PARKRAUM

The newspaper for customers of WÖHR Autoparksysteme GmbH | No. 1 - 2017

TRENDS
The main developments in the sector **Pages 6-7**

INSIGHTS
Details of the latest WÖHR projects **Pages 10–11**

Photo: Markus Hanke/Gallery Stock

In our own space

The world turns, and we turn with it: We first edited our customer newspaper PARKLÜCKE in 1987 – now it's time for us to revive the tradition in a new form, namely PARKRAUM. This newest of newspapers contains information from our sector, the latest developments within our company and around the world. In this first issue, we focus on a hot topic for both policy and society: electric mobility.
To enable e-mobility in future, we will need intelligent traffic systems, and space. As well as adapting the infrastructure, we will also need to adapt to changing requirements. Read on to discover how.

With kind regards, the management of WÖHR Autoparksysteme GmbH

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Show some vision!

Electric vehicles are currently the exception rather than the rule. Yet experts agree that this will change. When, and what needs to happen first?

Michael Specht

Drivers of electric vehicles (EVs) already enjoy quiet, powerful acceleration and a great feeling that they aren't polluting the environment with harmful exhaust fumes. These 'early adopters' have switched to a private means of transport with no emissions, but this green manoeuvre comes at a disproportionate cost. An EV costs around twice as much as a car with an internal combustion engine which performs comparably. This is because of the batteries: they can make up almost a third of the price of an EV. Improvements in cell chemistry and larger quantities will greatly reduce the price of lithium-ion energy storage in the next few years, and thus help EVs break through into the mainstream. The German government has now backed off from its initial target of putting a million EVs on the roads by 2020. Yet the automotive industry is still investing heavily in emission-free mobility, not least in order to meet the binding EU target for all new cars to emit a maximum of 95 g/km of CO_2 by 2020. If this is not met, manufacturers will face heavy penalty payments and – even worse in the eyes of sector experts – great damage to their corporate image. It is clear that among German motor manufacturers, BMW has the most experience with EVs: it launched the i3 in 2013. BMW has now sold almost 70,000 i3s. Yet on a global scale, the undisputed top slots go to the Nissan Leaf (over 265,000 have been made since 2011) and on the premium market California's Tesla. The model S sold more vehicles in America than there were Mercedes S-class registered, and in Norway it sold better than the VW Golf. From 2018–2020, manufacturers are promising ranges of up to 500 km, and systems able to recharge up to 80 per cent of battery capacity in under half an hour. EVs have the added advantage of much less wear and tear, and therefore incur lower maintenance costs. When they are serviced, they don't need regular oil changes or work on the engine, let alone the gears and exhaust. Even the brakes last significantly longer, as an EV can use its electric motor for braking in almost all cases. Many countries are promoting electric mobility using a wide variety of incentives: leading the way are China (the world's largest EV market), the USA, Norway and the Netherlands. In China EV owners receive a subsidy of up to a third of the purchase price, and are exempt from the 10 per cent purchase tax. The USA is a clear e-mobility trailblazer: Washington subsidises the purchase of a zero-emission car to the tune of over USD 5,000. Further bonuses, generally of USD 2,500, are granted by the individual states. Norway is currently leading Europe in terms of emission-free driving: there is no vehicle tax on EVs there, nor are they subject to VAT (at 25 per cent). The Netherlands come in second place for electric mobility in Europe. Commercial customers – especially taxi drivers – enjoy a particularly varied programme of state support. In Germany, dealers and the Federal government each contribute EUR 2,000 per vehicle sold.

> 'Many countries are promoting electric mobility using a wide variety of incentives'.

Zero-emission electric mobility remains an exception on our streets, and its share of overall electricity consumption is proportionately small. But what if more EVs than internal combustion engines ran on our streets, or even if everyone switched to electric? Could our current infrastructure cope?

As time goes by …

1880
Coburg (Bavaria) was home to the first electrically driven car. A real boom in electric cars followed, until 1910 when low oil prices made the internal combustion engine more attractive.

1990
The oil crisis reinvigorated electric mobility. The first standard measures taken to gradually reduce vehicle emissions were introduced in the USA.

2012
Small US manufacturer Tesla brought out the top-of-the-range Model S electric vehicle. With a range of 600 km, it was fully competitive with conventionally-powered cars.

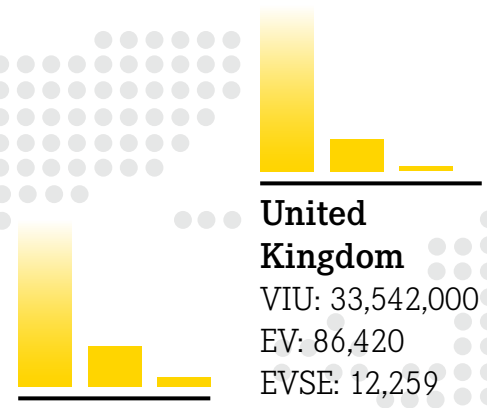
2016
The federal German government agreed a comprehensive programme of support. Buyers of EVs receive a subsidy of EUR 4,000, and buyers of plug-in hybrids EUR 3,000. These vehicles are also exempt from vehicle tax for ten years.

2021
In four years' time, automotive manufacturers will have to meet strict CO_2 thresholds set by the EU – Volvo has announced that in 2019 it will start phasing out internal combustion engines, and only launch new battery-powered or hybrid models. In these hybrid cars, combustion engines would only provide a backup system. This is the most radical transformation of this traditional market to date.

Global network

United States
VIU: 122,322,000
EV: 563,710
EVSE: 40,473

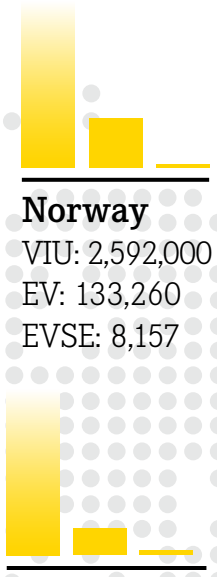
Until 2015, the **USA** had the largest stock of EVs, but in 2016 it was overtaken by China.



Netherlands
VIU: 8,336,000
EV: 112,010
EVSE: 26,789

United Kingdom
VIU: 33,542,000
EV: 86,420
EVSE: 12,259

France
VIU: 32,000,000
EV: 84,000
EVSE: 15,843



Norway
VIU: 2,592,000
EV: 133,260
EVSE: 8,157

Norway, with a 29% market share, had the best-developing electric mobility sector in the world in 2016.

Germany
VIU: 45,071,000
EV: 72,730
EVSE: 17,953

In Germany, the **Federal government** and **German** dealers subsidise the purchase of an EV to the tune of EUR 4,000.

VIU: Vehicles in Use
Total number of existing vehicles by country, stated as a no. of cars, 2015

EV: Electric Vehicles
(Battery and plug-in hybrid electric vehicles: BEVs and PHEVs) by country, stated as a no. of vehicles, 2016

EVSE: Electric Vehicle Supply Equipment
Number of publicly accessible slow and fast charging points (inc. AC Level 2, AC 43 kW, DC, Tesla Superchargers, inductive chargers) by country, stated as a no. of cars, 2016

It's not enough to simply present great EVs for sale if we want to win over the general population to electric mobility. Government, local and municipal authorities must also step in. What charging infrastructure is available? How can we establish no-emission mobility among the population at large? How can e-mobility be introduced into new residential projects?

Michael Specht

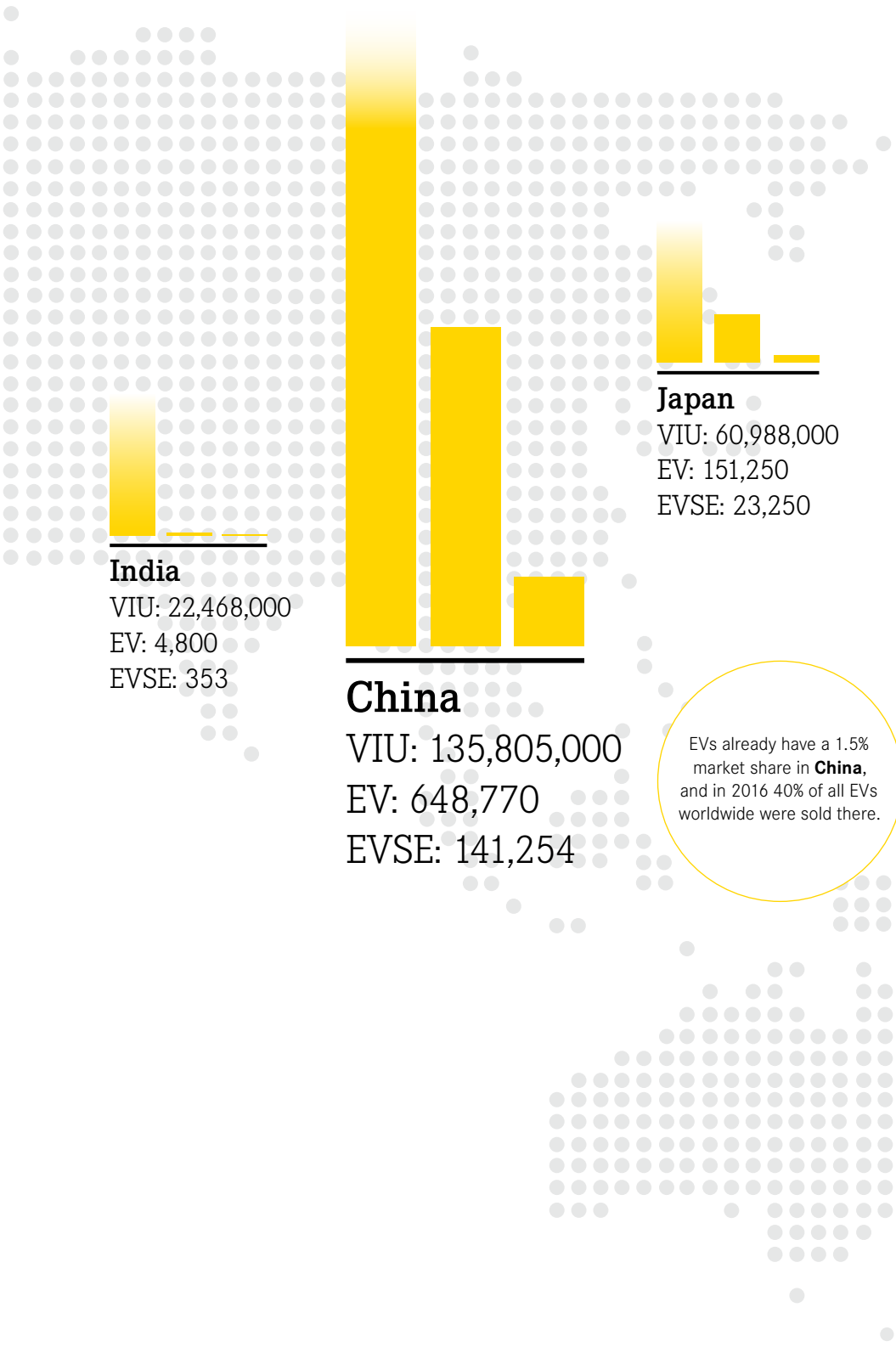
The surveys conducted in recent years have repeatedly confirmed that drivers are perfectly prepared to abandon their diesel or petrol car when they buy a new vehicle, and switch to electric. Yet the reality is somewhat different. Electric vehicles are still a rare sight on our streets – with the exception of Norway. They represent just a few percent of the total, often under one percent. There are understandable reasons for this. On the one hand, EVs can easily cost twice as much; on the other hand customers aren't prepared to accept small ranges, or are afraid they will be left stranded somewhere with a flat battery. There's also the widespread impression that there aren't many charging points available – there are only around 7,500 in Germany – which may be keeping EVs in their 'niche'.

In order to remove some of these reservations, automotive manufacturers such as BMW and Mercedes are increasingly populating their car rental fleets DriveNow and Car2go with their own EVs. The northern city of Hamburg has ambitious plans in this regard: automotive group Daimler plans to convert its car-sharing pool there gradually, reaching around 400 electric Smart cars by the end of 2019. BMW intends to deploy up to 550 EVs in Hamburg. A large-scale expansion in the charging infrastructure across Hamburg is also planned to accompany this move. Electric vehicles will then have access to over 1,100 charging stations, where they can also park. Car2go has already gone further than that in Madrid, Stuttgart and Amsterdam: it only offers Smart electric drive cars.

'While such schemes are already working well in cities, car sharing projects in rural areas still have a way to go.'

While such schemes are already working well in cities, car-sharing projects in rural areas still have a way to go. The company E-WALD is very committed to changing this. Since November 2013, it has not only offered a variety of EVs for short- and long-term rental in Bavaria, Baden-Württemberg and Hesse, but also delivers original ideas and tailored implementation plans for local authorities, municipalities, other authorities, energy suppliers and municipal utilities. These services are also available to developers and housing companies, private companies, industry and even private individuals.

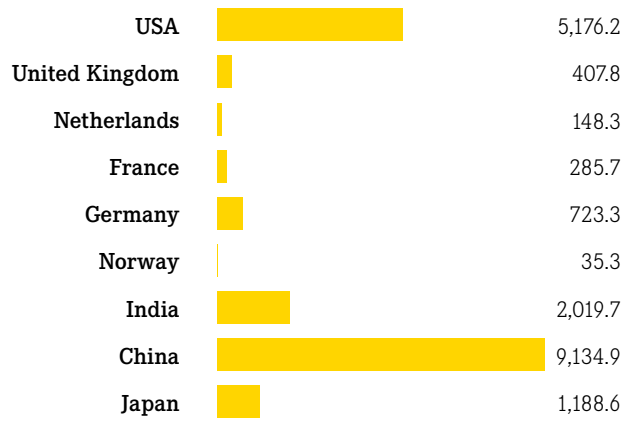
WÖHR Autoparksysteme GmbH has shown how EVs can combine smoothly with car parking systems. The car parking specialist has more than 60 years of experience in mechanical and automated parking systems, and still offers environmentally aware customers compact and aesthetically pleasing universal posts for e-charging to incorporate electric charging into parking spaces. In Kristiansand, Norway, the Kjøita Secret Garden residential complex exemplifies this approach. Beneath this 140-home complex on the Skager-



Source: based on IEA data from EV Global Outlook 2017 ©OECD/IEA 2017, www.iea.org/publications/freepublications/publication/GlobalEVOutlook2017.pdf, Licence: www.iea.org/t&c; as modified by WÖHR

Organisation Internationale des Constructeurs d'Automobiles (OICA), Paris

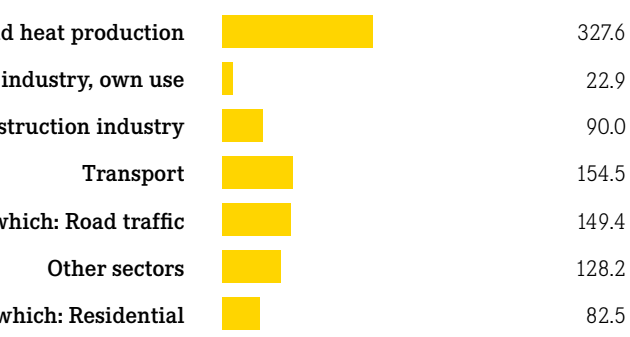
CO_2 emissions in 2014 from fuel combustion, by country



Source: based on IEA data from CO_2 Highlights 2016 – Excel tables ©OECD/IEA 2016, www.iea.org/statistics, Licence: www.iea.org/t&c; as modified by WÖHR

CO_2 emissions in 2014 from fuel combustion, by country, published 2016, given in million tonnes of CO_2

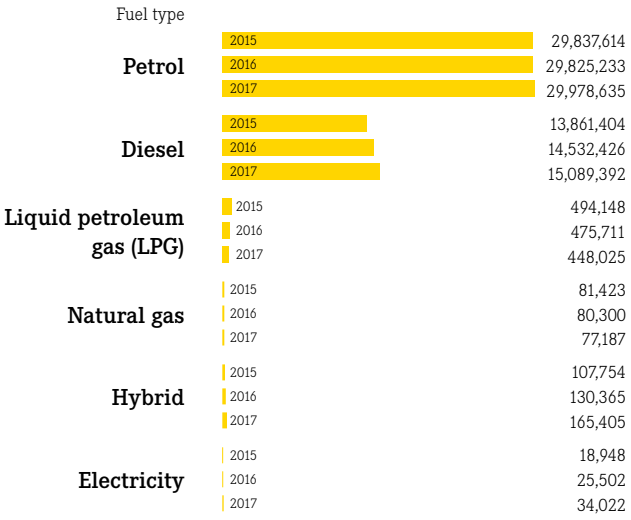
CO_2 emissions in 2014 from fuel combustion in Germany, by sector



Source: based on IEA data from CO_2 Highlights 2016 – Excel tables ©OECD/IEA 2016, www.iea.org/statistics, Licence: www.iea.org/t&c; as modified by WÖHR

CO_2 emissions in 2014 from fuel combustion in Germany, by sector, published 2016, given in million tonnes CO_2

Barometer for existing cars according to fuel type, 2015–2017 in Germany



Source: Federal Motor Transport Authority, Flensburg, Germany

Stated as a no. of cars

rak are 8,000 square metres of underground parking comprising 250 parking spaces, of which 44 are provided using a WÖHR Combilift System. EVs can park here and recharge their batteries at the same time. These spaces are separated off from the rest using electrically activated sliding glass doors.

The future of mobility is electric, or at least that's what top automotive manufacturers claim – and they are setting their strategic directions accordingly. Experts in the sector expect the share of EVs to rise to 25% or more in the next 10 to 15 years. If this were to translate into reality, that would mean more than 800,000 new EVs a year in Germany. Can the infrastructure keep pace with this? In other words, is there enough electricity to go round?

The word on the streets of Hamburg, at the forefront of e-mobility, is a resounding 'Yes'. That was what Stromnetz Hamburg GmbH concluded, too. The energy supplier joined forces with transport firms Hamburger Hochbahn AG and Hamburg Holstein GmbH. They commissioned Helmut Schmidt University Hamburg to look at how this impacts on the growth in electric mobility, in the context of an overarching study. The basic assumption was that by 2030 100,000 electric cars and 1,600 electric buses (for local public transport) would be on the streets of Hamburg. They would represent 15% of the current vehicle stock.

'To power these, we would need an additional 0.5 TWh a year' says Thomas Volk, Technical Director of Stromnetz Hamburg GmbH. To put that into context, overall annual consumption for Hamburg is currently 12.4 TWh. It would not be necessary to bring a new power station on stream to supply this additional electricity. Instead, a smart charging management system in the low-voltage public distribution network would suffice. This would mean peak loads could be controlled if too many users were charging at once. Some substations would also need to be adapted, or to 'shape up' as the study puts it. Thomas Volk is confident: 'This is included in modernisation expenditure for which we had already budgeted over the next few years.'

Yet the question remains: how can this be rolled out across the board? According to the current grid development plan, the north of Germany will generate around twice as much electricity as it needs once the last nuclear power plants have been switched off in late 2022/early 2023. The south of Germany will still need to import between a quarter and a half of its electricity. The planned high-voltage DC transmission lines from north to south Germany will not be ready before 2025 at the earliest. Bavaria and Baden-Württemberg have plans to lead the way in e-mobility, which may be affected by this. Other countries have set exact dates for their transport transition. In the UK and France, the only new cars registered after 2040 will be EVs; in Norway this date is 2025. But does it make sense to switch so swiftly to e-mobility? The sector has much ground to cover before it can make efficient, affordable EVs available for long journeys of over 500 km. Renault's Zoe model can only travel around 150 km at speeds of 130 km an hour under real road conditions before it needs recharging (Spiegel practical test February 2017). However, for short journeys the current EVs are already ideal.

When considering this issue, it is important to remember that although travel in EVs does not produce any emissions, their manufacture does. It takes a great deal of energy to produce a battery, and the process emits carbon dioxide which is harmful to the environment. Thus when buying an EV it's best to compare its climate compatibility with that of a conventional car. TÜV Süd has produced certification to help. BMW, among other manufacturers, has voluntarily applied for this certification for each of its new electric models.

Photo: WÖHR Autoparksysteme

FAQs

on charging electric vehicles

Where are most EVs charged?
Naturally, most are charged where they normally park: at home and at work. In addition to this charging infrastructure, public charging points are available at popular destinations such as shopping centres, and fast charge stations can be found on long-distance routes.

How long does it take to charge an EV?
It depends on three factors: the current supplied, which is determined by the type of charging station; how much charge is left in the battery; and how powerful the charging station is. An AC charging station supplies 11 to 22 kW, which can recharge a battery fully after a 40 km journey in 20–30 minutes. To recharge on long journeys, DC charging points are often provided. These supply up to 150 kW and during a coffee break supply sufficient charge for 300 km of driving.

What do I need to know about charging multiple vehicles at the same time?
This is not a major issue yet in Germany as EVs are not yet widespread. However, charging several EVs at once can overload your domestic electricity connection. A charging management system can help, as this coordinates the various vehicles' charging processes and therefore avoidsoverloading your domestic electrical installation.

Can I use my solar panels to charge an electric vehicle?
Smart charging stations can optimise the use of your own electricity generation by means of charging management. The charging power can adapt dynamically to the current solar output, but you can also manage the load according to the requirements of your business or electricity tariff.

AC or DC? Type 2, CHAdeMO, CCS or Type 1? Which standards do my parking spaces need to comply with, and which ones does WÖHR support?
Type 2, CHAdeMO, CCS and Type 1 are standards for charging sockets. In Europe, an agreement was reached to use Type 2 with AC for charging at up to 22 kW, and CCS with DC for fast charging at up to 150 kW. The Type 1 sockets used in German homes are not strong enough, and should not therefore be used to charge EVs. The ideal charging infrastructure for a car park built by WÖHR would be the combination of AC and Type 2 sockets, at either 11 or 22 kW. There are a large range of wallboxes on the market which can be fitted to WÖHR universal posts for e-charging.

How can I work out the charging power?
How much electricity is consumed for charging depends very much on the operator model. If you want to calculate consumption for charging employees' EVs, wallboxes with built-in, calibrated meters and card readers for charging cards should be used. These will allow individual charges to be recorded, allocated to a particular user and billed accordingly, for example on a monthly basis. The charging data will be recorded on the back-end system provided by an EV company, which can also manage the various users. One alternative is to charge vehicles on an ad hoc basis using an established payment system, such as credit cards. The necessary hardware for this is usually built into car park operators' automated pay stations.

Type 1 charging point
These points use the standard type of socket found in German homes. It is often referred to as a 'Schuko' socket (a registered trademark for a system of AC power sockets also defined as 'CEE 7/3'). Charging performance is very limited, and it is not normally possible to manage or measure charging from these sockets. Hence they are now normally only recommended for charging motorbikes and mopeds or lightweight vehicles.

Type 2 charging point and Mode 3 charging
A Europe-wide standard has been agreed for charging EVs: this applies both to the plug and socket (Type 2) and to the connector between the charging infrastructure and the vehicle (Mode 3). This is the standard type found in all vehicles and charging stations currently on the market. The 7-pin, Type 2 plug can transmit up to 43 kW for charging. The Mode 3 protocol ensures safety and allows smart charging management. These charging points use the chargers built into the vehicle, which keeps costs down, hence these are the main points found at destinations.

Combined Charging System (CCS)
The European CCS standard is a compatible expansion of the Type 2 plug, which allows high-performance charging with direct current (DC). The extensive high-performance electronics this requires are located in the charging station; these are therefore most often found at sites associated with long-distance travel.

CHAdeMO
The characteristics of the Japanese CHAdeMO system are comparable to CCS; it is often found in imported vehicles. Hence sites associated with long-distance travel are often equipped with fast charge stations that meet both standards.

Source: www.stoehr-gmbh.de

Comparison of e-vehicle models

A handy comparison between EVs in terms of range, charging time and price.

VW e-Golf

Electric range approx.	300 km
Electricity consumption at 100 km/h approx.	12.7 kWh
Rated output	136 hp
Charging point	Type 2
CCS fast charge station approx.	0:45 h (80%)
Charging time Type 1 approx.	17 hrs
Charging time DC approx.	5:20 hrs
Charging time AC approx.	5:20 hrs
Price approx.	EUR 35,900
Top speed (electric only)	150 km/h
0 to 100 km/h in approx.	9.6 seconds

Nissan Leaf Visia

Electric range approx.	250 km
Electricity consumption at 100 km/h approx.	15 kWh
Rated output	109 hp
Charging point	Type 1, Type 2, CHAdeMO, Combo 2
CHAdeMO fast charge station approx.	01:36 hrs
Charging time Type 1 approx.	13 hrs
Charging time DC approx.	6 hrs
Charging time AC approx.	9 hrs
Price approx.	EUR 23,365
Top speed (electric only)	-
0 to 100 km/h in approx.	3.7 seconds

BMW i3

Electric range approx.	290 km
Electricity consumption at 100 km/h approx.	13.6 kWh
Rated output	170 hp
Charging point	Type 2
BMW i Wallbox approx.	1:42 h
Charging time Type 1 approx.	9:30 hrs
Charging time DC approx.	03:30 hrs
Charging time AC approx.	07:30 hrs
Price approx.	EUR 37,550
Top speed (electric only)	150 km/h
0 to 100 km/h in approx.	7.3 seconds

Tesla S 100D

Electric range approx.	632 km
Electricity consumption at 100 km/h approx.	18.9 kWh
Rated output	256 hp
Charging point	Type 2, CHAdeMO
Supercharger Tesla approx.	1:20 hrs
Charging time Type 1 approx.	45 hrs
Charging time DC approx.	19 hrs
Charging time AC approx.	17 hrs
Price approx.	EUR 105,320
Top speed (electric only)	250 km/h
0 to 100 km/h in approx.	4.3 seconds

Sources: www.volkswagen.de, www.nissan.de, www.bmw.de, www.tesla.com Photos, l-r: VW, Nissan, BMW, Tesla

Multi-storey car park charging station

Photo: iStock

Interface: Multi-storey car park

The rise of electric mobility will also influence the multi-storey car park of the future. Ralf Stock, a car park expert and editor-in-chief of online magazine europarking, explains what developers should look out for.

Klaus Rathje

What will the car parks of the future need to offer users?

They will need to be user-friendly and functional, that's very important. Part of that is having facilities for charging electric vehicles. The car park of the future will be a mobility hub, offering much more than just parking. This will include car sharing and 'park and bike' schemes.

What equipment will need to be provided for electric vehicles?

Provision should be made for a variety of e-mobility needs. There will be customers who want to charge their vehicle quickly, because they will only spend two or three hours in the car park. Others will leave their car there all day while they work, and will want to recharge it more slowly, which is easier on the battery. It makes sense to generate your own electricity, for example using solar PV panels on the roof of the car park. There's a good example of this in Bruchsal, Baden-Württemberg. The car park has 1,700 spaces inside, and 2,500 solar modules on the roof, with an output of 625 kW. It can supply its own electricity requirements and provide 200 households with electricity all year round. This sort of equipment will certainly pay for itself.

It seems the rise of electric vehicles is unstoppable, now that France has announced a ban on internal combustion engines in future and Volvo wants to switch completely to e-mobility.

Yes, I hear 400,000 Tesla 3s have already been pre-ordered; e-mobility really seems to be taking off now. This offers a good new business opportunity for car parks. At any rate, charging stations are a good marketing tool – they say 'We're equipped for all our customers'. Conversely, this equipment could also provide an incentive for people to buy electric vehicles. My advice to developers is to provide a modular solution. First provide five parking spaces with charging stations, and then if there's more demand equip another five. Basic charging stations are available now for between EUR 1,000 and 1,500. Of course in an ideal world, users would have access to all charging options, including a Tesla charging point.

Will any changes be required to the regulatory framework?

We still have the problem that car parks are only entitled to sell electricity directly if they have an electricity licence. There is the option of users paying for charging time as part of parking time. Then again, car parks can also leave the operation of charging columns to the electricity suppliers themselves. There are many options, which can be confusing and for some developers this is a barriers to investing more in e-mobility infrastructure. While we're on the subject of legal aspects: I would change company car regulations to provide incentives for e-mobility. That could really create traction.

What do you make of automated parking systems?

The most convenient parking there is would be in fully automated residential underground car parks with maybe 300 spaces. Local residents are completely satisfied with the ones I know of. There are many examples which work well, such as Donnersbergerbrücke in Munich, where twice as many vehicles can now park underground in a building with the same volume, thanks to a parking system. It's a system that has worked smoothly for 10 years now. The benefit of this system has been documented. Cars parked in compartments like this are extremely secure. It's an ideal solution for office blocks as well as residential areas. It's something architects should pay more attention to. In conurbations, where land is expensive, this type of parking system is an especially safe bet.

Ralf Stock

is editor-in-chief and operator of the europarking information platform. He also act as a consultant in the hospital parking sector and an expert witness in courts. While working at general German automobile club (Allgemeiner Deutscher Automobil-Club (ADAC)), Ralf Stock tested car parks throughout Germany and created the user-friendliness quality label 'Das benutzerfreundliche Parkhaus'. He also worked with the Cologne-based Road and Transportation Research Association (FGSV) on their parking regulations.

6 TRENDS

Future developments in the sector

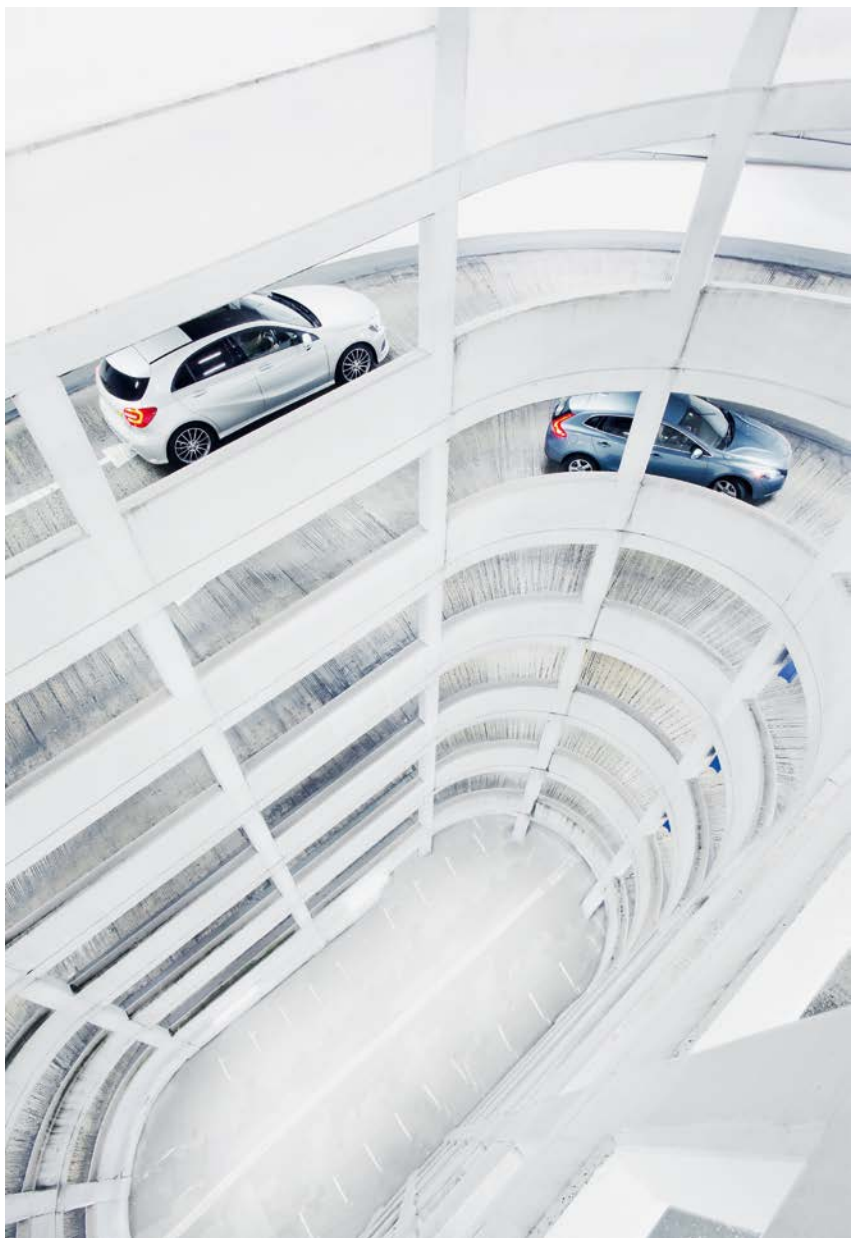


Photo: Matt Howell/Gallery Stock

Photo: WÖHR + BAUER

Photo: WÖHR + BAUER

Photo, top: Public underground car park, Bebelplatz/ Unter den Linden in Berlin: direct access to the Staatsoper Unter den Linden.

Photo, left: The modernised C&A underground car park in Reutlingen.

Constructing car parks for the next decade

Multi-storey and underground car parks are increasingly at the interface between many, sometimes conflicting demands.

Dr Ilja Irmscher

Car parks must be as user-friendly as possible. Standard DIN EN ISO 9241 deems a car park building to be fit for purpose according to its usability, the users' and operator's needs. If the car park is to be used in accordance with expectations, it must be made fully user-friendly. Some key aspects of this are: quality in terms of driving geometry; facilities provided for entering and exiting vehicles; the ability to adapt to the future dimensions of vehicles; and many other characteristics which make a car park user-friendly.

By user-friendly, we mean the quality of the user's experience of the car park. In the parking sector, the term has long been used in conjunction with a campaign by the general German automobile club (Allgemeiner Deutscher Automobil-Club (ADAC)), which created the user-friendliness quality label 'Das benutzerfreundliche Parkhaus'. Thus in the mid-1980s a list of criteria was drawn up with which to assess how user-friendly car parks were; it is constantly kept up to date. Although ADAC is no longer certifying car parks according to these criteria, its principles should still be applied. Another usability yardstick is the relatively similar assessment criteria for the European Standard Parking Award (ESPA), made by the European Parking Association. We recommend meeting the gold standard (fulfilling at least 65% of these criteria) as a minimum.

ADAC car park certification tests the use of the building in a logical order – from locating the car park using the local parking guidance and information system (PGI), to entering, parking and exiting the parking space, to exiting – and covers all operations involving the user.

Thus many modern aspects such as PGIs and additional services are already included in such assessments. A car park can only be deemed highly user-friendly if it is considered not merely as an external, architectural perspective, but instead as a functional whole, a traffic system with all areas of appropriate dimensions. Naturally it is important to comply with the relevant building and parking regulations, but these are not sufficient in themselves. Particular attention must be paid to specific geometric requirements for driving, and structural requirements.

Dr Ilja Irmscher

is CEO of GIVT mbH, an expert on stationary traffic and parking facilities, and the author of many publications, including 'Parking Structures. Construction and Design Manual'. He took the lead on car park testing between 2010 and 2013 for ADAC.

ADAC car park certification

- Shown in the local PGI and online
- Ability to find the car park with or without a navigation system
- Approach to the car park
- Entry to the car park
- Parking equipment (entrance)
- Traffic guidance and signage within the car park and on the various levels and sections, as well as in parking spaces
- Journey to the individual parking space
- Pedestrian route from the parking space to the exit(s)
- Ease of locating the car park entrance
- Payment system
- Pedestrian route from the payment point to the parking space(s)
- Route to the exit within the car park
- Parking equipment
- Exit

The basic dimensions of parking spaces and lanes in terms of driving geometry

Correctly sizing lanes and parking spaces within car park buildings is always an issue, especially since the basis for it is changing as the size of cars increases.

Dr Ilja Irmscher

There is one straightforward way to help establish which vehicle dimensions to apply. The Road and Transportation Research Association (FGSV) has derived the size of certain reference vehicles from the existing German fleet. The reference 'car' is one which represents 85% of existing cars registered in Germany in 1999/2000, and is approximately equivalent to a 2004 or earlier VW Passat model. A study was published which proposed an up-to-date reference car, based on cars registered for the first time in Germany in 2010, and derived using the same methods. This car was introduced into the amended FGSV reference vehicles list in 2017, and should be applied whenever new car parks are planned. In terms of real vehicles, it is more or less equivalent to the Audi A6 Avant. If larger vehicles are to be parked, then a larger reference car will be needed. We also recommend that a maximum-size vehicle be driven through the car park as a test, at least in large-scale car parks and public car park buildings. A transporter van such as the long-wheelbase VW T6 would, due to the area covered, be representative of a wide range of large cars, vans and SUVs at the top of the range or in luxury models, with a length of 5.3 m or more.

Swept paths and types of driving

Swept path analysis is universally recognised as a traffic planning tool, used to design any structure for road vehicles and to ensure it can be navigated satisfactorily. The first type of driving (Type 1) is an uninterrupted journey with constant turning angle, a vehicle's 'natural behaviour'. Type 1 driving applies in particular on the access roads and all ramps in car park structures. This ensures the driving geometry is sufficiently effortless, and the car park easy to use. The second type of driving (Type 2) is the extremely slow speed of manoeuvring, and allows the turning angle to be adjusted; progress along the route may not be constant. Type 2 driving describes typical manoeuvres performed in a tight space, with all sorts of changes in direction. Type 1 driving will always involve covering a larger area than Type 2 driving. Alongside the different types of driving, a safety clearance is required on either side: 0.5 m for Type 1 driving, and, exceptionally – because Type 2 driving is conducted very slowly – only 0.25 m for Type 2 driving.

Tractrix curves are no longer drawn using templates: instead, special CAD tools are used to simulate the above requirements with precision. Tractrix curves reflect travel movements in ideal conditions. In practice, they are only followed approximately, depending on the driver's skill.

Entering and exiting the vehicle, parking space width

In addition to the driving geometry, all the requisite space for entering and exiting the vehicle, and accessing the boot, must be established. The size and range of movement of car users must be taken into account. As a guide, we recommend using European anthropometric data. Key guide values for adding a person onto the floor plan alongside the vehicle are the 'width' and 'length' of the user, 0.60 and 0.30 m respectively.

'The size and range of movement of car users must be taken into account.'

In order to determine lateral entry into and exit from the vehicle, the driver door on the reference vehicle is considered to be open. A constant access width of 0.60 m is thus derived as a minimum requirement for comfortable vehicle entry and exit; smaller widths require users to rotate their bodies. The minimum access width should be considered as 0.30 m, although this presents a major risk of clothing getting dirty by touching the vehicle and/or the wall. Logically, these requirements should also apply to mechanical and automatic parking systems.

If we apply the recommendations for facilities for stationary traffic, EAR 05, and the minimum parking space width currently applicable in Germany of 2.50 m, a minimum of 0.60 m width to either side of the vehicle can be achieved by parking a 1.90 m wide car centrally in the space. Some parts are narrower than this due to the width of the door and any wing mirrors which extend to the side. If cars are parked in the standard manner, part of the neighbouring parking space can be used for entering and exiting the vehicle. If cars are parked next to upright building components, the additional room will not be available and these parking spaces will need to be widened. According to EAR 05, they should be 2.85 m wide or, if such components are on both sides, 2.90 m.

Driving geometry and lanes

It is normally assumed that a vehicle will be parked at a 90° angle, as is often the case. First, it will drive past the space, after which it will (1) stop and then (2) reverse park. The vehicle then drives forwards out of the space again in another manoeuvre (3). This is determined by the characteristics of the front axle, used for steering, and not – or to a much lesser extent – due to the rear axle. For the parking manoeuvre to be comfortable in terms of geometry, a parking space 2.50 m wide will require a lane 6.00 m wide. Any pillars in the lane should be set back 0.75 m, and the parking spaces next to them should be widened accordingly. The various car park regulations still permit lanes 5.50 m wide, yet these are only sufficient for parking at 90° if the driving is very precise, if vehicles are small, or if parking spaces are significantly wider; this width is not recommended. If vehicles are to be parked on a diagonal, narrower lanes may be possible.

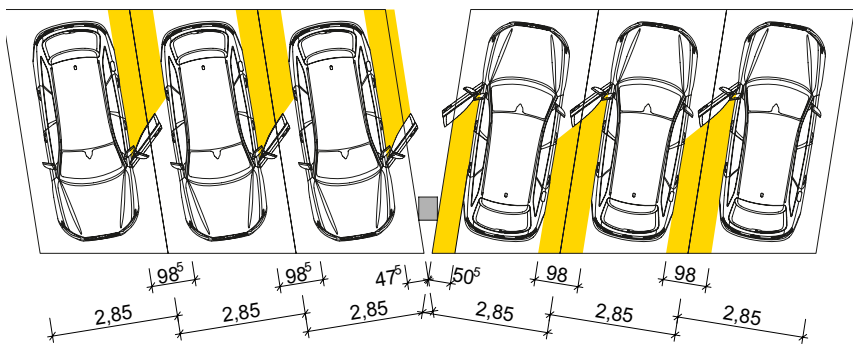
If vehicles are forward-parked in their spaces, then the boot will open into the lane and will therefore be easily accessible in normal car park buildings. However, forward parking in a total of three manoeuvres can only reasonably be achieved when parking on a diagonal, for example at a cash-and-carry, with bays positioned at 45°.

Typical situations in which cars will be forward-parked and loaded through the boot from the lane, while parked at a 90° angle, are at many supermarkets and DIY or furniture superstores, or in the case of mechanical and semi-automated parking systems with forward entry. If this is to be combined with the optimal usage standard of three manoeuvres per parking procedure for a large car such as the Audi A6 Avant, then parking spaces must be widened to around 2.75 m and lanes to around 7.50 m.

Photo: WÖHR Autoparksysteme

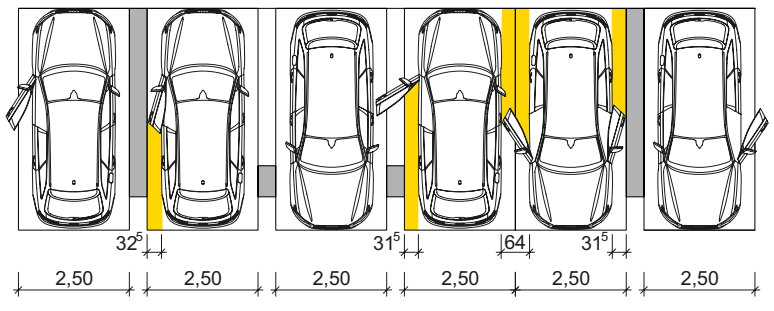
Parking scenario WÖHR Parklift 405.

Clearances for entering and exiting the vehicle – 45-degree parking



Distances between vehicles parked on a diagonal with parking spaces 2.85 m wide.

Clearances for entering and exiting the vehicle – 90-degree parking



Distances between vehicles parked on a diagonal with parking spaces 2.50 m wide.

Graphics: GIVT mbH, Berlin

8 LEGAL

Legal provisions and stipulations in the sector

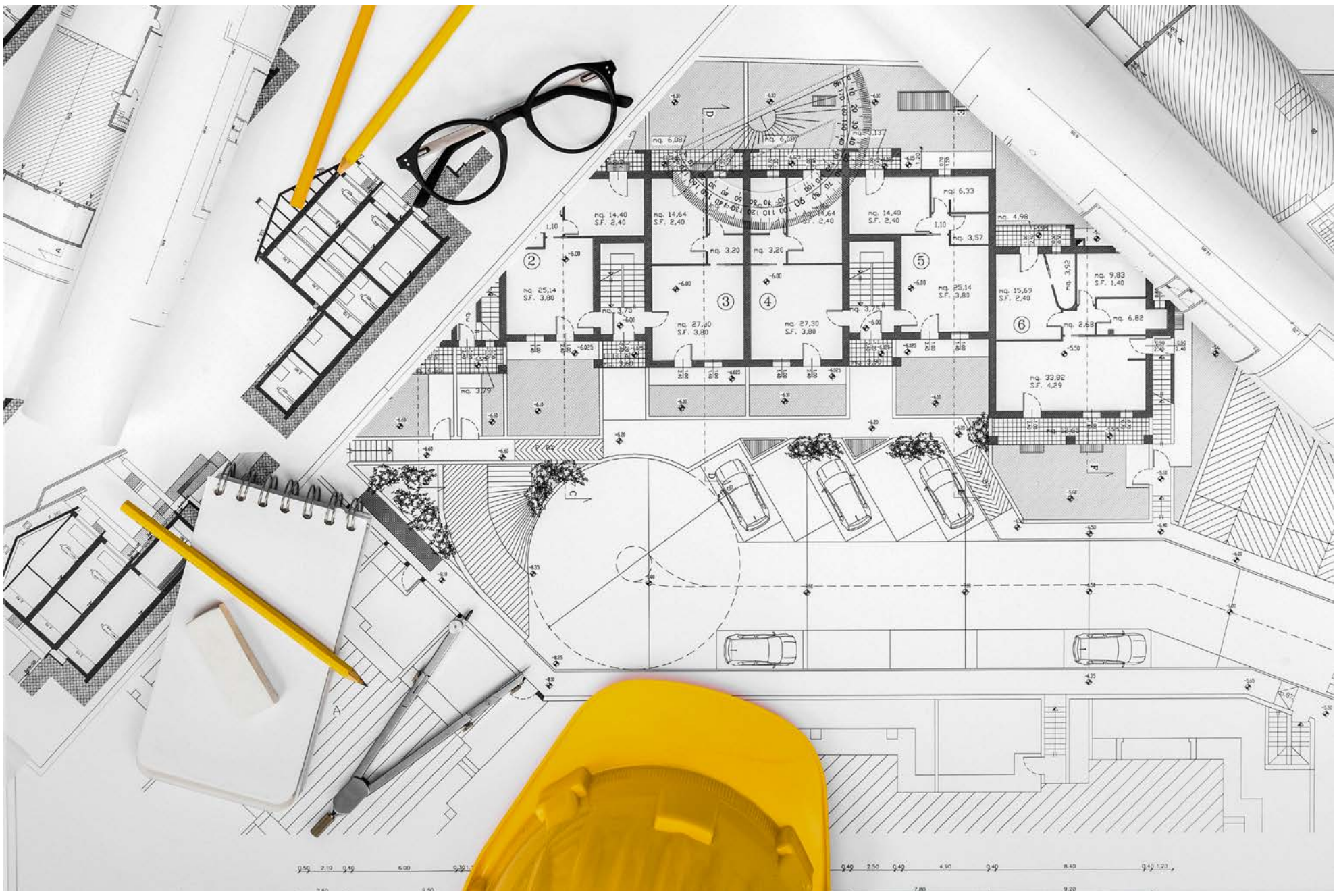


Photo: iStock

Tips and information:
What you need to know about building authorisation.

In future, permission will be granted to build at a higher density and to greater heights. The introduction of ‘urban areas’ into the BauNVO land use legislation allows greater flexibility for building design in inner cities. This move aims to create districts where residential, catering, retail and cultural facilities are located close together and coexist more harmoniously.

The first question asked about any construction project is whether it will require official building authorisation. Some projects may not, for example garages, including roofed-over parking spaces, with an average wall height of up to 3 m and an area of up to 30 m²; this does not apply in the outer zone. For some projects, it is sufficient to notify the competent authorities, for example with a residential building. If none of the conditions for the simplified procedure cited above apply, then you must apply for building authorisation for the project. It is also possible to submit applications for building authorisation across the board, just in case.

The rule is very simple: if you plan to build, you should apply to your local authority (municipality) for building authorisation. In contrast, the consequences of not following this rule are far from simple. If you fail to comply with certain regulations or to fulfil certain requirements, you may be refused building authorisation, construction work may be halted or you may even be ordered to demolish what you have already built. You will find provisions relating to building authorisation in the relevant Land building regulations. It cannot therefore be assumed that these provisions are uniform throughout Germany, which makes it difficult in practice to navigate the various requirements.

The competent building authorities will examine your application to see if it meets all the requirements under public law. These include primarily the BauGB, BauNVO and individual Land building regulations.

Very recently, the Bundestag approved a law to implement EU Directive 2014/52/EU into urban planning legislation and to reinforce the new co-location in urban areas. The densification of land use in cities plays a central role in the amendments to building legislation.

Short city routes

Over the past century, growth and development in cities were mainly achieved through an expansion in terms of area. It was deemed desirable to separate the living and working parts of life clearly. That area-based expansion approach has now been overturned, and this century settlements are becoming denser, with more mixed use. The new zoning category ‘Urban Areas’ was introduced into the BauNVO, and the Technical Guidance for Noise Protection was adjusted accordingly. This adjustment is aimed at providing local authorities with the flexibility to make it easier to build in densely populated urban areas. Thus building projects such as the Hafencity in Hamburg will not now need to go to such lengths to justify an exception to the rules. As a result, developers can build higher and more densely, can provide flexible, mixed-use properties and can thus create living spaces more quickly, with shorter routes between home and work also contributing to environmental protection. Compact building methods are at the heart of an Urban Area.

Building authorisation is easier to secure and more flexible in an Urban Area than in purely residential areas. The competent building authorities and published plans can provide information about which areas have been designated as Urban Areas in the legally binding land-use plan.

§

Amendment of § 6a BauNVO

The idea of urbanisation is now common knowledge in the context of populating towns and cities. With reference to this, the law to implement EU Directive 2014/52/EU into urban planning legislation and to reinforce the new type of co-location in urban areas came into force on 13 May 2017. At the heart of this law is the introduction of the Urban Area into the BauNVO. Buildings in these areas should be constructed more densely and should be taller.

Amendment of §§ 650a–650v BGB

The introduction of new types of contracts for architects and engineers, construction companies, developers and consumers will replace contractual agreements with legislative provisions. The lack of clear legislative provisions had been hindering progress towards a planning process and construction contract handling which were both economically viable and met the interests of all parties. This reform of construction contract legislation aims to remove these obstacles.

Photo: Stocksy/Hugh Sitton

Reform of construction contract legislation

Legislative reform of provisions relating to construction contracts – Law on Contracts for Work and Services made more concrete using special types of contract.

It is important for consumers, construction companies, developers, architects and engineers in Germany that the Bundestag passed the reform of the provisions relating to construction contractson 28 April 2017. Specific legal provision is made for the construction contract as an extension of the general contract for work and services.

The provisions in the Law on Contracts for Work and Servicesare often not precise enough for more complex construction contracts which are to be fulfilled over a longer period. In such cases, the parties are obliged to shore up the contracts using supplementary agreements and references to case law. It is therefore often difficult to achieve a smooth handling of contract business. Consumers in particular may face specific risks when a construction project is underway, since the Law on Contracts for Work and Services does not currently contain sufficient consumer protection provisions, merely a few individual provisions.

The reform of construction contract legislation also involves incorporating the construction contract (§§ 650a–§650h BGB), the consumer construction contract (§§ 650i–650o BGB), the architect contract and engineer contract (§§ 650p–650t BGB) and the developer contract (§§ 650u et seq. BGB) into the BGB, Book 2 Division 8 Title 9.

These provisions establish the definitions for the respective contracts, the compensation regulations, termination and liability for defects upon acceptance.

These regulations come into force on 1 January 2018.

www.bundesgesetzblatt.de

Bundesgesetzblatt Year 2017 Part I No. 25, 12 May 2017

Bundesgesetzblatt Year 2017 Part I No. 23, 4 May 2017

Photo: Maurice Kohl

4 questions for... Sebastian Buggert

Expert on international market and cultural psychology, consumer and customer research at the rheingold institute in Cologne: www.rheingold-marktforschung.de

1 In our increasingly digital world, it looks like the car will soon be scrapped as a status symbol. What do you think?

Until the 1990s, cars were the product you would use to demonstrate your independence and freedom. Cars gave you your identity. There are now many other products and media which fulfil this role. However, a longing for comfort every day, the experience of speed and acceleration are still sensations belonging to a self-determined life.

2 Mobility will change radically due to digitalisation and automation. How will consumers react to these changes?

Driving cars is a real experience in people's lives. In my car I have time and space for myself, when I drive I experience control and self-efficacy. Things in our everyday, regulated existence – where we often feel overwhelmed – are not present here. So I think drivers will continue to enjoy driving themselves for a long time to come, or will at least want the option of driving, depending on the situation.

3 Smart homes and smart cities are the talk of the town: to what extent will streets and traffic become connected?

We are currently at a stage when we assume that automation and digitalisation will develop exponentially. We are almost at the peak of a growth curve which can no longer be stopped. How much cities and therefore by extension traffic control will become networked will also depend on developments in our safety situation.

4 Do you think that a city with no traffic jams will come into being one day thanks to new technology?

Shanghai already has highly developed control systems which greatly improve traffic. If there's a system that lets people arrive at their destination an hour earlier or have fewer accidents, then it will motivate many people to let themselves to be guided by that system and give up their independence.

WÖHR installed its first Combilift in 1984, and the technology has improved steadily over the years. The Combilift is a semi-automated parking system which uses a combination of stacking cars and moving them closer together. A variety of add-ons are now available for the system, to make parking more convenient.

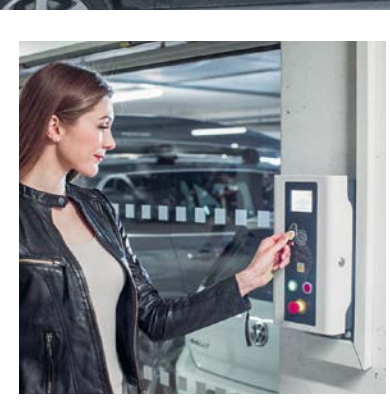
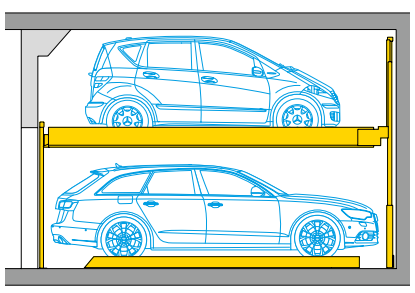
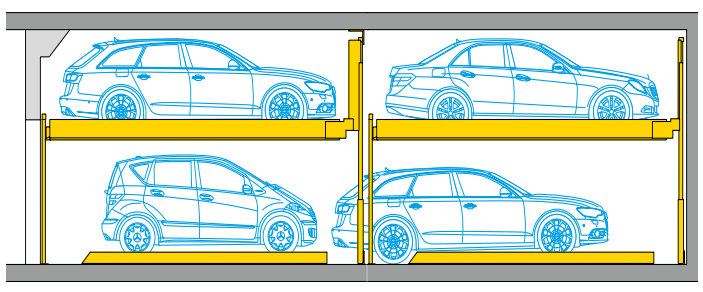


Diagram I Combilift 551



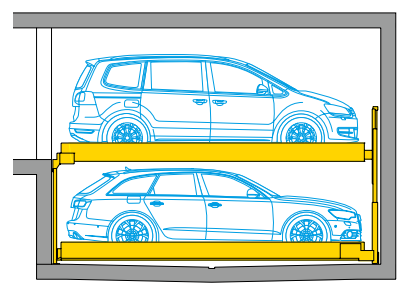
The WÖHR Combilift with two levels of parking and no pit, for independent parking. The technology works like a sliding puzzle: all parking spaces can be accessed directly from the entry level. At ground floor-level, one space is always free. The spaces on the ground floor level slide sideways into the empty spaceso that the upper level can be lowered.

Diagram I Combilift 552



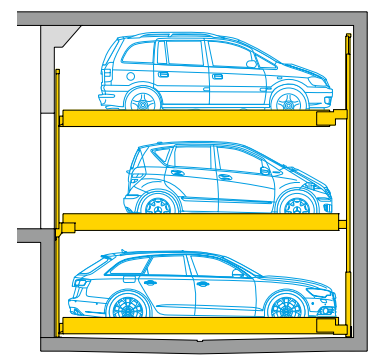
If additional depth is available, the Combilift 552 can be added to provide an extra row of parking behind Combilifts 551, 542 or 543. Up to three rows of Combilifts can be positioned behind one another. One central operation device selects the parking space. Spaces which are in the way automatically slide to the side, allowing users to drive into the selected space.

Diagram I Combilift 542



The Combilift 542 differs from the 551 in that it needs a pit and has two vertically stacked parking levels. With a clearance height of only 2.20 m required (clearance height for SUVs on both parking levels 2.30 m) this lift can be built into conventionally sized underground car parks.

Diagram I Combilift 543



The Combilift 543 is a compact, space-saving parking system on three vertically stacked levels. Vehicles enter and exit via the middle level. A maximum of ten grids can be arranged beside one another and controlled from an operation panel. As with all Com bilifts, parking spaces in the Combilift 543 can also be selected via RFID, remote control or the WÖHR Smart Parking app.

All Combilifts are available for 2.0 t and 2.6 t vehicles. Depending on the system configuration, vehicles up to 2.05 m high can be accommodated. The options for parking space width are between 2.30 m and 2.70 m.

Parking place profiles

A variety of parking place profiles are available as accessories for the WÖHR parking system. The galvanized SMART PROFILE offers increased walkability and parking comfort for drivers and vehicles.

The latest innovation in parking space profiles is the ALU PRIME PROFILE, made of anodized aluminium. With a profile height of just 46 mm, it ensures maximum parking and walking comfort. Through the use of innovative materials, this profile also offers increased corrosion protection while providing a first-class parking experience.

For additional information on parking place profiles from WÖHR.

Smart Parking

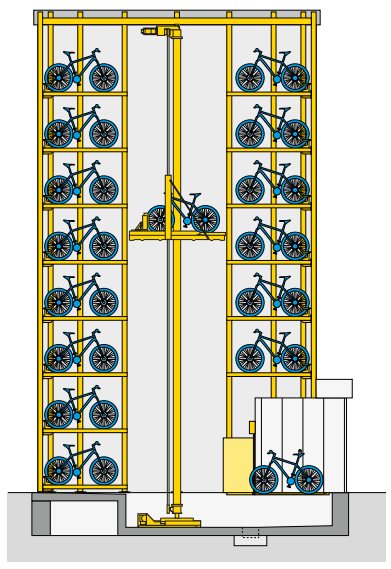
As of 2017, WÖHR Combilift systems have come supplied with the Smart Parking app. That means all smartphones with an operating system of iOS 9 or Android 5.0 and higher can be enabled as remote controls for WÖHR Combilift systems.

universal posts for e-charging

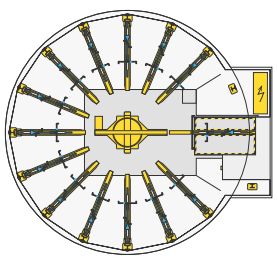
Wallboxes can be attached to the WÖHR universal posts for e-charging on site, which provides an altogether comfortable and elegant way of charging your EV.

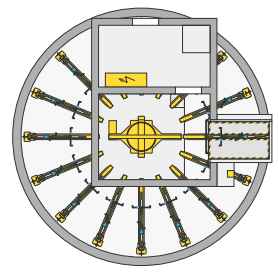
Up, up and away! The Bikesafe from WÖHR

In March 2017, the first Bikesafe from WÖHR Autoparksysteme GmbH was handed over to Jürgen Schwarz, Director of Rutesheim Education Centre.

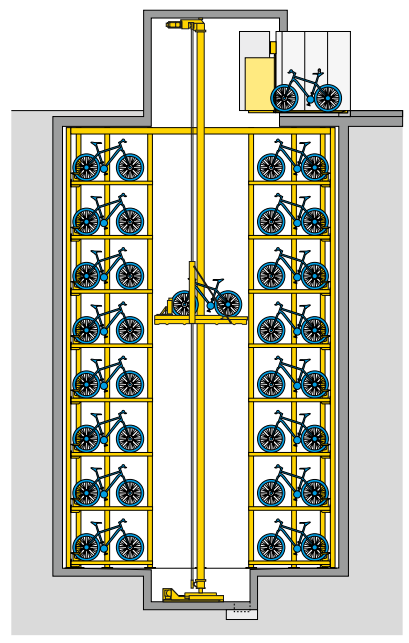


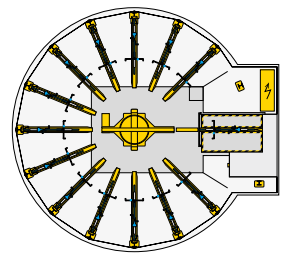
Bikesafe Tower
The overground option spans eight parking levels, offering 122 bike parking spaces. Average access time is just 16 seconds.

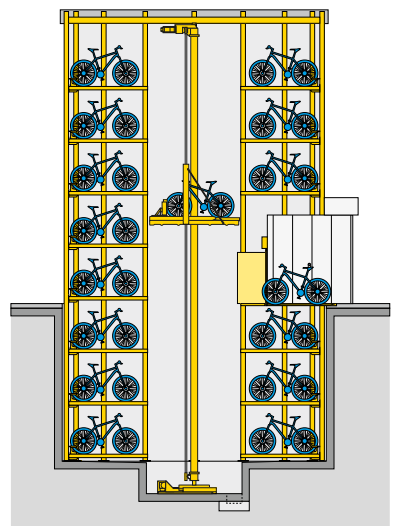




Bikesafe Shaft
The underground option creates up to 128 bike parking spaces.







Bikesafe Tower/Shaft version
Depending on the specific site, the entrance area can be located on a different level.

WÖHR'S Bikesafe provides safe parking for cyclists: The tower version covers around 37 m² and provides space for 122 bikes.

The Federal Ministry of the Interior supplied police crime statistics for 2016 which show that bike theft represented 14% of all thefts in Germany. The Federal Ministry of Transport and Digital Infrastructure (with the Sinus market research firm) also stated in its 2015 Fahrrad-Monitor (German Cycling Monitor) that safe bike storage is the biggest incentive for Germans to cycle. The Bikesafe keeps bikes behind closed doors, so it protects them against theft and vandalism. Neither cyclists nor unauthorised persons have access to the parking levels.

The Bikesafe can be operated in different ways: the standard version operates using an RFID chip. This is best suited to long-term tenants. In public places where users park for short periods, bike spaces can also be booked and paid for flexibly, for example using WÖHR's web platform.

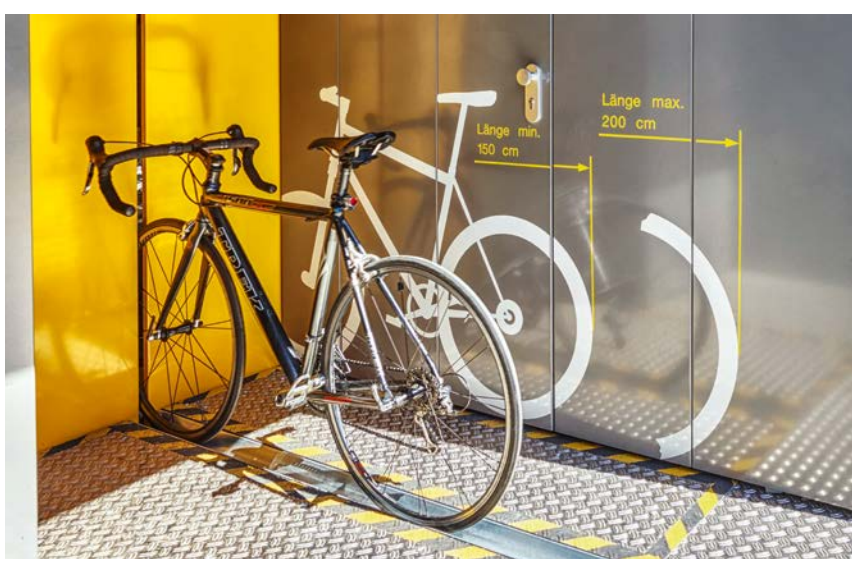
It is easy to operate and user-friendly. First, users place their bikes on a rail in the entrance area. There are sensors underneath the rail to weigh the bike, and tell the system to begin the storage process. Next the storage process is triggered: the sliding door opens a crack, so that the wheel can pass through and the bike is held firmly. The user confirms at the terminal that the storage process should proceed, for example using an RFID chip. Then the vertical conveyor with gripper technology, at the very heart of the system, transports the bike into the storage area. The door closes behind it and the bike is positioned on a free rail using a vertical lift. Storage is dynamic, which means that the closest free space to the entrance is selected. Retrieval works the same way, but in reverse. Users request their bikes at the entrance area using their RFID chip. It takes an average of 16 seconds for the bike to be ready to collect. The prototype Bikesafe in WÖHR'S testing hangar performed some 1,750,000 bike parking procedures between April 2016 and July 2017. Scaled up to 122 storage spaces and two storage procedures per day per space, that is equivalent to a lifetime of some 19 years. WÖHR currently offer both above- and below-ground versions of the Bikesafe, or a combination of the two. The façade can be customised, depending on its surroundings. WÖHR supplies an aluminium façade as standard, available in the current range of RAL colours. Both the Bikesafe and façade are manufactured at the Friolzheim site. Optional external drawers can be used to store e-bike batteries and helmets.

Bikesafe opens in Rutesheim, Germany

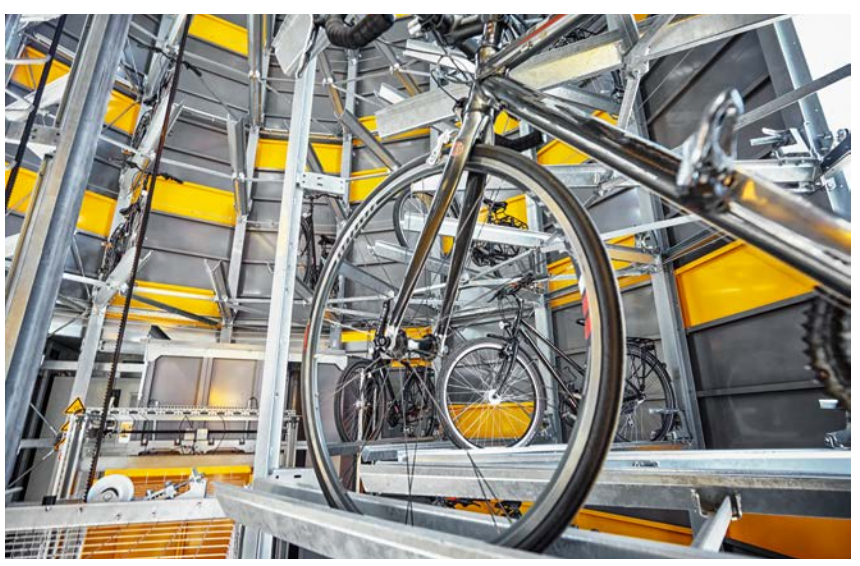
In April 2017, Jens Niepelt, Managing Director of WÖHR Autoparksysteme GmbH, opened the first Bikesafe: 'We are very happy to have this great reference project in the immediate vicinity of our company headquarters. We at WÖHR have been successfully involved in smart parking for automobiles for 60 years, and will naturally continue to do so.

But with Bikesafe, we have now opened a new, additional chapter to show that we can also stack smaller, lighter, two-wheeled vehicles intelligently.'

This flagship for sustainable, environmentally aware practice in the town was supported by the Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety. All current bike models weighing up to 30 kg, including e-bikes and pedelecs, can be stored in the Bikesafe.



The Bikesafe entrance area.



Parking rails in the Bikesafe.

Photos and graphics, p.s. 10–11: WÖHR Autoparksysteme

64 %

of drivers are dissatisfied with the parking situation in German city centres

33 %

of people find parking in residential areas poor or very poor

10 minutes

is the average time taken to find a parking space in Germany; in Italy it takes up to 15 minutes

The search for a parking space emits

1.3 kg

in unnecessary Co_2, so harms the environment

German drivers pay a mere

€60

a year to use multi-storey car parks

Searching for a space adds

4.5 km

onto each journey

€16 German drivers pay

a year in parking fines

€2.100

is lost on average due to accidents while parking and manoeuvring (fully comprehensive insurance)

Sources: APCOA PARKING Study 2013; ADAC, Allianz, Autoscout 24

Save the date:

Industry conference

5–6 March 2018, Mannheim, Germany

The Management Forum Starnberg is holding an industry conference on ‘Building and operating multi-storey and underground car parks’. It will address the latest trends in car park construction, covering new-build and renovation, façade design and quality management. The speakers will include Ferhan Cokgezen of WÖHR, Dr. Ilja Irmscher of GIVT and Dr. Karl-Ludwig Ballreich of Mannheimer Parkhausbetriebe GmbH. WÖHR is a conference Platinum Partner.

www.management-forum.de

Save the date:

MIPIM trade fair

13–16 March 2018, Cannes, France

MIPIM is the world’s leading property market trade fair, which gathers influential international property players from the office, residential, retail, healthcare, sport, logistics and industrial sectors for 4 days of networking, learning and transaction. WÖHR will be making its presence felt there with a stand of its own.

www.mipim.com

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