europe.

Numerous European destinations are tied to the Euro-lines Network, an association of 32 bus companies. The destinations include Berlin, Paris, Barcelona, London, Vienna, Warsaw and Istanbul. The network of routes meanwhile extends from Norway, through France and Italy, all the way to Greece, Portugal and even Russia. Morocco and Kazakhstan are two non-European countries covered by the network.

100 YEARS OF INTERCITY BUS TRANSPORT: GREYHOUND IN THE U.S.

The United States of America have the best-known intercity bus system in the world: Thanks to numerous Hollywood films, the famed Greyhound buses are very popular as they celebrate their 100th birthday this year. But instead of the elegant, silver-gray aluminum streamliners of the Scenicruiser model, the scene is dominated by functional, three-axle vehicles. The vast distances in the U.S. and somewhat patchy rail network coverage make a far-reaching network of bus lines necessary to serve locations near and far. By its own count, the company serves 3,800 destinations in the U.S. and Canada. With its more than 1,700 buses, Greyhound transports about 18 million passengers a year. It also has numerous subsidiaries. There is no mystery to its success. Greyhound is unmatched for its low prices. The buses travel at frequent intervals on popular routes. The carrier also cooperates with the American rail company Amtrak. The Internet has meanwhile become standard in new Greyhounds. New and in great demand, the City-to-City Express links major U.S. cities without stopovers and already features more than 100 destinations.

MARKET SHARES, BASED ON TIMETABLE KILOMETERS



TREND RESEARCH

CAR OR SMARTPHONE?

Young people find smartphones and tablets exciting. But does this mean the car has lost its place as a status symbol?



IS THE AUTOMOBILE LOSING ITS STATUS?

“IF YOU LIVE IN A CITY, YOU DON’T NEED TO OWN A CAR,” SAID WILLIAM CLAY FORD JR. IN NOVEMBER 2000. ESSENTIAL WANTED TO KNOW WHETHER THE CAR REALLY IS LOSING ITS SIGNIFICANCE AND ASKED PROF. DR. HOLGER RUST FOR HIS OPINION. THE AUTHOR OF TWO GLOBAL STUDIES ON THE ISSUE “YOUTH AND THE AUTOMOBILE” HAS A MORE DIFFERENTIATED VIEW OF THE FUTURE FOR GERMANY’S FAVORITE CHILD AND PUTS IT IN THE CONTEXT OF SOCIAL TRENDS. HE ARRIVES AT SURPRISING CONCLUSIONS AND PROPOSES SOME EXCITING THEORIES.

**CHANGES IN STATUS
HAVE MAINLY
PRAGMATIC CAUSES**

Longer periods spent in education, couples starting families later, limited-term employment contracts and high rents in city centers are part of daily life for many young people. This is a context in which the automobile initially loses its functionality. Consider young people below the age of 21 who are shaped by their urban ex-

periences. If you ask them about the importance of consumer goods, they will give the automobile a secondary role. But if you ask the same people about their future, their family and the time when money will no longer be a restriction, the automobile reclaims its position. From a consumption standpoint, young people still see cars as features of a fulfilled life.

Their status shifts for pragmatic reasons – potentially toward car sharing. But the brands of the cars shared definitely matter to the users – whether it is a Mini, smart or Korean vehicle makes a

huge difference. The issue of status is implicitly tied to the issue of mobility.

**NO POST-MATERIALISTIC
LOSS OF STATUS**

In the context of automotive history, the importance of status is rather on the increase in established markets. Three decades ago, a VW Passat was known as a “Pampers bomber”. Today, station wagons need to exude, above all, elegance. And, although



FACT CHECK

- ▶ IN 1995, 48 PERCENT OF GERMANY'S NEW-CAR BUYERS WERE YOUNGER THAN 45 YEARS OF AGE – and the current figure is just 27 percent. However, the proportion of people between the ages of 20 and 40 in the general population has declined sharply – from 32 to less than 25 percent.
- ▶ BETWEEN 2003 AND 2012, the number of private registrations fell by 25 percent. But if you adjust the new registrations for the effect of the scrapping bonus in 2009, the decline comes to just 4 percent.
- ▶ PURCHASING BEHAVIOR HAS UNDERGONE MASSIVE CHANGE: Between 2003 and 2012, new registrations of cars in commercial use rose 60 percent. Because nearly every company car ends up in private hands after the typical three-year usage period, the number of private changes of ownership has increased sharply. In 2012, more than 6.5 million owners were pleased to take delivery of their “new” used cars.
- ▶ THE RESULT is that the passenger car fleet has increased by 2.3 million vehicles in the last five years, reaching the record figure of 43.4 million. That works out at 525 cars per 1,000 German citizens. In 2008 – before the global economic crisis – it was just 500 vehicles. That represents growth of 5 percent in just four years.

formerly purely utility, farming and forestry vehicles, the SUV's position as a status symbol is evident every morning in front of elementary schools and kindergartens. But there are still more trends: The customizing scene is growing and has become global. In America, the “import car scene” is very popular, picking up on elements of Manga comics and computer games. The movement has its source in young people from third-generation Asian immigrant families. Pimped-out versions of the Mazda RX-7, Nissan Skyline GT-R and Mitsubishi Lancer Evolution are all cult vehicles. There is also an inner-city scene in Germany, where individualized cars are a big deal. Worldwide, the classic car scene is primarily the preserve of the affluent. Motor-Talk is one of the fastest-growing online activities, with more than 2 million members registered in Germany alone and at least 15,000 online at any given time.

THE MEANING OF STATUS IS CHANGING

Status is a free-floating currency that can refer to changeable things within a product category. For example, around four years ago, someone came up with the idea of putting a Rolex GMT Master onto the Net. Its characteristic metal-link wristband had been removed and replaced with a cheap fabric band, the so-called NATO strap. A cascade was soon underway, and the Rolex with the NATO strap is now a fashion statement. Tudor, Rolex's second brand, equipped its “Heritage Chrono” in the sales brochure with the strap. You could characterize the motive behind the change as “breaking away from the classic.” Around the world, you can frequently see this in informal housing designs, the use of second-hand furniture or pride in signs of wear and tear in the likes of torn jeans. This is also seen in the automotive world. At an auction in January 2014, two examples of a black Mercedes 300 SL manufactured in 1956 were

sold at a public sale. One was a completely restored vehicle and the other showed the traces of 60 years of use. The car with the patina sold for 1.4 million euros – 400,000 euros more than the totally restored car. The status of an automobile is not linked one-dimensionally with its value. According to American analysts, the Toyota Prius is considered “the ultimate status symbol in eco-luxury”.

THE STATUS OF THE AUTOMOBILE WILL GROW WORLDWIDE

Many people in European cities have certainly had their fill of the continuous search for parking spaces. But we see the opposite situation in Chinese cities. There, people would rather spend six hours in traffic jams in the long-wheelbase version of an Audi or BMW than jam themselves into a subway. This mainly relates to status. If the issue in India had been purely mobility and not status, the Tata Nano would surely have been a success. We assume that the importance of the automobile will tend to increase worldwide over the next 10 years. In countries with a high degree of mobility, growth will come mainly from women, who are similar to men in these matters. And let's not forget

senior citizens. An important part of engineer-driven usability research deals with individual, age-related mobility. In developing countries, such as India, China and Brazil, this is rather an overall social trend. No-where is the automobile's importance greater than in Russia. And no city has as many traffic jams as Moscow has.

THE IMPORTANCE OF SUSTAINABLE MOBILITY FOR YOUNG PEOPLE IS OVERSTATED

The ecological factor may be important, but it is not a top priority. This can be seen when people throw away things like smartphones that are still functional as soon as something new comes along. Young people are barely interested in alternative power-trains or solutions that could drive the mobility of tomorrow. They reflect only what is currently being discussed in the media. Their attitude is that industry should deal with bringing solutions to the market, and we will see whether we accept them or not. There are no technological preferences. It is not least because of this that BMW is striving to use status to introduce electric mobility. Because status works.

TRENDS IN STATUS SYMBOLS ARE DEFINED VIA THE WEB

This is the result of communication in images – spanning the globe in a matter of seconds via millions and millions of blogs, social media activities and websites. Technology facilitates quick agreement on the aesthetics of life. Young people are wearing hats again and particular lifestyles are echoed worldwide in certain milieus. Folding bicycles from the '70s – without gears – are suddenly considered cool. Blogs such as “FreundevonFreunden” cultivate and spread styles worldwide – but they change every second. The cultures of trends and taste on the Web show that something can happen at any time in the next few seconds and it can change the entire world. Suddenly a product pops up somewhere and becomes an icon, like the '50s-era “Loft” workshop lamp designed by Jielde. By its own count, Tumblr had more than 170 million blogs in February 2014. And then there are networks such as Pinterest and others. Roughly speaking, this translates into more than 35 or 40 million blogs on fashion and aesthetics. Every day there are umpteen million images

posted. Content analysis shows that the automobile is an indispensable, design-oriented feature of a beautiful life. One of the most-posted car models is the Porsche 356 – a design icon from the '50s and '60s. Fashion movements are oriented to these kinds of visions, less so to technology.

A NEW AESTHETIC STANDARD CAN BRING ABOUT A PARADIGM CHANGE – AND CREATE A NEW STATUS.

Things have cultural potency, and they change our lives. A new aesthetic standard coupled with ease-of-use can cause a paradigm change – and create new definitions of status. Apple's success story is proof. It shows that a new standard must be set in function, technology – and above all – aesthetics.

In Web communication's own dynamic (i.e. where people have not yet tried or managed to use mathematical algorithms to fix commercial shackles to the Web) this can even happen unintentionally: Without anyone really envisaging or asking for it, a product can be identified with a cultural trend by inadvertently picking up on that trend. We have to live with this form of reverse marketing – the development of tastes will be increasingly anarchic and hard to predict, but also inspiring.

THE AUTO INDUSTRY MUST CAST ITS CULTURAL NET WIDER

A company whose policy is to innovate must always pose the question: How deep are we reaching into the layers of cultural conventions, where are they similar worldwide and where do they differ? And how can we exploit this for our products? A product that is ours must always be considered as a cultural product. Experiences with Big Data and hardcore mathematics show that we are approaching the limits of what is calculable, i.e. where the cultural dynamic develops independently. Commercial adventure and wealth lie beyond this boundary. Fulfilling old needs anew with surprising things – that is the way.

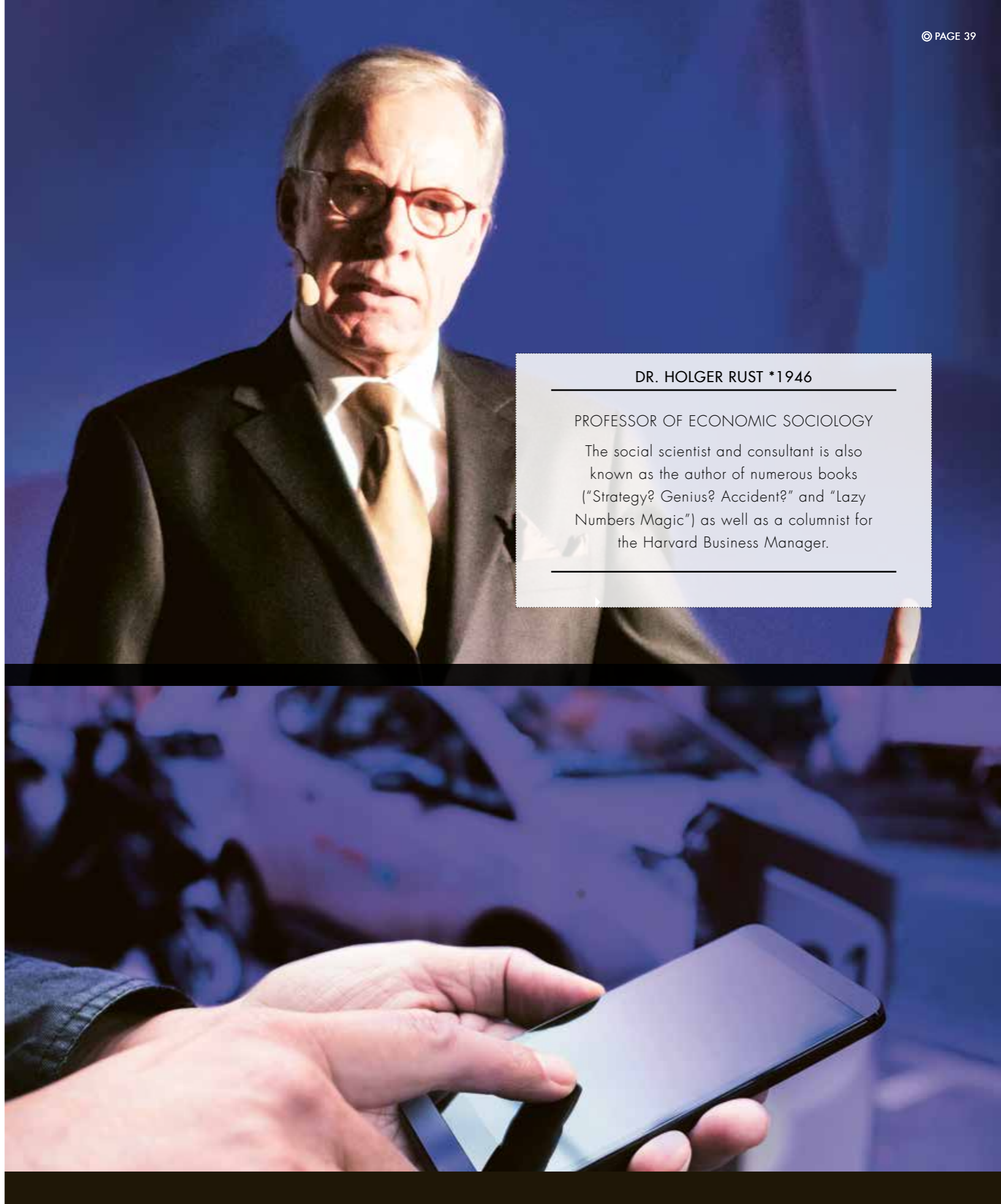
THE AUTO INDUSTRY STILL HASN'T FOUND ITS WAY

The uniformity of ideas for the future is surprising. You should not ask customers about it, as they do not know what is possible. Ten years ago, no one asked for a mobile telephone without a keypad. Industry must have the courage to devise technological solutions on a cultural basis and pose questions that delve more deeply: What basic needs must actually be met? One possible answer could be to transform cars into mobility concepts. But that is just one.

The path to "Google-ization" or "Apple-ization" must be examined with a critical eye. Overdoing the technology in vehicles is producing a bubble. If technology continues to be a driver and uninterrupted innovations result, cars will no longer have resale value. A car driving around that is 50 or 60 percent computer will be out of date in just a few years. And its value will be annihilated.

THE AUTOMOBILE'S LOSS OF STATUS – MEDIA HYPE?

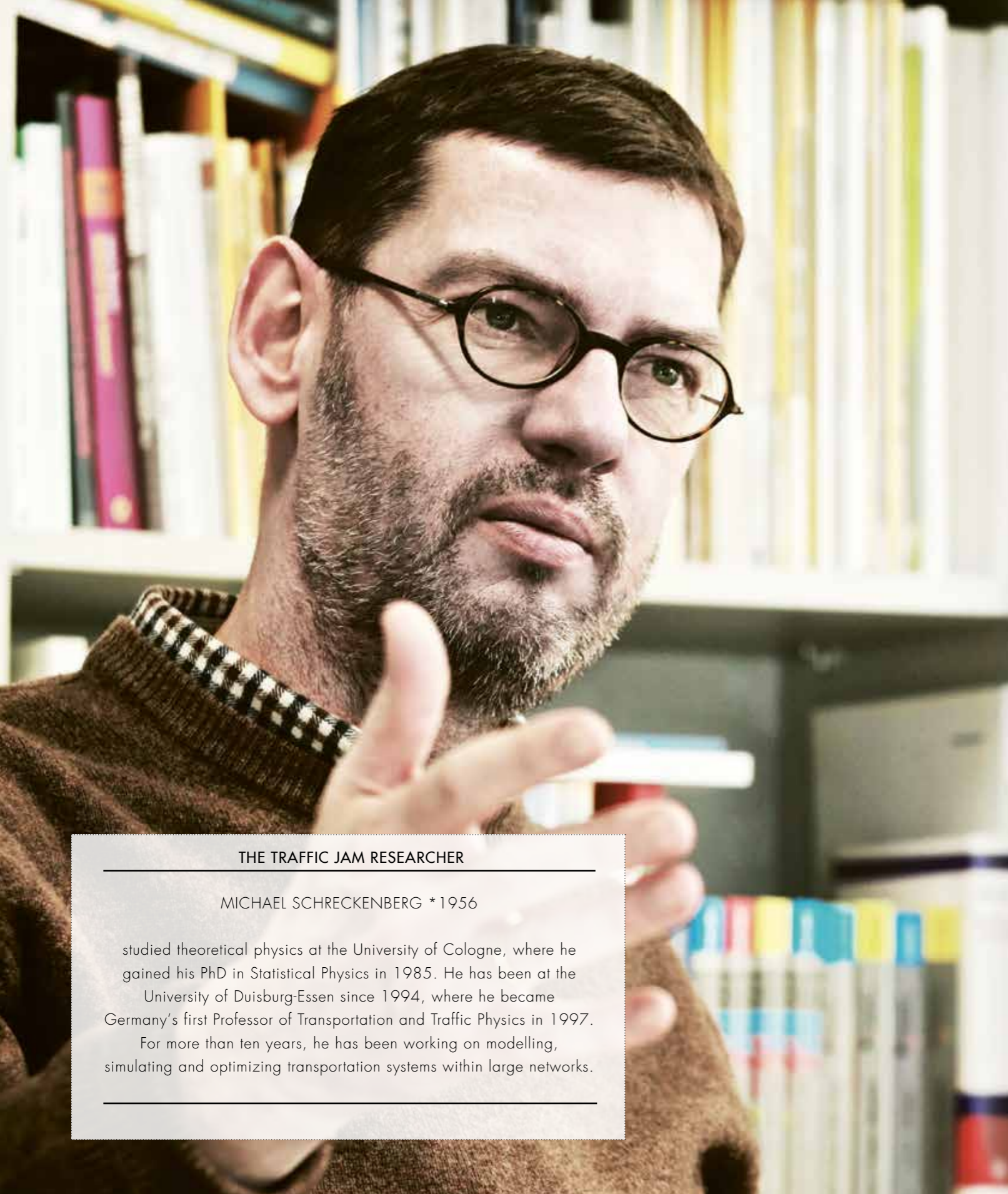
Reports that an item like the automobile is losing its status naturally seem especially dramatic – after standing for our core industrial competence and for our society, culture and economy for more than 50 years. But to conclude that things are actually changing fundamentally is too superficial an interpretation. Consider this: Many studies and publications primarily have the – altogether legitimate – goal of generating public attention. For example, less than 0.5 percent of the population is vegan, but as a proportion of food reporting, coverage of the vegan diet is 20 percent. Content that challenges the old order is always welcome. And this raises the question of whether reporting on the automobile's loss of status isn't one thing above all else – media hype.



DR. HOLGER RUST *1946

PROFESSOR OF ECONOMIC SOCIOLOGY

The social scientist and consultant is also known as the author of numerous books ("Strategy? Genius? Accident?" and "Lazy Numbers Magic") as well as a columnist for the Harvard Business Manager.



THE TRAFFIC JAM RESEARCHER

MICHAEL SCHRECKENBERG *1956

studied theoretical physics at the University of Cologne, where he gained his PhD in Statistical Physics in 1985. He has been at the University of Duisburg-Essen since 1994, where he became Germany's first Professor of Transportation and Traffic Physics in 1997. For more than ten years, he has been working on modelling, simulating and optimizing transportation systems within large networks.

TRACKING DOWN TRAFFIC JAMS

HUMANITY IS IN A TRAFFIC JAM. CITIES HAVE BEEN IN GRIDLOCK FOR SOME TIME. AN OPEN HIGHWAY IS THE EXCEPTION RATHER THAN THE RULE – OR AT LEAST IT FEELS THAT WAY. ARE THE MANY TRUCKS OR THE RISING NUMBER OF CARS TO BLAME? ESSENTIAL ASKED DR. MICHAEL SCHRECKENBERG, PROFESSOR AT THE UNIVERSITY OF DUISBURG/ESSEN, WHO ANALYZES TRAFFIC JAMS SCIENTIFICALLY AND LOOKS INTO THEIR CAUSES AND BACKGROUND.

PROFESSOR SCHRECKENBERG – WHO IS TO BLAME IN A TRAFFIC JAM?

SCHRECKENBERG: It of course comes as no surprise that back-ups are the result of traffic density. But more traffic jams occur than necessary due to drivers and their behavior. All it takes is a brief moment of inattention while driving to set off a chain reaction and everything slows down.

WHAT IS HAPPENING THERE?

SCHRECKENBERG: An inattentive driver following too closely only needs to slow down for a brief moment. But the one behind him has to brake sharply, and the next one even more sharply. This carries on rearward like a shockwave – at about 15 kilometers per hour against the

direction of travel. And further back, drivers have to stop without realizing why. This has been simulated under test conditions.

ON A COMPUTER?

SCHRECKENBERG: Much more practically. A few years ago, a university in Nagoya, Japan, had 22 drivers travel on a 230-meter circuit. So there were about 10 meters of traveling space available for each car. You would think that would be enough room. The instruction was to follow at a distance of a few meters at a moderate speed. But in each instance, it did not take long for the column to come to a halt. As soon as one driver moved more slowly – perhaps because he looked in the rear-view mirror or adjusted the

radio – the traffic cascade began and everything came to a standstill. And that is basically how it works every day on the autobahn.

AND WHY IS THAT SO DIFFICULT FOR DRIVERS?

SCHRECKENBERG: It involves a mix of psychological and physical factors. A high traffic volume is a very sensitive situation physically. And our psychology often tips the scales on how we react and the consequences.

CAN'T IT BE OUTSMARTED?

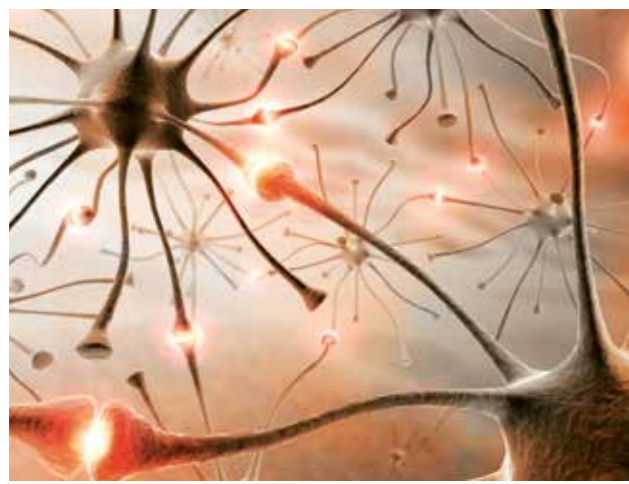
SCHRECKENBERG: It's worth taking a look at the animal world. If the "traffic" on ant roads becomes denser, the ants just accelerate. And those who aren't keeping up step out of the line to make room for the others. But ants



have no brain, no psyche, only neural nodes, and are focused like robots on one task: increasing the transport volume of the group. This form of cooperation is apparently impossible in humans – despite the fact that commuters, in particular, virtually shut down major parts of their brain in traffic.

PARDON ME – COMMUTERS SHUT DOWN THEIR BRAINS ON THE WAY TO WORK?

SCHRECKENBERG: The brain is the human organ that consumes the most energy. And since humans in the course of evolution have learned that energy must be saved where possible, the brain is the first organ to “shut down.” Magnetic resonance imaging can demonstrate



IN ENERGY-SAVING MODE IN A TRAFFIC JAM
Synapses in the cerebrum

that, for routine movements, the brain of a commuter functions only in energy-saving mode. This means that if something changes, it takes time for commuters to react. In one case, the speed limit was lowered from 120 to 80 km/h. Within 48 hours, 1,500 driver’s licenses had to be seized due to excessive speed. The commuters had not noticed the change on their regular route.

WHAT CAN WE LEARN FROM THE ANTS?

SCHRECKENBERG: With the help of electronics, we could link cars with one another and have them drive the way ants move. The question is, to what extent are humans willing to participate? In any case, networking technology makes sense. Our simulations show that you can prevent between 10 and 20 percent of traffic jams with just 5 percent networking. The fact that cars move synchronously like a herd of animals also promotes cooperation among road users – an important prerequisite for flowing traffic.

ARE CONCEPTS AND TECHNOLOGIES FOR AUTONOMOUS DRIVING LIKE THOSE THAT DAIMLER AND GOOGLE RECENTLY PRESENTED A STEP IN THIS DIRECTION?

SCHRECKENBERG: Definitely. But you have to allow for two aspects. On one hand, current plans call for autonomous driving to be limited to 45 minutes. Afterwards, the driver must take control again, although he has not been driving and should actually be relaxed. The reason is that humans have a hard time letting themselves be driven for more than three-quarters of an hour, sitting still and nonetheless staying focused. That is difficult to handle mentally. And then the legal dimension comes into play.



STILL MANY QUESTIONS TO BE ANSWERED
Autonomous driving

As a driver, I continue to be responsible and liable if my car hits something. So I must remain just as focused as if I were driving myself.

SO WITHOUT PEOPLE, NOTHING WILL REALLY MOVE FORWARD?

SCHRECKENBERG: You can already recognize a high degree of cooperation in commuters. They are all in the same boat. But I see risks. Distraction reduces attentiveness and thus the willingness and capacity to cooperate. In vehicles, our attentiveness declines when we look at our navigation system, cruise control or climate control system. And more controls are always being added. Just think about the apps that are now making their way into

the automobile. There would actually be 500 pages of instructions to read – but people would rather try everything out while driving. The distractions not only increase the risk of accidents, they also bring the traffic flow out of its rhythm – as in the Nagoya test. But in all honesty, you have to say that our traffic system is not designed for cooperation.

IN WHAT WAY?

SCHRECKENBERG: Our traffic system relies on discipline. There is a very nice experiment with dogs. It involved one group of dogs that was disciplined – these animals had to sit still for a half an hour. Another group of dogs was allowed to run free. Both groups of dogs were then led by a cage where an aggressive dog sat. The disciplined dogs also reacted aggressively, while the other dogs were not really interested. That is what it is like in traffic jams or at construction sites and reduced speed zones. People are initially disciplined and then, after the construction site, they have the feeling that “now I can really step on it”. But that is exactly the wrong approach.

SO FEWER RULES FOR FEWER ACCIDENTS?

SCHRECKENBERG: Fifteen times more accidents occur below a prescribed speed limit than above it. When I am allowed to drive 100 km/h, I drive 100 km/h – whether that is particularly appropriate or not. And a German also says: I have the right of way – I insist on it! Planning too often ignores people. A sign is put up ahead of an environmental zone and you are not allowed to drive into it. But it could well be that pollution on that particular day is minimal. I have proposed putting up variable signs that take the degree of air pollution into

consideration. But the response was that this shows no understanding of people – that it is too complicated. Even on the autobahn, variable speed limits with explanations lead to greater understanding and less tension.

WHAT ROLE CAN TRAFFIC GUIDANCE SYSTEMS PLAY?

SCHRECKENBERG: First of all, navigation devices and radio traffic reports mean we have more traffic jams, because they occur on the bypass routes where no one previously drove. It is best to stay on the main route. Many signs are just nonsense, because the capacity of the secondary road network – i.e. federal, state and district roads – is so small that it does not pay. The speed in an autobahn traffic jam is about 10 km/h. But that is still faster than driving on overloaded country roads.

WHAT ARE YOUR FORECASTS FOR FUTURE ROAD USAGE?

SCHRECKENBERG: Truck traffic will continue to grow. One truck wears out roads about as much as 60,000 cars. The near future will be marked by massive reconstruction work. We have neglected traffic infrastructure for 40 years, especially the bridges, and this will dominate the traffic situation over the next 15 years.

AND FURTHER INTO THE FUTURE?

SCHRECKENBERG: That will take care of itself. Individual transportation is becoming very expensive, especially in cities. Fewer and fewer people are able to afford their own car – or want one. So we are coming back to the beginnings of the trend: Individual auto-mobility will only be available to the privileged. Peak oil will soon be surpassed – think about the Chinese who are registering more cars than all of Europe. And they are all fueled with gasoline. Another factor is demographic change. The mobility behavior of the older generation is taking a different form. Older people will take intercity buses because they are cheaper and more comfortable. It will be important for our society to create the necessary infrastructure and invest massively in the expansion of the local public transport system (ÖPNV).

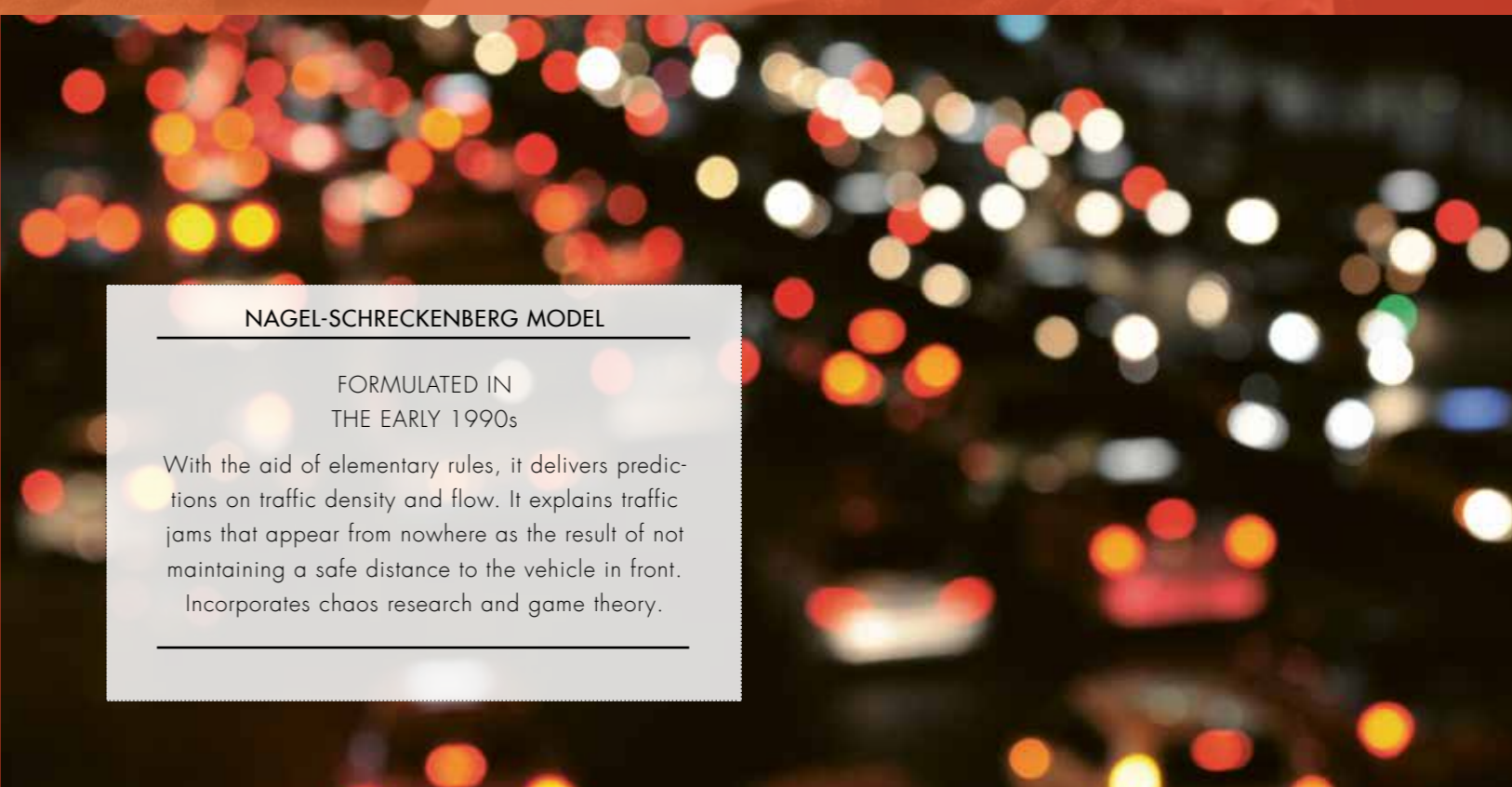


TRAFFIC JAMS
WORLDWIDE
KEY FACTS

- ▶ TomTom, the manufacturer of navigation devices, has calculated how much time commuters who would have a 30-minute travel time to work on clear roads spend in traffic jams every year. In Stuttgart, the figure is 86 hours, in Hamburg 78 hours and in Berlin and Munich 74 hours.
- ▶ The European traffic-jam capital is Moscow. In the morning rush hour, it takes 114 percent longer to travel by car and as much as 133 percent longer in the evening commute than it would if the roads were clear. Per year, the extra time required in Moscow each year for a 30-minute commute is 118 hours.
- ▶ Other cities on the rankings of European cities are Istanbul, Warsaw, Palermo, Marseille, Rome and Paris. Stuttgart lies in twelfth position on the European league table.
- ▶ In Germany traffic jams result in annual costs of 7.8 billion euros – 533 euros for each commuter household. Driving the costs are lost time (4.8 billion euros), increased cost of goods (2.1 billion euros) and additional fuel consumption (824 million euros).
- ▶ In 2012, São Paulo suffered one of the worst traffic jams in history. Due to strike action by subway workers, five million people were unable to travel to work in the usual manner. The result was gridlock on 249 kilometers of the city's roads.



PROF. DR. MICHAEL
SCHRECKENBERG
TRAFFIC RESEARCHER



NAGEL-SCHRECKENBERG MODEL

FORMULATED IN
THE EARLY 1990s

With the aid of elementary rules, it delivers predictions on traffic density and flow. It explains traffic jams that appear from nowhere as the result of not maintaining a safe distance to the vehicle in front. Incorporates chaos research and game theory.



SMOOTH RIDE

URBAN MOBILITY SOLUTIONS REQUIRE MORE THAN JUST TRANSPORTATION FROM POINT A TO POINT B. THEY MUST BE SAFE, EFFICIENT AND ABOVE ALL COMFORTABLE. THIS ALSO APPLIES TO RAIL VEHICLES. WITHOUT SMART VIBRATION DAMPING, RIDING ON RAILS WOULD BE ANYTHING BUT PLEASURABLE AND RELAXING.



Cars and buses have a relatively easy time ensuring acceptable levels of ride comfort. Pneumatic tires absorb the slight unevenness that produces rolling noise and vibrations. The suspension only needs to balance out the unevenness of really rough pavement. By contrast, the wheels of rail vehicles are made from high-quality steel, so noise and vibration damping is left solely to the train's "chassis", the so-called bogie.

COMFORT ON THE RAILS

The specialists at Freudenberg Schwab Vibration Control use individualized solutions to bring a

smooth ride and stability into the bogies of modern railways. For example, Schwab developed all the vibration-relevant components that guarantee the comfort and safety of Stadler Rail AG's low-floor multiple unit known as FLIRT (Fast Light Innovative Regional Train).

Chassis for passenger trains feature primary and secondary suspensions. The primary suspension is located between the wheel set and the chassis frame, and the secondary suspension between the chassis frame and the railcar body.

For the primary suspension, Schwab provides buffer stops, axle bearings and spring washers. These components handle sound de-coupling be-

tween the wheel set, the bogie and the wheel guides in longitudinal and transverse directions. The tasks of the secondary suspension are more complex. They ensure comfort and quiet operation. Vertical and lateral buffeting must be offset. At the same time, it is essential to ensure the displacement of the chassis toward the body through bends. Here, vibration specialists from Swiss company Adliswil turned to a combined air/rubber suspension. The system is secured with an integrated emergency spring, which guarantees a safe ride even if air pressure fails. Joint rods and other rubber-metal components round out the vibration control package, which has proved successful with customers throughout the world.



PEOPLE MOVER WITH PNEUMATIC TIRES

Not all rail vehicles ride on steel wheels. Manufacturers like Austria's DCC Doppelmayr Cable Car have turned to pneumatic tires for passenger transportation such as those used for connections between terminals at airports. Engineers at Freudenberg Schwab Vibration Control developed an impressive comfort package for

these people movers as well. For example, a cable-drawn railway is also a component of the newly opened Hamad International Airport in Doha, the capital of the emirate of Qatar. On a 500-meter stretch, two trains per hour and per direction each transport 6,000 passengers at a speed of 45 km per hour. Air suspension systems with a lateral buffer balance out disruptions from transverse movements and differences in cable lengths. A stabilizer absorbs the radial and torsional forces resulting

from rolling motion. Multifunctional spherical bearings serve as connecting elements between the individual railcar bodies and absorb the shearing forces through bends. Thus, airline passengers in Qatar glide along comfortably on rails and enjoy the view of the desert landscape through the panorama window of the futuristically designed Cable Liner Shuttles without being disturbed by noise and vibration.


 NEWS

CHANNEL



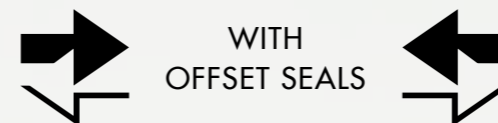
UPSIZING

WITH A LARGE DIAMETER

Since the end of the 1990s, **magnetic multipole encoders** have been standard equipment on many passenger cars. They are used to transmit information on wheel speed to the ABS control unit. For diameters between 60 and 80 mm, this is extremely precise due to exact angle division. But the signal senders are increasingly in demand for applications involving larger dimensions. Not just from the automotive industry, but increasingly from other industries, such as manufacturing systems.

Larger diameters produce greater centrifugal forces, which in turn subject the material to higher stresses. The magnetic requirements also increase: Compared to conventional dimensions, the distance between the encoder and the sensor often triples. Therefore, Freudenberg Sealing Technologies engineers developed the tools for its forming and magnetizing processes to accommodate encoders with a diameter of more than 200 mm. As a result, **upsizing** is no longer a problem.

MULTITASKING



Offset Seals are the right solution when components must be simply, quickly, securely and cost-effectively connected with one another. Whether for engine covers, engine blocks, oil pans, sensor brackets, spark plug seals or other engine components, **Offset Seals are recommended as extremely cost-effective connectors.** They consist of two metal rings in any desired form at the inner and outer diameter. The rings are insert-molded and connected with one another using an elastomer compensator. The multifunctional connectors can handle three tasks: positioning and sealing within the bore, compensation for axial and radial center deviations; and positioning and sealing of the plug-in piece. This multitasker can also be individually designed for the respective connection points. Offset Seals reduce heat transfer, vibrations and mechanical stresses. The simple integration of stops and mounting limits allows both manual and automated installation processes.

Offset Seals are right in step with the philosophy of coupling functions. They enable the simplification of existing solutions or the discovery of completely new options. By way of example, Offset Seals provide the perfect seal for the bores for spark plugs and camshaft sensors in camshaft covers. The elastomer compensator minimizes the cover's mechanical stresses on the sensor. Furthermore, the precise fit enables the elimination of screw fasteners. Offset Seals are suited for use as connectors and compensators for the **low pressure range to 1.4 bar and for operating temperatures from -40 °C to +150 °C.**



35TH MOTOR SYMPOSIUM

LEVITEX AT CENTER STAGE

The **35th International Motor Symposium is taking place on May 8 and 9 at the Vienna Conference Center.** Experts from around the world will discuss the latest findings in engine and transmission development, future legislation and fuels and components. In light of new European Union limits on CO₂ emissions, automakers and suppliers have been called upon to exploit further the potential of the internal combustion engine. **Levitex, a gas-lubricated mechanical seal,** is the highlight of the Freudenberg Sealing Technologies (FST) stand. It enables reductions in CO₂ emissions of between 0.5 grams and 1.0 gram per kilometer. The first Levitex seals are functioning on test stands and in customer prototypes. Series production is planned for 2017.



KURT ZIMINSKI
 GENERAL MANAGER OF THE GLOBAL SPECIAL
 SEALING PRODUCTS DIVISION IN REICHELSCHEIM



ADDED VALUE THROUGH DIVERSITY

ONE THING IS CLEAR TO KURT ZIMINSKI, GENERAL MANAGER OF THE GLOBAL SPECIAL SEALING PRODUCTS DIVISION IN REICHELSCHEIM: "WITH OUR WIDE VARIETY OF PRODUCTS, WE ALWAYS CREATE ADDED VALUE FOR OUR CUSTOMERS. AND THAT IS OUR RECIPE FOR SUCCESS." THE PRODUCT PORTFOLIO IS INDEED IMPRESSIVE. BUT WHAT IS SO "SPECIAL" ABOUT SPECIAL SEALING?

This American manager, who has been head of the global division since January 2011, takes just a moment to consider. "The 'special' part is that we do not focus on specific products or markets. We ask ourselves: Where can we take our material, product and process expertise and use it to create added value for customers by offering solutions to problems?" Thus, the division – which has five locations in the United States and Europe in addition to its headquarters in the Odenwald – supplies companies from 18 different segments, ranging from the automotive and aerospace sectors to process industries and everything in between. Its philosophy is to work closely with the customer to develop and produce the ideal solution to a specific sealing problem. To use its resources as efficiently as possible, the global division is divided into

five Lead Centers. Three of them have their main offices in Reichelsheim.

FOR GOOD TASTE

The Lead Center Special Sealing Industry (SSI), for example, works with food & beverage and pharmaceutical companies. This industry faces huge requirements in cleanliness and hygiene. Whether beer, milk or chocolate is being produced, all seals have to withstand abrasive chemicals and high temperatures during the cleaning of bottling equipment, separators and special pumps. There is also the risk of flavor transfer. For example, the drink dispensers of an American fast-food restaurant fill paper cups with root beer, cola or lemonade, depending on which button is pushed.

The development of sealing rings that are resistant to flavoring agents keeps root beer from tasting like a cola and vice-versa and provides a high level of sanitization.

All the departments within Lead Center SSI have been consolidated under one roof since July 2013. Ziminski expects the new building in Reichelsheim to create valuable synergistic effects. "Nowhere else do we have this kind of close relationship between production and development."

AUTOMOTIVE HIGH-TECH

50 percent of the division's products go to the automotive industry. The U.S. native, who worked at the di-

KEY FACTS

FREUDENBERG SEALING TECHNOLOGIES,
 REICHELSCHEIM

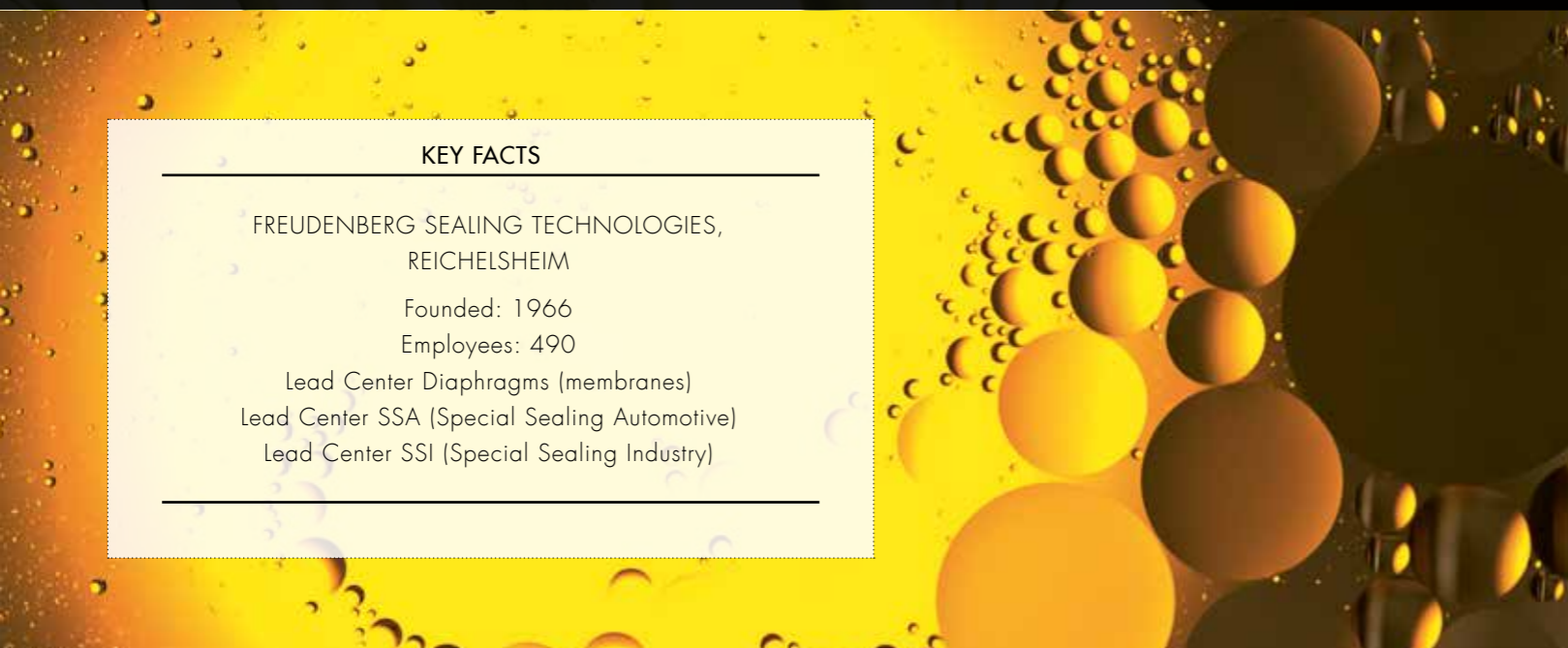
Founded: 1966

Employees: 490

Lead Center Diaphragms (membranes)

Lead Center SSA (Special Sealing Automotive)

Lead Center SSI (Special Sealing Industry)



vision's site in Morristown, Indiana, before coming to Reichelsheim, is particularly proud of one of the center's latest developments: an innovative seal for high-pressure gasoline pumps. "Our Duo Forseal withstands more than a billion piston strokes at a frequency of 200 Hertz." The piston pressure accumulator for advanced DSG gearboxes is also a real showcase of expertise. "Customers who look at the component often ask me what it has to do with sealing technology and why we have something like that in our portfolio. The answer is: We're the only ones to get this type of pressure accumulator leak-tight. And we are reluctant to divulge this knowledge."

PASSION FOR NEW SOLUTIONS

ALWAYS SPECIAL – BE IT FOR SPACE OR A FAST-FOOD RESTAURANT

Ziminski sees even more room for growth in the auto industry. "There are at least four of our products installed in SCR pumps alone. They inject AdBlue® into the exhaust systems of diesel engines, reducing emissions. Thanks to our materials expertise, we can deal with the special demands of the corrosive urea." For example, small-format Plug & Seals are used for the intake and outlet lines of the SCR pump.

The Lead Centers Diaphragms focuses on membranes – the smallest membrane is for a fluid valve and has a diameter of 5.4 millimeters. The biggest membrane is used in a mud pump in mining and measures a proud 1.1 meters.

"The different sizes are just one as-

pect of our diversity," sums up the business studies graduate, whose interest in sealing technology has developed into a real passion over 17 years with Freudenberg Sealing Technologies. "I am fascinated by the different applications and the variety. We are currently working on a manufacturing process that enables us to make parts with media-repellant and crystal-blocking surfaces. The application possibilities for this technology are virtually limitless – from automatic coffeemakers to oxygen equipment for scuba divers."

The Lead Center "Liquid Elastomers", part of the Global Special Sealing Products Division, is headquartered in Tillsonburg, Canada. Seals for the aerospace industry are developed and produced here; Ziminski is especially proud of these sophisticated aerospace products: "No sector has more stringent approval criteria." It also has expertise in developing solutions to down-to-earth problems. For example, it was able to help the supplier of ovens to the "Kentucky Fried Chicken" fast-food chain. Hot chicken grease damaged seals to the point that they showed signs of breaking down after only a few days. With a special FKM-based seal, the replacement interval was extended to more than six months.

The Special Sealing Division's sealing expertise creates added value everywhere, be it in aerospace, the automotive sector or process industry.



TIRELESS ENVIRONMENTAL ACTIVISTS

About 140 million special seals are manufactured at the Reichelsheim site each year. Solvent vapors are produced during the cleaning, coating and drying of their metallic carrier parts. The vapors not only have an unpleasant smell – they can contaminate the environment as well. As a result, the cleansing of discharged gases is a top priority. Since 2012, the Global Special Sealing Products Division has relied on an **innovative biological facility**, which consumes only a fraction of the energy that a conventional facility needs to burn up solvent vapors.

The discharged gases are first guided through an active charcoal filter before a washer transforms them into a liquid state. Then the fluid reaches one of four large aluminum containers. These containers are filled with bark mulch, which is home to millions of micro-organisms. The liquid waste gas provides Freudenberg's tiniest employees with energy and carbon. **They convert the discharged air into water, energy and carbon dioxide.** The bark mulch has to be replaced every five years. It is a perfect example of sustainable environmental protection. And energy is needed only for the operation of fans and pumps.



OCCUPATIONAL SAFETY WITH FORMULA ONE TECHNOLOGY

Thanks to carbon, Reichelsheim employees no longer have a "weight problem": Previously, they had to push carrier parts for mini Plug & Seals on metal trays weighing 4.5 kg into a molding machine. That translated into a load of 1,100 kg per shift for each worker. Günter Ziegler, manager, Process Technology, considered that an intolerable situation. Working with his team, he looked for an alternative material for the trays. The first ideas, involving carbon fiber, were quickly scrapped since the material cannot withstand the machine tool's high temperatures, which can climb to 185° C. A solution finally came from a mixture of various plastics combined with carbon – an approach used in Formula One racing. The extraction trays weigh just 1.5 kg. The new trays offer an advantage beyond a substantial easing of employee workload: "If the old trays were placed on hot tools, they expanded in the heat and often jammed together," explains Christian Rathke, a process technician. "That no longer occurs with the carbon trays."





PATTONAIR GOLD STANDARD AWARD

Almost no other sector matches the aerospace industry when it comes to a critical need for zero defects and absolute functional stability – making multiple supplier awards from aerospace companies all the more significant. For the third time since 2010, Freudenberg-NOK Sealing Technologies (FNST) has received the coveted “Pattonair Gold Standard Award.” With the latest award, the British firm Pattonair, a leading global supplier of supply chain services to the aerospace and armaments industries, **has recognized the dedication of the Freudenberg customer service center in Lutterworth in the UK.**

“This award stands for the tireless commitment and the outstanding support from the Lutterworth facility, with whose help our business has grown and will continue to grow,” said Pattonair Purchasing

Director Craig Pilling at the award ceremony last December. The British subsidiary of Freudenberg provides aerospace companies with sealing components for engines, landing gear, wheels, brakes and flight propulsion systems and is certified under the stringent ASEN9120 standard.

Scott Wilson, key account manager for aerospace at Freudenberg-NOK, considers the award a milestone following five years of intensive process optimization. “We are sparing no effort to understand the problems confronting the customer as well as possible. This is the basis of extremely good cooperation.”

The “Pattonair Gold Standard Award” is bestowed annually for outstanding performance in customer service, technical support and delivery.



FREUDENBERG SEALING TECHNOLOGIES
INVESTS IN ITS OBERWIHL FACILITY

Freudenberg Sealing Technologies has invested **4 million euros** in its Oberwihl facility **for new production halls and factory infrastructure**. A second phase will see the investment of further 5.8 million euros. The renovation, which is scheduled to be completed in three years, is designed to add more than 1,000 square meters of production space. Safety at work, process improvements, increased cleanliness and new road access are among the top priorities. The plant, which is more than 60 years old, mainly produces O-rings for industrial and automotive customers. This field is expected to see continued growth. “With this modernization, we are making our Oberwihl factory fit for the market’s challenges,” says Claus Möhlenkamp, Chief Executive of Freudenberg Sealing Technologies. “It also indicates our clear commitment to the facility.”



COOPERATION WITH GE TRANSPORTATION

For years, the Plug & Seal connector was the only Freudenberg Sealing Technologies product to travel on GE Transportation locomotives. Since 2009, the sealing specialist has increasingly been the source of materials know-how for the world’s largest manufacturer of freight and passenger train locomotives and diesel engines for railways. The Plug & Seal supplier has become a **closely allied systems partner** in the development of new technological solutions.

For example, Freudenberg-NOK Sealing Technologies helped in the search for a special O-ring that could handle the extreme media conditions in engines. “We called in our O-ring expert from our factory in Santa Ana,” says Darin Hull, key account manager at Freudenberg-NOK in Milan, Ohio. “He talked to the customer about the functionality of cylinder liners on the piston. **The O-ring that we developed is one of the most advanced there is for diesel engines.**”

In a detailed examination, Hull and his team are looking into the requirements of locomotive manufacturers and have carried out numerous projects. They are now working on several components for a GE engine and are developing entire assemblies so that the customer can bundle further purchasing potential.



MAXIMUM POWER UNDER EXTREME CONDITIONS

WIND TURBINE ROTORS MUST ALWAYS BE AT THE OPTIMUM ANGLE OF INCIDENCE. HYDRAULIC ACCUMULATORS DELIVER THE HYDRAULIC ENERGY THAT TURNS THE BLADES INTO THE WIND. SPECIALIST IN THE FIELD IS HYDRATECH INDUSTRIES. ONCE AGAIN, THE LATEST GENERATION RELIES ON FREUDENBERG SEALING TECHNOLOGIES.



Absolute reliability is essential for the “pitch control” of the rotor blades – and not just for reasons related to efficiency. As an emergency brake, the system is also a key element of the equipment’s safety concept. In extreme situations – when the rotor has to stop immediately – the blades must be positioned at a 90-degree angle to prevent damage. Each of the usual three blades has its own piston pressure accumulator. The redundancy creates a comforting safety buffer. By managing the “pitch control” of a rotor blade, the facility can be brought to a complete stop in nearly all circumstances.

But a hydraulic accumulator only works if it has a sealing concept that functions under all conditions. At the

same time, the real-life demands on the components are enormous. Wind and weather place huge stresses on the seals, which are supposed to last at least 20 years. These energy storage systems are sold worldwide, so all climatic conditions have to be considered, including winters that last for months with double-digit sub-zero temperatures and merciless solar radiation near the Equator.

TESTING UNDER STRESS

That is why Hydratech Industries in Silkeborg, Denmark, has a 1,600-square-meter testing ground. This is where hydraulic accumulators have to demonstrate their perfor-

mance under severe conditions – especially with regard to leak tightness, pressure, temperature and wear. In the process, the energy accumulators are exposed to pressures of up to 200 bar – which never occur in practice, but guarantees reserves for long-term operation. In a 40-square-meter cold room, seal performance is tested at a temperature of minus 40 degrees Celsius. And testing also takes place at the other extreme. In another facility, the ambient temperature of the accumulator is raised as high as 60 degrees. Hydraulic oil becomes extremely thin at this temperature, which puts maximum demands on seal performance.

The Danish manufacturer uses the Simko 300 from Freudenberg Sealing

ONE SEAL INSTEAD OF TWO

Technologies in its latest generation of hydraulic accumulators. “This seal stands out for both its robustness and its low frictional resistance,” says Asger Rasmussen at the Danish service center. “As a result, you need just one seal for the hydraulic accumulator, instead of the two seals that were previously necessary and made the entire seal design more complicated and vulnerable.”

The energy of a hydraulic accumulator is stored in a nitrogen-filled cylinder. Two seals previously performed various tasks right at the interface between the hydraulic oil and the nitrogen. The first one sealed oil out of the

hydraulic system, while the second held the nitrogen in the cylinder. But there were pressure differences in the chamber between the two seals. This was primarily due to the less robust gas seal. Moreover, the PTFE design was susceptible to installation errors.

The Simko 300 now does the job on its own – and more effectively. It seals out oil as well as gas. Pressure differences are no longer an issue. The materials expertise of Freudenberg Sealing Technologies played a crucial role in the new solution. Its engineers succeeded in changing polyurethane in a way that retained its positive attributes such as excellent leak tightness, high surface protection and low frictional resistance. Yet, at 98 Shore A, it simultaneously achieves almost the same hardness levels as PTFE.

EASY INSTALLATION – LONG LIFE SPAN

Furthermore, the Simko 300 has a significantly longer service life and is much easier to install. That makes it especially suited to use in wind power facilities. The results from the Hydratech test center demonstrate this. “The Simko 300 has been largely unfazed by our tough test procedures,” says R&D Manager Jimmi Wenderby. “This is extremely important to us. It is the only way to ensure that the hydraulic accumulator does not lose power over its entire lifespan.”



THE SEAL TESTING SERVICE

IT WAS AN UNUSUAL PROJECT: LAB MANAGER CHRIS FRANTZ OF FREUDENBERG-NOK SEALING TECHNOLOGIES WAS GIVEN THE JOB OF DEVELOPING A TESTING PROCESS FOR SEALING COMPONENTS FOR EATON HYDRAULICS. THE WORLD'S LARGEST MANUFACTURER OF HYDRAULIC DRIVES WANTED TO AVOID A SITUATION WHERE ITS OWN REQUIREMENTS FOR SEALS WERE FIRST SHOWN TO BE INSUFFICIENT DURING THE VALIDATION PROCESS FOR A DRIVE SYSTEM.



CHRIS FRANTZ

FREUDENBERG-NOK SEALING TECHNOLOGIES
IN PLYMOUTH, MICHIGAN

This was an exciting challenge for Frantz and his team in Plymouth, Michigan. It only took them six months to define a validation process for Simmerrings used in hydraulic drives at Eaton Hydraulics. Within a short timeframe, the process reflected precisely the demands to which the seals were exposed during tough everyday conditions. But the conceptual work was not enough for the engineer and his staff. In the mechanics lab in Plymouth, they produced the test equipment to carry out the validation themselves. With resounding success: With the new process, the test cycle could be reduced from 80 to 45 days. It was also substantially less costly to execute and provided more precise simulation data and test results.

After the success, a question arose: Why not also offer the service to other customers? "Manufacturers of large components or assemblies were accustomed to carrying out tests on small parts, such as sealing rings or flat gaskets themselves and then integrating them into the validation process," says Frantz. But engines, transmissions and other assemblies have become increasingly complex – while performance requirements have grown. "Our customers had enough to do with the overall system," adds Frantz. "They didn't want to make its interaction dependent on the functioning of untested, comparatively unimportant components." Chris Frantz and his team began offering their test and validation measures to all customers of Freudenberg-

NOK Lead Centers. Equipped with in-depth knowledge, experience and unique technical options, the test-stand specialists are developing test designs and structures for a series of customers. According to Frantz, this capitalizes on a Freudenberg Sealing Technologies core competency and creates added value for everyone involved.

SPECIALIZING IN TEST DESIGN

"Our customers want to avoid a situation where a highly complex technology product such as an aircraft engine fails in a validation test because an O-ring malfunctioned somewhere,"

says the testing expert. "Due to test designs and test cycles adapted precisely to subsequent usage situations, we are in a position to deliver components that function well from the start and on a sustained basis. And we do this in three ways: We test, test and test again..."

There is virtually no other lab in the industry with such a well equipped mechanical workshop, with such precise measuring equipment and multifaceted test stand options. The Freudenberg-NOK mechanical laboratory is considered an industry benchmark. It supports all the Lead and Competence Centers in testing and related services.

PROVIDING EXPERTISE

The laboratory staff can create precisely the conditions under which a seal must later function. "This allows our Lead Centers to provide their customers with validated test results," says Frantz. "Neither Lead Centers nor customers generally have the capability to handle this themselves." He sees the main advantage coming from a specialization in complicated test processes and conditions. "We develop the test specifications jointly with the Lead Centers," explains the

lab manager. "So we tell the customer that we are developing and carrying out this or that test so he can later rely on a validated, proven product. We translate requirements and specifications into test configurations. We can do this better than the manufacturers themselves."

It is an elaborate process that can take from a few weeks to a few months – depending on project complexity. By offering to handle the validation of supplied components, Freudenberg-NOK Sealing Technologies has again shown itself to be a problem-solver for its customers and has placed itself ahead of the competition.



NEW DIALOG PLATFORM

SOMETIMES YOU NEED TO THINK OUTSIDE THE BOX, ESPECIALLY WHEN IT COMES TO TRENDS AND INNOVATIONS. FREUDENBERG SEALING TECHNOLOGIES HAS ADOPTED NEW APPROACHES IN ITS INTERACTION WITH CUSTOMERS. THE TREND FORUM WAS A COMPLETE SUCCESS.

Last November, Freudenberg Sealing Technologies invited general industry customers to Mannheim's Rosengarten Conference Center to take a look into the future. At the first Trend Forum, FST's sealing specialists discussed new technologies with about 200 participants and presented more than 40 product innovations. The focus was on four megatrends: demographic change, raw materials, renewable energy and mobility.

With the Trend Forum, FST has created a new platform for dialog with its customers. "The concentration on four core themes offered the opportunity to structure lectures, presentations and workshops with very targeted topics," says Claus Möhlenkamp, Chief Executive of Freudenberg Sealing Technologies. "We succeeded in highlighting the opportunities and risks that the continually changing conditions hold and how our company can support its customers with well thought-out solutions."

At the same time, customers could explain their wishes and future requirements to FST's sealing specialists. In contrast to a trade fair, the event in Mannheim offered the opportunity to conduct technical discussions and jointly develop new business ideas over a period of a day and a half.



2013 TREND FORUM

FASCINATING PRESENTATIONS
INTERESTING DISCUSSIONS

More than 40 product innovations were presented at the Trend Forum. One speaker was Future Researcher Matthias Horx, who spoke on megatrends.



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FEEDBACK & CONTACT

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