BAUER REVIEW

FOR EMPLOYEES AND FRIENDS OF THE
BAUER GROUP COMPANIES

2019

49

BAUER

Contents

Since 2001, Europe's largest intra-urban city development project has been under development, the HafenCity, Hamburg. The final part of the development will be the Elbtower, which will reach a height of 244 m. Test piles for the foundations were carried out by Bauer, who recorded the deepest bored pile to date, at 111.4 m.

Internal news

The start of 2019 was unlike recent years. Since November 2018 the BAUER Group has been headed up by a CEO who is not a member of the Bauer family for the first time: Michael Stomberg. In an interview to kick off this 49th issue of the BAUER Review, he reports about his first year at Bauer, the challenges of his new position and his personal impressions. This BAUER Review also focuses on an overarching topic that has a major influence on our time: urbanization.

For centuries, cities have been the hubs of social, economic and cultural life. While urbanization now tends to be a slow process in the western world, generally only involving optimizing structures, cities in developing and emerging countries are exploding into megacities with millions of citizens. According to a study by the United Nations, roughly 70 percent of the global population could be living in urban environments by 2050, with some forecasts terming cities "the habitat of the future".

Urbanization continues apace and creates immense challenges for the ecological, economical and in particular infrastructural development of cities. This is a megatrend that offers the various segments of the BAUER Group numerous new opportunities.

Interview with Michael Stomberg

Mr. Stomberg, you've been the new CEO of the BAUER Group for about a year now. How do you personally sum up this time?

Michael Stomberg: First of all, I'd like to say that I feel really comfortable here. I've been well received and accepted. I've now experienced all the traditionally scheduled events in a typical year at Bauer. I've attended the annual press conference, an in-house exhibition, or in this year's case, the Bauma. Other events include the annual general meeting, various executive meetings, a Group conference and, most importantly, Christmas parties and a summer party. At all these events, my main goal was to try to get to know the people in the company. I've met executives as well as many other employees, all of whom contribute to the success of the company. What I've noticed in particular about these events is how people treat each other, and how they treat me, the "new guy." From the beginning, I was impressed by the open and direct communication at Bauer. I'm especially pleased about this because a direct style of communication is personally important to me and I always encourage all employees to have an open exchange and give feedback.

Since you became CEO, you've been on the road a lot, visiting many different Bauer locations around the world. How well did you get to know the company on these trips?

I think I've come to know much of the company in my first year, but certainly not all of it. Nor was I expecting to do so. From day one, the multifaceted nature of Bauer's three business segments and the many unique aspects within all the segments have fascinated me and have never ceased to impress me. Can you think of another company of our size that offers such a wide variety of products and services, from mining to reed bed treatment plants? Not to mention our impressive specialist foundation engineering methods or the innovative range of equipment that we offer our customers. Above all, you discover something new at each one of our company's international locations. There are different challenges in every region, in every market. I find it incredibly exciting and of course also challenging to set the right course for the company together with all my management colleagues. So I'll sum up by saying that I've become familiar with our company quite well, but I'm far from understanding Bauer completely. I should also add that the process of observing and understanding is never really finished because challenges and tasks change over time. That's why it's also important for me to engage in dialogue with our employees and continuously assess whether our perception of our company is still right and whether we might need to make changes in certain places.

One of the most exciting questions for the employees and the public is not only 'What's the new CEO like?,' but 'How will he run the company and will he make changes?' So what do you have planned?

I've been asked this question many times, especially by people outside the company, such as investors. I attended my first investor conference in January, not even three months after I started. From the point of view of the investors, it's understandable that they are immediately on the lookout for changes made by a new CEO. But I've tried to explain that immediate changes aren't always the best option. In order to make the right decisions, I believe the most important thing is to understand the company and the underlying contexts. It's difficult to set the right course for the future if you don't consider the com-

pany's past and its culture, if you don't immerse yourself in the many different individual topics and don't listen to why certain decisions have ultimately been made. Still, it's unlikely you'll always make the right decisions all the time, unfortunately. But you're much more likely to make better decisions if you consider the alternatives, know the past and take into account the culture of the company. And that takes time. Of course, as CEO, I'll also make decisions that will change the company, there's no question about that. But rather than making a change simply for change's sake, I'll do it with a sense of conviction that I'm doing it for the company and for the sake of the long-lasting success of the business. My most important task is to have the right management teams in the right places and to ensure that we're asking the right questions and that we have the right atmosphere for good decision-making.

Before joining the BAUER Group, you worked for many years as a managing director of Eagle-Burgmann, a global supplier of industrial sealing technology. So you're moving from the product business to the construction business. Did you get a culture shock at first when you saw the kind of things we have to "grapple with" in the construction industry?

The construction business has its own unique challenges of course. Especially for a company like ours, which is so international, fragmented in some places yet spread all over the world. Dealing well with market fluctuations, political changes and technical aspects is a truly Herculean task. Not that the industrial product business, which I have a lot of experience in, is always simple – it too brings lots of challenges. Economic changes can have a strong and sudden impact, especially when it comes to capital goods. You can quickly become overwhelmed by the overheads that you inevitably have when you maintain production plants and facilities all over the world. Ultimately, it's always about understanding your business, listening to customers and consistently putting things into action as a team. I feel we're well positioned at the management levels of the Group and have employees who are skilled at handling the challenges of the business – be it in Construction, Equipment or Resources.

Let's talk about Michael Stomberg the person. What do you do in your free time? What are your interests? Do you have any hobbies?

I have two daughters, who are now in their teens, an "exciting" stage of development. They keep my wife and me busy. This year we took the kids to the US for the first time. Being teenagers, they thought it was "totally awesome" and we had a great tour of the country. Otherwise, we usually vacation in Portugal. The coastal areas have wonderful beaches for surfing, which I'm still pretty bad at, but I'm highly motivated. I've been windsurfing since I was a kid and recently I've been trying stand-up paddleboarding. Water activities are a nice form of relaxation for me. At home I like to go mountain biking, especially on trails along the Isar river. We're also pretty involved in our community, we live in a small village in the south of Munich. Of course, I also try to get together with friends as often as possible. When I have the time, I like to cook for my family and friends. I like to experiment, maybe that's just my nature as a scientist.

What are your plans for the next few months? What will Bauer focus on? Are there any specific issues that you've identified as priorities for the future?

Of course, I want to continue to learn about and understand the company. As I said, that's an ongoing process. More specifically, I see some issues where we need to build more synergies and work more closely together in the future. We have numerous highly decentralized subsidiaries that specifically serve our local markets. I think our subsidiaries could support each other even better, even across segments. Mining is a good example. The Group's offerings in this segment are impressive. For example, Schachtbau Nordhausen is one of the few companies in Germany that is still active in the mining industry and also carries out projects abroad, especially in Kazakhstan. In the Construction segment, we've also carried out specialist foundation engineering work for mining projects such as for a diamond mine in Diavik. On top of that, we build equipment that mining customers find useful, from BG-series drilling rigs to Prakla machines to cutters, which are seeing increased use. Furthermore, the Resources segment has been carrying out exploration and well drilling for mine operators for many years. So Bauer offers an incredibly broad range of products and services for mining. But we still need to learn that we can work together to make further headway in these areas and offer customers more comprehensive solutions for their requirements more quickly. This is just one example, but I'm sure there's much more we can improve about our teamwork. My goal is to strengthen the family atmosphere and down-to-earth culture at the company, to offer employees a pleasant, exciting and safe working environment amid all the changes necessitated by trends such as digitization. Of course, we want to continue to be a reliable partner to our customers for all Bauer products and services. We all want to develop and implement new ideas together – with the passion for progress that we're known for. I'm looking forward to it.

A BAUER BG 15 H was used for a project in the Munich pedestrian zone and in the immediate vicinity of Marienplatz square. Due to the special location of the construction site, the rig had to be transported through narrow downtown streets.

Status report

The BAUER Group had a satisfactory financial year in 2018. Less than six months after I took over as CEO of the Group, I had the pleasure of reporting on the company's good performance at our press conference in Munich in April. Although total Group revenues fell by 4.9 percent to EUR 1.69 billion, the operating result was actually slightly above our expectations. Earnings after taxes were EUR 24.1 million, a significant improvement over the previous year's weak results. We want to further increase our earnings in the future, even though regional market fluctuations remain a challenge.

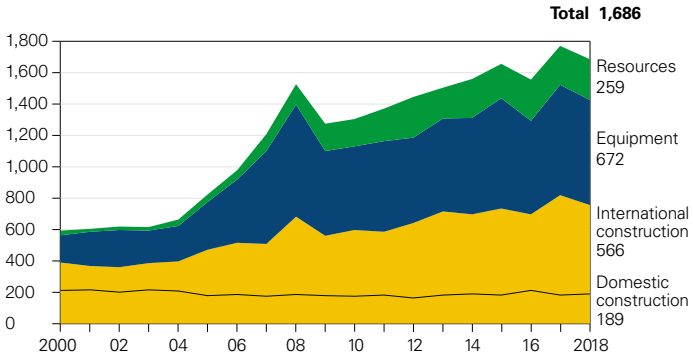
Revenues in the Construction segment fell by 8.1 percent to EUR 767.6 million due to delayed projects and, among other reasons, an order in Dubai that was halted shortly before the project began. Nevertheless, the operating result was very positive because we were able to complete our projects successfully from both a technical and an economic standpoint. Earnings after tax amounted to EUR 9.6 million.

The Equipment segment had another very successful financial year in 2018. Once again, the main drivers were the sales markets in Europe and Asia, especially China. Extensive infrastructure projects around the world continued to result in high demand for specialist foundation engineering equipment, especially large and special equipment, but also after-sales services. As a result, total Group revenues were at a good level of EUR 723.1 million, albeit at 4.2%, slightly below the previous year's level. Earnings after tax amounted to EUR 34.0 million.

Our Resources segment was still undergoing restructuring in 2018. Although total Group revenues rose by 5.3 percent to EUR 261.5 million, earnings after taxes were still very negative at EUR -16.0 million. As in previous years, write-downs due to overcapacity of equipment at our subsidiary in Jordan and the lack of orders at this subsidiary had a negative impact in 2018. Our brewing technology company also had a difficult year and had to be restructured. On the other hand, our environmental business experienced a record order backlog and was very profitable once again.

Development of total Group revenues by segment

in EUR million (segments after deducting Other / Consolidation)

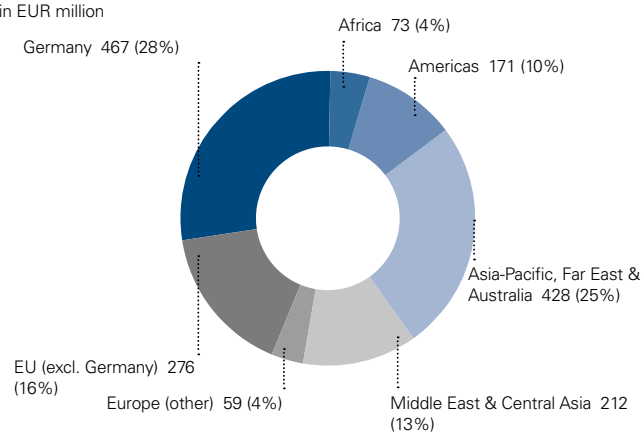


We will work hard to improve the entire Group's earning figures in a long-lasting way. This applies to all areas, but especially the Resources segment. Instead of changing the segment's basic strategy, we want to focus on the issues that have had a negative impact in recent years.

If we look at the current year, we can see that the global economic outlook is worsening. This situation has primarily been caused by political protagonists. The main culprits are the trade conflict between China and the US, Brexit, the escalation of the conflict with Iran, the ongoing sanctions against Russia, the difficult political situation in the Middle East (caused in part by the low price of oil) or the protests in Hong Kong. These political changes, among other things, are causing project delays and postponements, even when the basic demand is there.

Geographical breakdown of total Group revenues

in EUR million

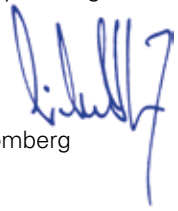


This demand is driven by ongoing urbanization. We continue to see growing construction markets as well as an ever-increasing demand for environmental services and anything to do with water. Our order backlog reflects these fundamental trends and we continue to see many opportunities around the world for our products in all three segments.

Nevertheless, these basic conditions pose a major challenge, especially for companies with a strong international presence. Given that we have about 12,000 people working for us in roughly 70 countries around the world, we're actually always experiencing both situations at once: some regions and markets grow rapidly while other countries delay or halt their construction activities due to political or economic crises. Dealing with these challenges is one of our greatest tasks. I'm confident that we're on the right track, even if we will not be able to achieve our original goals in 2019.

I would like to thank all employees for your dedication, all customers and partners for your trust and partnership, and all friends and enthusiastic followers for your interest in our company. I look forward to continuing my exciting and challenging role as Chairman of the Management Board and to the coming years together with you.

Sincerely,
Michael Stomberg



ORGANIZATION

Bauer constructed a 6,500 m² excavation pit for a new boarding house building in Munich's Neuperlach district.

The megatrend of urbanization

The movement of people to cities

The world is changing. Statistically speaking, one in two people now live in urban areas and that proportion is increasing. The trend towards urbanization is a global shift because it now affects humanity as a whole rather than just individual countries or regions. The United Nations Department of Economic and Social Affairs projects that by 2050, more than two-thirds of the world's population, an estimated 6.4 billion people, will live in cities. As a result, more and more megacities with populations of ten million or more are emerging around the globe.

Some regions are clearly more affected by this trend than others. United Nations statistics show that urban growth is happening mainly in the developing and emerging countries. Of the world's 30 largest megacities, 20 are in Latin America or Asia. For example, the Tokyo metropolitan area, population 37 million, has about as many inhabitants as the whole of Canada. Jakarta, Indonesia, is home to just over 32 million people. The Chinese city of Chongqing has a population of more than 30 million and its administrative municipality is almost as large as Austria. The Delhi metropolitan area, which includes the Indian capital of New Delhi, has a population of about 29 million. By comparison, New York, the epitome of a western metropolis, has just over 21 million inhabitants and is not even ranked among the top 5 largest cities in the world.

As a result of urbanization, fundamental problems are intensifying, as cities grow: space is becoming scarcer and more expensive, traffic is increasing and energy and water supply systems have to keep up with growing demand. Housing density is increasing dramatically. Taller and taller buildings are being built in smaller and smaller spaces. "All this is leading to larger and larger construction projects, which present many exciting opportunities for the construction sector, especially specialist foundation engineering companies. There is enormous pent-up demand for construction, both in the emerging economies and in the established industrialized nations. This applies to transportation infrastructure as well as residential and public buildings, dams and flood protection

MC 64 with low-headroom trench cutter for construction of an underground parking garage in Paris.

facilities," says Arnulf Christa, Chairman of the Management Board of BAUER Spezialtiefbau GmbH. Parked vehicles and traffic flows must also be relocated underground to an increasing extent, which is also leading to growth in the specialist foundation engineering sector. Large-scale projects in urban areas are becoming more complex. This is affecting construction site logistics and coordination. "Bauer is already represented by active construction companies in many countries that are driving the growth of urbanization," continues Arnulf Christa, "no other specialist foundation engineering company is so broadly positioned in the emerging markets."

Huge opportunities for the construction industry

Infrastructure in particular can barely keep up with the pace of urbanization. New concepts for urban development and mobility are needed. Many cities around the world are currently investing heavily in public transit systems. For example, construction work began this year on the second main line of Munich's suburban rail network. In Manila in the Philippines, a new section will be added to the Metro Manila Skyway. The subway networks in Bangkok, Moscow, London, Cairo, Kuala Lumpur, Panama and Dubai are also being continuously expanded. These are just some of the projects in which Bauer is directly involved as a construction company. Bauer supplies construction equipment for numerous other projects, such as the Grand Paris Express. "The infrastructure and mobility needs associated with urbanization present unprecedented challenges for the construction industry, but they also open up enormous opportunities," explains Dr. Ruediger Kaub, Chairman of the Management Board of BAUER Maschinen GmbH.

Construction projects in urban areas are resulting in new requirements for the equipment used in these spaces. For example, noise and exhaust emissions are an important issue, especially in inner-city areas. As a result, there is now greater focus on the need for electric construction equipment. Cramped building sites are another major issue and require increasingly compact, easy-to-transport yet powerful equipment. "We've introduced some major innovations in recent years, from our energy efficiency measures to our low headroom equipment for working below existing structures to our first electrically operated cutter, which we unveiled at Bauma in Munich," says Ruediger Kaub.

Urbanization also poses other challenges for growing cities: in order to meet increasing energy demand, additional power plants must be built and dams

Project "One Bangkok:" In the Thai metropolis of Bangkok, a new city in the city is being built on a 17 hectare site.

must be constructed or rehabilitated. Furthermore, residents must have access to a clean water supply and waste disposal must be organized sustainably. Cities like Mumbai are investing heavily in waste management and sanitation in addition to modernizing public transit. The Mumbai metropolitan area, India's economic and financial hub, has a population of more than 22.8 million. The Indonesian capital of Jakarta is also planning a massive expansion of its public transportation network and water supply system by 2030. The megacity's 10-year development plan includes nine major projects, worth 40 billion dollars. These projects are focused on expanding the rapid transit system, such as the urban Mass Rapid Transit (MRT) and Light Rail Transit (LRT) lines. The projects also include the expansion of the city's drinking water supply and wastewater treatment system as well as the construction of 600,000 housing units.

Specialist foundation engineering and earth works for a multi-storey underground parking garage under the eastern Altstadtring ring road in Munich.

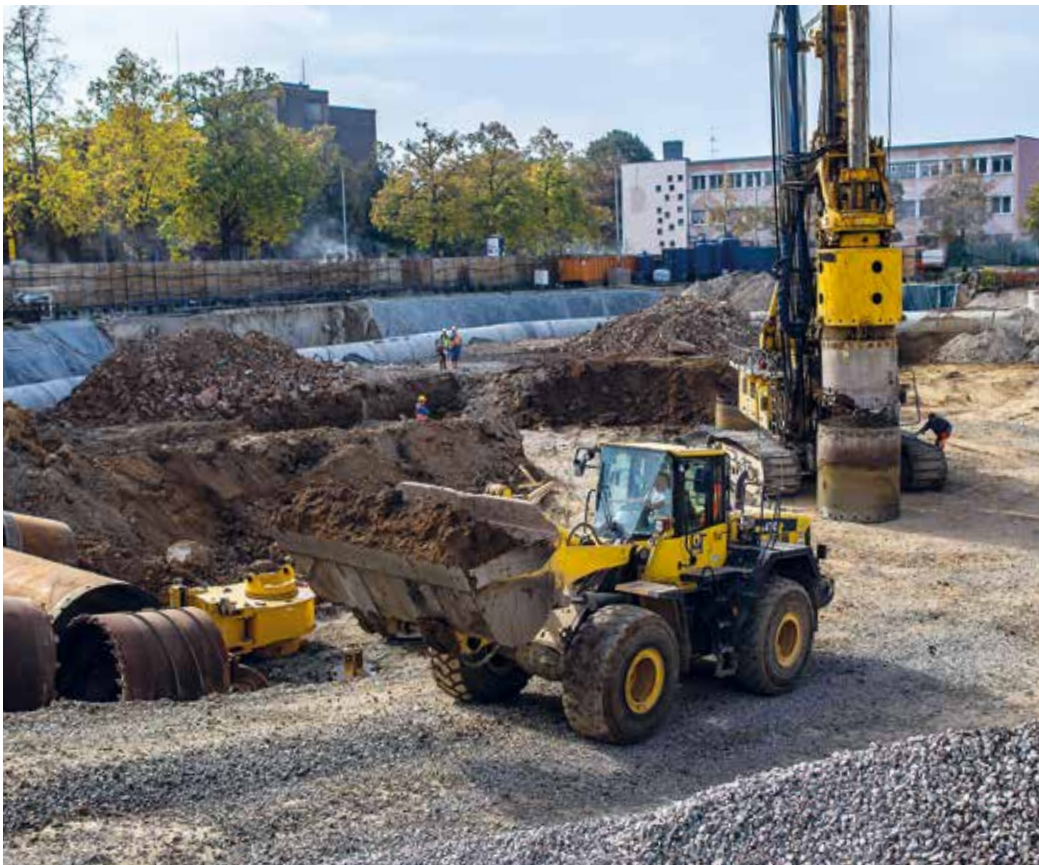
Brownfield remediation takes on new importance

Urbanization is also presenting exciting opportunities for the Resources segment. "Urbanization is the foundation of Bauer Resources' original business model," explains Dr. Roman Breuer, Managing Director of BAUER Resources GmbH. Many contaminated urban sites that Bauer's environmental division has remediated or is currently remediating are former industrial parks. These rehabilitated sites have become attractive to real estate developers, as building space becomes increasingly scarce and expensive. "Of course, these projects are always somewhat dependent on current economic trends. But at the moment, things are moving at a fast pace and we don't expect this growth to stop anytime soon," continues Roman Breuer. Incidentally, the brownfield remediation is also a growing trend in China, not just in Germany and Europe.

Urbanization as a driver of growth

How cities ultimately develop depends on how their growth is planned and managed, according to the United Nations World Cities Report from 2016. In China, for example, the government is taking a new approach to channeling the migration of millions of people from rural areas to cities. New "satellite cities" are being built around megacities to satisfy the demand for housing. The government is currently building several large cities around Beijing that will form a single metropolitan area. More than 100 million people will live in this area. Sixty kilometers outside Shanghai, one of the fastest growing megacities in the world, another new satellite city is being built on land reclaimed from the sea.
However, the primary goal is not just to build more housing and infrastructure for mobility and industry in urban areas that are already dense. New construction must also be sustainable and efficient while meeting the growing demands of urban dwellers. This approach to planning and building is not only exciting, it also offers excellent prospects for the future. Urbanization is continuing and the world's metropolises will be an important engine for the construction industry in the coming years. Against this backdrop, urbanization will remain a stable driver of growth in the long term.

Replacement boring for brownfield remediation on a site in Stuttgart.



Bauma 2019

"An all-round successful event"

It may not have ended with a bang, but on Sunday, April 14, the Bauma trade show in Munich once again finished with a deafening chorus of horns to conclude the seven-day expo. According to the organizers, it was the largest Bauma of all time: 3,700 exhibitors presented over seven days on an area of 614,000 m². Of course, the BAUER Maschinen Group was once again one of them. "Bauma is the perfect platform for us to showcase the technological innovations of our equipment and process engineering to a very large audience of experts from around the world," says Dr. Ruediger Kaub, Chairman of the Management Board of BAUER Maschinen GmbH. The digitization and electrification of construction equipment were the hottest topics at the giant expo. These topics will play an increasingly important role as urbanization continues around the world and results in new infrastructure and mobility requirements.

Dr. Ruediger Kaub (right), Chairman of the Management Board of BAUER Maschinen GmbH and Executive Director Sales Christian Gress.

The core area of the exhibits at the booth, which covered an area of 2,750 m², was again made up of drilling rigs, as has become tradition. BAUER Maschinen GmbH presented its new platform for small drilling rigs optimized especially for Kelly drilling. In 2018, Bauer launched the BG 15 H, a completely new rig that offers all the benefits for handling the challenges of cramped construction sites. Now Bauer has added the BG 20 H to the line. Both BGs are based on the same BT 50 carrier, which Bauer has completely redesigned. Other common features include a transport width of just 2.5 m and the integrated service platform, which has now been introduced for the first time in the segment for compact drilling rigs. In addition, the BG 23 H, BG 33 and BG 45 demonstrated the multifunctional character of the PremiumLine series of rigs. Equipped with various attachments and tools, they demonstrate a small selection of possible applications. The BG 23 H and BG 33 were showcased on the latest generation of BT 65 and BT 85 base machines with significant safety innovations.

First MC duty-cycle crane with electric drive

Environmental sustainability is becoming more and more important on specialist foundation engineering construction sites. In a wider context, the ecological footprint of construction sites is becoming an important factor that also has a direct economic impact. For this reason, Bauer has taken an important step to-

First BAUER MC duty-cycle crane with electric drive.

ward putting an idea into practice and unveiled its first electrically driven cutter at Bauma. The cutter is based on a BAUER MC 96 duty-cycle crane and is equipped with a powerful 500 kW electric drive.

RTG Rammtechnik GmbH showcased two of their rigs at Bauma: an RG 27 S, equipped for the CSM method and an RG 19 T, with its SilentVibro MR 150 AVM sound-insulated vibrator. Between these two machines, a DKS 50/100 drill drive from EURODRILL GmbH was on display. With the RG 19 T, visitors to the booth also experienced a world premiere patented by RTG: a sheet pile assistant that delivers enormous savings in terms of time and safety.

BAUER MAT Slurry Handling Systems unveiled the new CMS-45 container mixing plant at Bauma. The centerpiece of the system is a 1.8 m³ colloidal mixer with an off-center mixing tool and an external circulation line. The exhibits from KLEMM Bohrtechnik GmbH focused on innovations in the field of kinematics, the machine control unit and on the topics of energy efficiency and functional safety. The KR 806-3GS drilling rig has been redesigned in important respects and this was the first time that Klemm had presented it. Compared with the previous model, the kinematics, among other aspects, were completely redesigned. Another Klemm exhibit was the KR 704-2E, which has an electric drive that allows work to be carried out extremely quietly and without exhaust emissions. The KR 704-2E rig had previously been completely redesigned to comply with the new drilling rig standard and to add other features, such as automatic adjustment to different power supply frequencies. The rig is ideal for use in confined spaces and basements, where a diesel engine is unsuitable because it would generate exhaust emissions. This year Klemm also exhibited the HBR 120 rod manipulator. The system was awarded the EURO-TEST Prize from BG Bau at Bauma 2016.

The new BG 20 H.

In addition, the BAUER Maschinen Group's entertainment program once again had a lot to offer: there were daily visits to the manufacturing plant in Aresing, near Schrobenhausen. Furthermore, some of the customers and visitors had the opportunity to visit job sites to get an excellent impression of Bauer machines in use. And the end of each day of the trade show didn't mean an end to festivities in Schrobenhausen. Every evening many guests got to experience the friendly, warm atmosphere at Bauer. The traditional Bavarian evening went down especially well, with typical regional specialties and accompanying live music.

Taking stock of the show, Executive Director Sales Christian Gress was very happy with the outcome: "The extremely good customer response to all our business divisions and the excellent feedback of visitors to our booth are confirmation that Bauma was a success for us. All in all, it was once again an all-round success."

High-profile politicians such as Bavarian Prime Minister Markus Soeder (3rd from left) also visited the Bauer booth.

As always, drilling rigs made up the core area of the exhibits at the booth, which covered an area of 2,750 m², but Bauer subsidiaries also had impressive exhibits.

Digital construction

b-project data management software

NOMINATED FOR: bauma Innovation Award 2019

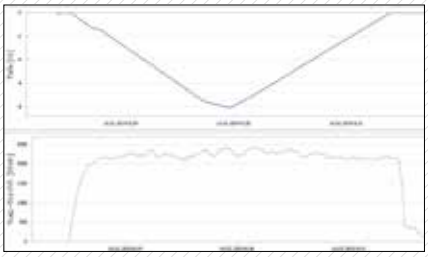
Digitization is constantly advancing and has the power to transform many different areas of life. In today's smart homes, you can now control your home from an app and remotely adjust everything from the heat to the lights to the stereo system. You can effortlessly connect your smartphone to your car and thanks to the cloud, you can access all your data – whether photos, videos, music or texts – anywhere, anytime, on any device.

"In the BAUER Group we use the term 'Digital construction' for innovations in the area of digitization," says Florian Bauer, member of the Management Board at BAUER AG and responsible for the topic of digitization. At BAUER Spezialtiefbau GmbH, digitization is regarded as an important and central tool in the context of BIM (Building Information Modeling). BIM optimizes construction project planning, using a 3D model, which is augmented with the dimensions of time and costs. With the aid of BIM, construction projects can be mapped completely digitally for every phase, from planning to conception and financing to project execution. The entire construction process is visualized to ensure the best possible solution for each individual project.

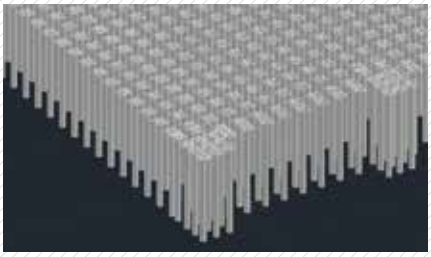
However, quality is largely assessed using the collected production and material test data, since the majority of specialist foundation engineering work is performed below the ground surface and can therefore not be visually inspected and documented. Documenting this data and managing the required information represent a considerable workload for the construction site staff. Bauer Spezialtiefbau therefore records all relevant production data systematically and completely digitally. This data is networked in a targeted manner and automatically analyzed.

Against the backdrop of this "digital construction site", the data management software b-project was developed. "This software is a central tool that allows for the digital collection, automated linking and analysis of all relevant data arising during the course of a project," continues Florian Bauer. Data management covers various areas of application. At the beginning of a construction project, the existing planning data from the design office is digitally recorded and transferred directly to the

BAUER digital



User interface of the b-project data management software with analyses of drilling depth and suspension flow rate.



Graphical visualization of a bored pile project in 3D.

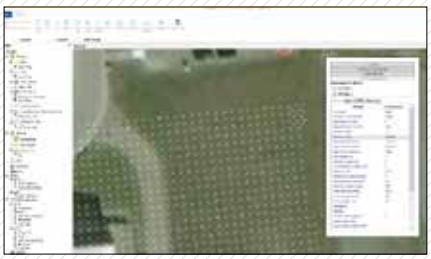
construction site. The machine production data generated during the construction process is imported into b-project, analyzed and made available to the site manager in the form of pre-completed reports. In addition, test specimen lists and technical progress reports are automatically generated.

"The digital machine data generated by our drilling rigs form the basis of the production reports generated in b-project," explains Prof. Dr. Sebastian Bauer, Managing Director of Research and Development at BAUER Maschinen GmbH. This actual production data is automatically fed back into the quality documentation and progress report, thereby forming central interface points in the system. "With the help of b-project, the original data from the planning phase can be directly linked with the actual data from production and analyzed," says Florian Bauer. This automated approach substantially reduces the work involved in documentation and testing and facilitates a standardized, automated and effective optimization process for the construction site. "The software also offers a wide range of visualization options, from analyses in tabular form to graphical analyses using 3D models."

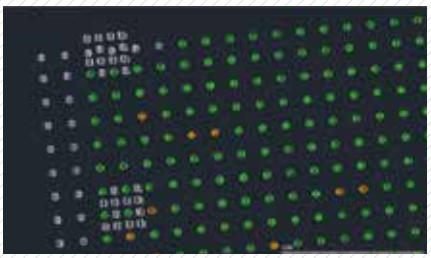
By providing analyses for process control, process optimization and invoicing, b-project will make it possible to digitally capture and represent almost the entire construction site workflow in the future. Florian Bauer: "Our aim is for b-project to reduce the work involved in recording, linking and analyzing the various data so that we can identify possible improvements quickly and reliably. This is an innovative approach for projects of the future."

The b-project data management software was nominated for the 2019 Bauma Innovation Award in the category of Construction/Construction Methods/Building Processes. A total of 138 innovations, including 50 international and 88 national entries competed for the award, with 47 entries making the first shortlist. The official celebration for all nominees and award winners was held in Munich on April 7, the evening before Bauma opened. The third prize in the category of Construction/Construction Methods/Building Processes was awarded to Florian Bauer, member of the Management Board of BAUER AG, Prof. Dr. Sebastian Bauer, Managing Director of BAUER Maschinen GmbH, Marcus Daubner, head of Digital Construction and Stefan Schnitzler, technical project manager for b-project.

Presentation of the 2019 Bauma Innovation Award 2019, left to right: Stefan Schnitzler, Prof. Dr. Sebastian Bauer, Florian Bauer and Marcus Daubner.



Georeferenced summary of pile element properties such as planning parameters, production parameters, quality tests and logs.



Graphical verification of quality criteria. In this example, degree of completion and compliance with drilling depth requirements.

Specialist foundation engineering on all continents

USA With six different drilling diameters and four different casing lengths overall, the production of the total of 153 piles for the foundations of a residential complex with retail outlets in Tampa presented a particular challenge. **Bottom**

Panama To protect the Pedro Miguel locks on the Panama Canal against erosion, a BG 28 was used to build a secant pile wall consisting of 302 piles. **Right**

Dominican Republic To construct the new Monte Grande Dam on the Yaque del Sur River, roughly 30,000 m² of cut-off wall are being built down to a depth of 30 m. The works are being implemented with an MC 96 duty-cycle crane with a BC 40 cutter. **Top**

Haiti In Port-au-Prince, Bauer drilled a total of 97 piles for the foundations of two bridges across the Grey River. The BG 28 was brought in from the Dominican Republic for the works. **Left**

Indonesia To expand the airport in Jakarta, Bauer executed ground improvement works on an area of 199,000 m² to connect the northern and southern runways and laid foundations for a taxiway bridge. A total of 1,072 piles were installed to a depth of 37 m. **Right**

Vietnam Using a BG 28 and a BG 40, piles and a diaphragm wall is being constructed for the building complex 'The Nexus' in Ho Chi Minh City. The direct proximity to a subway tunnel is proving a particular challenge. **Bottom**

Australia To build the pillar foundations for five bridges in Queensland, two BG 30 drilling rigs were mobilized just two weeks after the contract was awarded. For each bridge, two abutments with four piles were driven up to 3.5 m into the bedrock. **Top**

Malaysia No less than three records were broken during the piling works as part of the Lot L&M project in KLCC – Kuala Lumpur City Center. For the skyscrapers, Bauer drilled the deepest piles in Malaysia to date using the currently largest Bauer drilling rig BG 72 and the world's longest kelly bar at 150 m. **Bottom**

Philippines For the Manila Skyway Metro, a roughly 31 km-long expressway on piles, Bauer drilled 33 onshore piles and 76 offshore piles in the bed of the San Juan River. The deepest bores were drilled offshore. **Left**

Burkina Faso To build a circular ventilation shaft for mine work, a secant pile wall and foundation piles to support the vertical drilling system were constructed using a BG 15. **Bottom**

Qatar For the new Red Line of Doha's subway system, 333 tube-à-manchettes were drilled and installed for the purpose of filling in a total of roughly 4,000 m³ injection material to stabilize the soil. **Bottom**

Egypt Bauer has been involved in expanding the metro in Cairo for several years. The specialist foundation engineering works for phase 3 of the mega-project are currently underway. The works for four of the six subway stations and two of the seven ventilation shafts have already been successfully completed. In total, approx. 250,000 m² of diaphragm wall are being built. **Top**

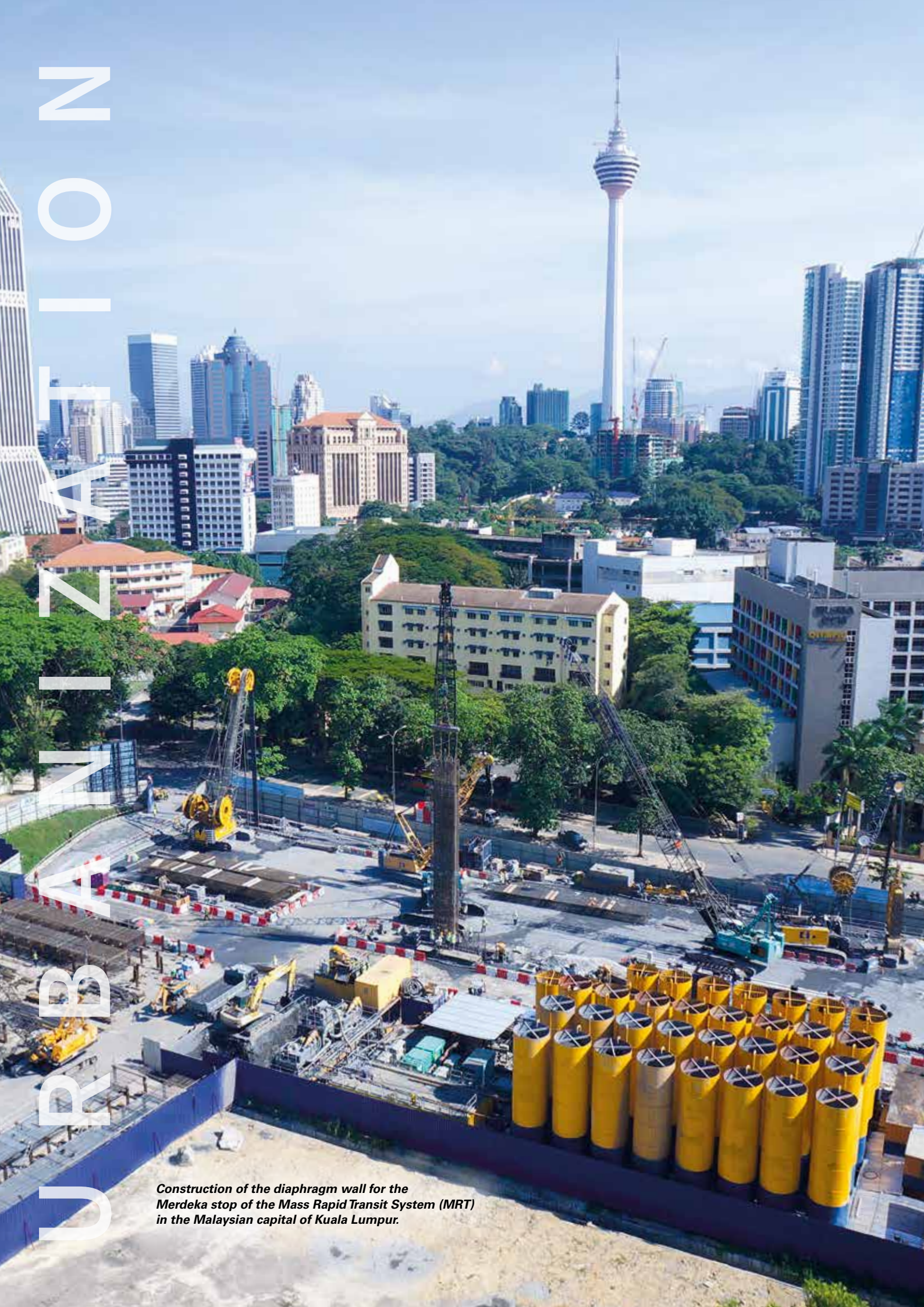
Egypt Roughly 350 km south of Cairo, 56 piles were drilled in the bed of the River Nile as foundations for the Dayrot Nile Bridge. **Bottom**

Saudi Arabia Seven drilling rigs, comprising of models BG 15, BG 28 and BG 40, are being used for the foundation works for a medical center in Jeddah. Over 200 employees are involved in building the foundation and shoring piles. **Top**

Jordan To seal earth basins used to create potash via condensation of salt water from the Dead Sea, around 112,000 m² of diaphragm wall is currently being built with embedded sheet pile walls. Additionally, 790,000 m³ of soil must be moved in order to widen the dike. **Top**

Lebanon Bauer already completed the works for the Jannah Dam, north-east of Beirut, in 2017. Roughly 20 drainage bores with a length of between 5 and 35 m were drilled retrospectively in the dam's drainage tunnel. **Top**

URBANIZATION



Construction of the diaphragm wall for the Merdeka stop of the Mass Rapid Transit System (MRT) in the Malaysian capital of Kuala Lumpur.

Infrastructure

Specialist foundation engineering and subways

Metro, underground, tube, subway, T-bana, metrorail, U-Bahn: there are as many names for underground rapid transit systems as there are cities that operate them. The official opening of London's Metropolitan Railway on January 10, 1863 marked the beginning of rapid transit. With seven stations, the 6 km line was the world's first subway. The journey from Paddington to Farringdon took just 18 minutes, improving the daily lives of countless Londoners. Soon more connections were added. The underground railway network grew and for nearly 150 years, the London Underground was the longest subway network in the world – before it was relegated to third place by the Shanghai Metro and Beijing Subway.

Crossrail London

"We too have played a part in building this iconic subway system," says Michael Stomberg, CEO of BAUER AG. "As part of the Crossrail project for a 180 km underground railway line that crosses London from east to west, we helped build the Tottenham Court Road tube station in 2011 and the Liverpool Street and Whitechapel stations starting in 2012." The sites are located in the Soho district and in the heart of London's financial district. Constructing the piles and diaphragm walls for all three stations proved especially challenging not only because of the space constraints, but also because of the strict noise control regulations that had to be met in the downtown location. In addition, crews had to minimize vibrations and avoid disrupting underground tunnels, pipelines and neighboring buildings. The section between Paddington and Abbey Wood, where the stations executed by Bauer are located, has now been renamed the Elizabeth Line. Crossrail is currently scheduled to open between autumn 2020 and spring 2021.

The beginnings

Bauer's participation in major underground projects is not limited to current infrastructure projects around the globe. It actually stretches back to the beginnings of specialist foundation engineering at Bauer. The construction of the first underground lines in German cities in the 1960s harbored new possibilities for Bauer and the injection anchor the company developed in 1958 at the Bayerischer Rundfunk construction site in Munich. Starting in 1965 the first project was for the subway system of Munich, the Bavarian capital. Bauer carried out numerous projects including construction of the excavation pit for the interchange station at Marienplatz. This was followed by countless other subway projects in Germany, Austria and even Spain: Berlin, Dusseldorf, Essen, Cologne, Bonn, Frankfurt upon Main, Stuttgart, Nuremberg, Hamburg, Vienna and Madrid. For example, in Hamburg, an underground rail line and a suburban rapid transit line intersected in the vicinity of the Jungfernstieg subway station under the Inner Alster lake. A total of

75,000 m of anchoring was installed for the 21 m deep pit. In the 1970s, many smaller cities followed the example of large German cities like Berlin, Hamburg and Munich. Kroepcke square, a central intersection in Hanover's pedestrian zone, was home to the largest excavation pit in Europe in 1971/72. Two subway lines intersected at the square and 3,184 anchors were installed for the 26 m deep excavation pit. Starting in 1976, Bauer was involved in the construction of the Stuttgart subway. Munich also continued to grow and expand its subway network.

Opportunities in the Far East

In the 1990s, there was not much demand for new subway projects in reunified Germany, although existing structures, such as the underground station at Potsdamer Platz in Berlin, were expanded. As a result, the focus shifted toward international infrastructure projects in the Far East. During this period, the BAUER Group had an increasing number of contracts in East Asia. The Construction and Equipment segments were active in all the major countries of the region: Japan and South Korea, Malaysia and Singapore, the Philippines, Thailand, Indonesia, Taiwan and Hong Kong. In 1992, Bauer started two projects that involved expanding existing subway lines: Higashi Nakano Station in Tokyo, Japan and the metropolitan railway in Seoul, South Korea. The situation was different in the Thai capital of Bangkok. The city had no underground public transit system at the time, so all structures had to be built from the ground up. From 1997 to 2000, Bauer was involved in the construction of six stations on the MRT Blue Line, Bangkok's first subway line, which was 22 km long. The success of this project laid the foundation for further infrastructure contracts in Bangkok in the following years. Most recently, Bauer helped construct another line: the MRT Orange Line in 2018. More than 370 bored piles with diameters of between 800 and 2,000 mm were drilled to a depth of between 40 and 65 m and approximately 58,600 m² of diaphragm wall was installed to a depth of 27 m. "We were dealing with extremely stringent tolerances and had to carry out the work above existing tunnels. Extreme care and accuracy were our highest priority. Also, we had to ensure the stability of the subsoil and access to the construction site during the rainy season," says Arnulf Christa, Chairman of the Management Board of BAUER Spezialtiefbau GmbH. The new line is scheduled for completion in 2022.

Thai Bauer carried out the specialist foundation engineering work for the new MRT Orange line in the Thai capital of Bangkok.

All over the world

After completing many projects in the Far East in the 1990s, Bauer was awarded its first subway projects in North and South America in the early 2000s. Projects included Fulton Street Station in New York City as well as Metro Valparaíso, also known as Merval, in Valparaíso, Chile, where Bauer helped expand the rapid transit system and added additional connections to neighboring cities. Bauer was also involved in the construction of the underground line in the city of Viña del Mar, the fourth largest city in Chile. In addition to Valparaíso in South America, another important contract for Bauer in Latin America was the construction of the subway in Panama City. Construction of the first metro line began in 2010 as part of an effort to improve the traffic situation in Panama's capital. Here too, Bauer was commissioned to execute the diaphragm walls of four underground subway stations and to construct several secant pile walls for

Bauer has been involved in the expansion of Cairo's various cutters are being used on BAUER MC 128

Munich · Hamburg · Berlin · Dusseldorf · Essen · Cologne · Bonn · Frankfurt upon Main · Nuremberg · Stuttgart · Vienna · Madrid · Hanover · Tokyo · Taipei · Seoul · Singapore · Shenzhen

ventilation and emergency shafts. After the subway opened, Bauer was contracted to build another line, this time above ground rather than underground. Bauer's first prestigious infrastructure project on the African continent was the expansion of the subway in the Egyptian capital of Cairo. Lines 1 and 2 were initially constructed from 1985 to 2002 without Bauer's participation, although an increasing number of Bauer cutters were used in the multi-phase construction project for Line 3 beginning in 2008. Specialist foundation engineering work for the section, which will cross the Nile and will include six underground stops, finally commenced in September 2017.

metro since 2008. Among other equipment, and MC 96 duty-cycle cranes.

Grand Paris Express

Underground rapid transit systems continue to be expanded in Europe. In Paris, for example, two lines of the world-famous Métro Paris are currently being extended and four lines are being added. The subway is 119 years old, making it the sixth-oldest subway in the world. The French capital wants to expand its underground network by 200 km by 2030, overtaking the London Underground, currently the largest underground network in Europe. "Grand Paris Express" is the name of this gigantic infrastructure project, which is the largest of its kind in Europe. "In this project, several French customers of Bauer Maschinen are relying on high-performance BAUER MC 96 duty-cycle cranes with attached BC 40 trench cutters. The cutter is equipped with a rotating hose rewinding system and can be continuously rotated between -50 degrees and +95 degrees relative to its standard position," says Ruediger Kaub, Chairman of the Management Board of BAUER Maschinen GmbH. Walls up to 70 m deep are being constructed using the diaphragm wall method for the future stations, ventilation system and emergency exits as well as insertion and receiving shafts for the tunnel boring machine. Construction of the Grand Paris Express began in 2013. Sixty-eight stations and a network of automated metro lines will be built by 2030. Up to 15 Bauer cutters are being used in this large-scale project.

In the French capital, up to 15 Bauer cutters are being used at a time for the gigantic "Grand Paris Express" infrastructure project.

Outlook

"With so many prestigious projects under our belt, we continue to be engaged in new and challenging subway projects all over the world," says Michael Stomberg. "We're playing a big role in improving people's quality of life through all these urban projects. An expanded or completely new rapid transit system enables mobility. And the mobility of people is the engine for every urban region." Two major construction projects for the second main line of Munich's suburban rail network were awarded to a joint venture that includes Bauer. These projects are examples of the continued positive outlook for this sector. The first contract involves aboveground work on the section between Laim and Donnersbergerbruecke station and the second contract is another underground project that is centered around Munich Central Station, including the tunnel line between Donnersbergerbruecke and Marienhof. "This marks our return to the city where Bauer's activities in the subway sector all began," says Michael Stomberg. "I believe urbanization will remain a global megatrend for years to come. That means there will be a continued need for infrastructure projects such as subway systems and we've successfully completed references with many important projects in this area over the last 50 years."

Machinery in customer operations

Canada As part of the FalCon project in Saskatchewan, samples were taken successfully at a cutting depth of 251.4 m. Prior to this, no other cutters worldwide had reached this depth in commercial applications. The FalCon project by Rio Tinto Exploration Canada Inc. and Star Diamond Corporation, aims to demonstrate the geological viability of the kimberlite fields at Fort à la Corne. A BC 50 cutter and an MC 128 duty-cycle crane were used for sampling. **Top**

USA To build an 85 m-long retaining wall in Bedford, Pennsylvania, our customer Carmen Paliotta Contracting used a BG 26 with Kelly equipment. **Bottom**

Chile For a project in the Atacama desert at an elevation of 3,800 m above sea level, our customer Hellema Holland used a PRAKLA RB 50 universal drilling rig. **Bottom**

Honduras Geotecnica Solutions implemented vibro displacement in Puerto Cortés using a BG 20 H with a TR 17 deep vibrator. **Bottom**

Canada Our customer Henry Drilling used two BG 30 V and a BG 28 V to build a secant pile wall in the Canadian tundra in Nunavut. **Top**

United Kingdom Ivor King (CEC) Ltd used an RG 21 T to install sheet pile walls in Manchester. **Top**

Sweden For the subway in Gothenburg, our customer Aarsleff is building a secant pile wall using a BG 36 H. **Top**

Sweden In Stockholm, our customer Top Drill AB drilled a total of 135 bores for the foundations of a residential building using a Klemm-Lafette 313. **Bottom**

Belgium When restoring a church near Brussels, our customer CVR nv. opted for a Klemm KR 801-3FS for micro-pile drilling. **Bottom**

Austria In Linz, our customer Implenia Spezialtiefbau GmbH used a BG 30 H with continuous flight auger equipment, which was lifted from the excavation pit again after the works. **Bottom**

Austria Geops Bohrgesellschaft mbH used a KLEMM KR 805-3G for a dewatering well drilling with stand pipe for a tunnel. **Top**

Germany Porr Equipment Services GmbH used a BG 45 V with Kelly equipment to build a secant pile wall for a hydroelectric power plant on the River Inn. **Top**

Germany Our customer Max Bögl used a BE 275-60 desanding plant by BAUER MAT from Immenstadt for microtunneling at Frankfurt airport. **Bottom**

Poland To secure a slope in Tęgoborze, our customer IMB Podbeskidzie successfully deployed an RG 25 S. **Bottom**

Bosnia and Herzegovina Our customer Euro-Asfalt d.o.o. made use of a BG 30 V and a BG 22 H in Zenica. **Bottom**

Czech Republic For the pile foundation of a high-rise office building in Prague, our customer Hinton a.s. used a BG 24 H with Kelly equipment. **Top**

Ukraine In Kiev, our customer Bud-Objekt TOV used a BG 28 with Kelly equipment to install foundation piles for an apartment building. **Top**

Italy In the city center of Padua, our customer Impresa Marini Ermenegildo S.p.A. used a BG 39 with a cased continuous flight auger. **Bottom**

Algeria To drill a well for agricultural irrigation, our customer Amais SPA deployed a PRAKLA RB 50. **Bottom**

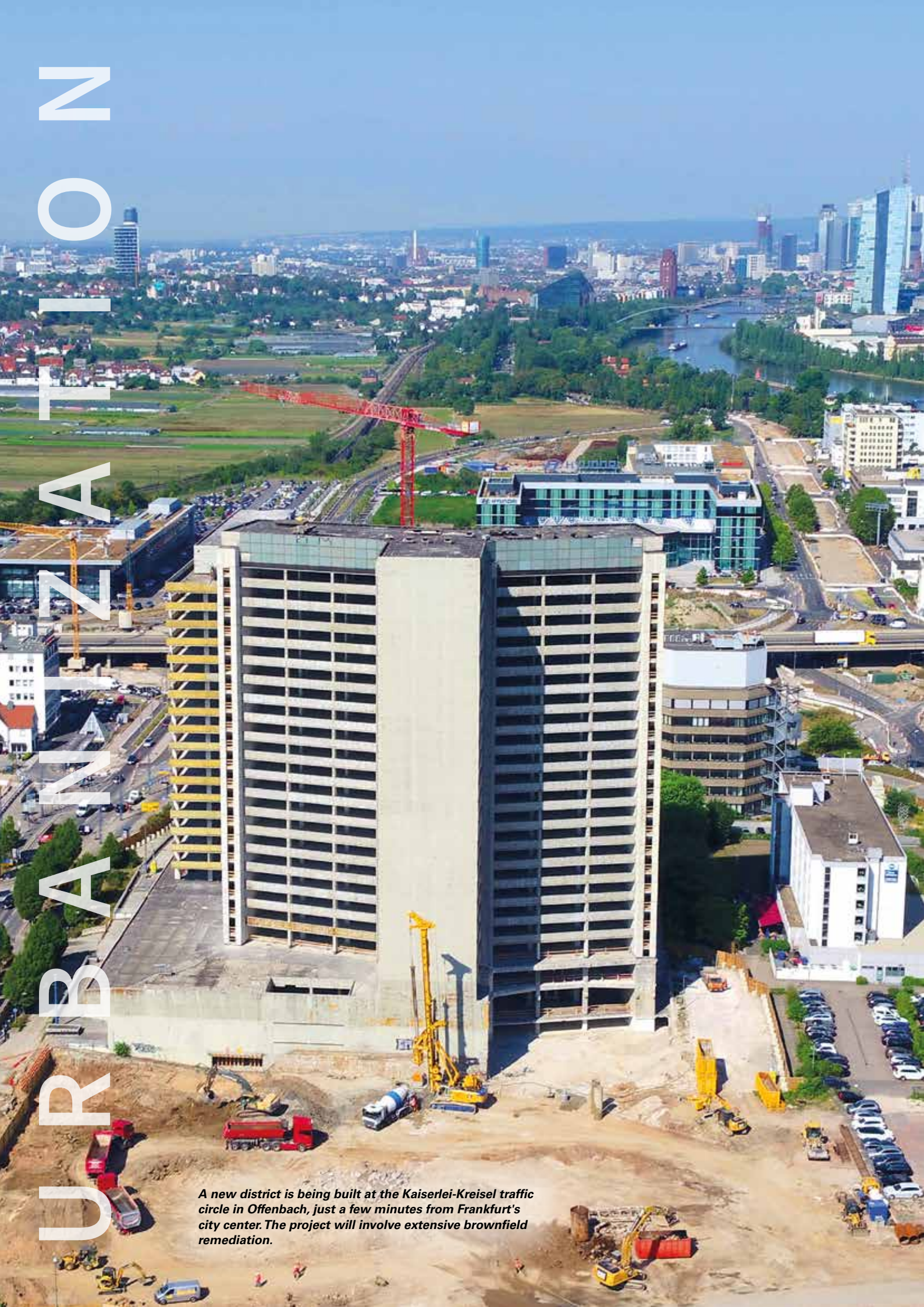
Egypt Our customer Arab Contractors Mechanical & Electrical Engineering drilled foundation piles down to a depth of 30 m, using a BG 36 V in Kelly drilling mode. **Top**

Turkey Our customer Sezerler Zemin Ins. San. Tic. Ltd. Sti. drilled multiple piles to protect a pipeline against landslides using a BG 28 H with Kelly equipment. **Bottom**

China In the Chinese metropolis Shanghai, our customer Shanghai Tunnel used a BC 40 cutter on an MC 96 duty-cycle crane, as well as a BC 50 cutter on an MC 128 duty-cycle crane. **Top**

Australia In Adelaide, Keller Australia used a BG 30 equipped with a cased continuous flight auger to build a five-story car park. **Top**

URBANIZATION



A new district is being built at the Kaiserlei-Kreisel traffic circle in Offenbach, just a few minutes from Frankfurt's city center. The project will involve extensive brownfield remediation.

Brownfield remediation

The cities of the future are emerging on brownfield land

Places where car parts were once manufactured or motor oil was refined are now home to coworking spaces where start-ups are focusing on the urban mobility of tomorrow. The way we live is changing rapidly and as many industries transform, land and buildings are becoming available. In almost every city, there are sites that have gone unused, been abandoned, or left to wither away as industrial wastelands. But these vacant industrial sites are increasingly being brought back to life: historic mine pits are being transformed into cultural centers, former foundries turned into gigantic logistics parks or apartment buildings and office complexes. Port cities such as Hamburg or Copenhagen are even building entire districts on former dockland.

A key aspect of urbanization involves finding and redeveloping industrial brownfield sites. From the point of view of property owners, this makes economic sense: many investors around the world are looking for investment opportunities. Recycling land is also essential from a social and political point of view. Many cities need new housing and want to encourage new ways of living and working. Lastly, the city and the countryside are mutually dependent. Rural areas have always been the ecological counterbalance to densely populated cities and metropolises. If cities can no longer cope with growth due to lack of space, these shortages will be remedied at the regional level and more rural land will be developed. Instead, the focus should be on reducing the use of unspoiled land for ecological reasons and revitalizing urban areas for commerce and services.

In fact, there is no shortage of brownfield sites that can be revitalized. For example, Germany is estimated to have around 50,000 hectares of reusable land, about one third of all existing industrial and commercial brownfield sites. Some abandoned areas are not as unusable as they might appear, especially if they are approached with expertise in environmental technology.

From specialist foundation engineering to waste disposal

The BAUER Group has been using this environmental technology with great success for around 30 years. In the late 1980s, Bauer had the idea that the company could provide all the necessary services from a single source: from carrying out the excavation pit to executing the soil remediation. In 1990, the joint venture Bauer and Mourik Umwelttechnik was formed and – following the departure of the Dutch partner – the name was changed to BAUER Umwelt GmbH. Since 2007, Bauer Umwelt has been a central pillar of the BAUER Group's Resources segment.

Today, Bauer Umwelt is one of the leading remediation companies in Germany. Distribution is organized regionally and divided into the East, North, West, Rhine-Main-Neckar, South-West and South regions. Close Group-wide cooperation

has always played a major role in project execution, but it has become even more important over the past ten years. Remediation usually starts with specialist foundation engineering. After that, Bauer's environmental division handles everything from replacement boring to demolition and excavation to groundwater treatment and waste disposal. Thanks to this comprehensive range of services and perfect teamwork, the excavation pit is completely finished when it is handed over to the client. "There are only a few companies that can do this," says Samer Hijazi, Managing Director Division Bauer Environment at BAUER Resources GmbH. "I think that's pretty unique in Germany."

Another recent change: just a few years ago, waste disposal was only a small part of the overall contract, but now it makes up 60 or 70 percent of a project. The excavated contaminated soil is then taken to one of the five soil treatment centers, where more than 400 different types of waste are accepted, stored and treated. "Sometimes the soil is not contaminated at all, but we still take care of it," says Samer Hijazi. "Nowadays, even non-contaminated soil has to be disposed of."

The Diamalt project is currently the largest construction project in the district of Allach-Untermenzing in Munich. Bauer Umwelt carried out extensive remediation work in order to prepare the site of the former baking agent factory for redevelopment.

Historic industrial park to become modern business center

The eastern side of Munich is home to an impressive example of how a contaminated industrial brownfield site can be transformed into a lively office park. There, technology group Rohde & Schwarz is planning to build a cutting-edge building complex around a historic 1920s office building on a site where motorcycles and clothing were once manufactured. The "iCampus" integrates seamlessly into the infrastructure of the Bavarian capital as part of the city's Werksviertel district. The site's proximity to the Ostbahnhof station and Mittlerer Ring expressway ensure excellent travel connections in all directions.

However, before the new district can be transformed into the mixture of living, working and recreational space envisioned by the urban planners, it requires a complete brownfield remediation. Bauer Umwelt was contracted for the demolition of adjacent buildings as well as the remediation work and soil excavation. By mid-2020, a total of 100,000 m³ of soil will be excavated at the site. The tight schedule for the construction phase is another special challenge in addition to the urban location and the cramped site conditions.

Replacement boring in the tightest of spaces

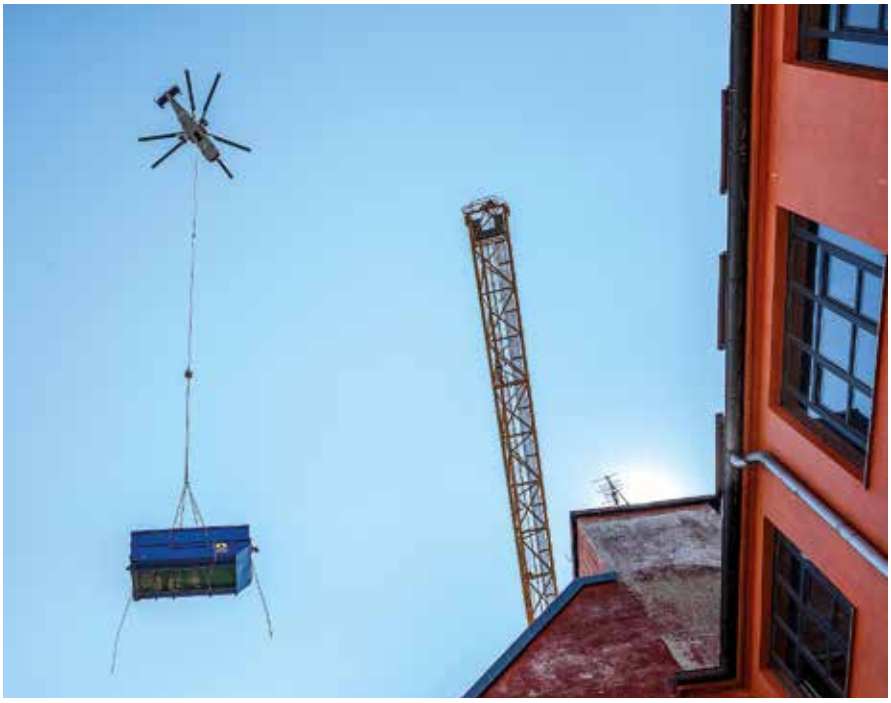
In Wuppertal, North Rhine-Westphalia, Bauer Umwelt demonstrated that replacement boring is possible not only in a city center, but also under a tent cover. In a 6.5 m tall building, the BAUER Group's specialist in brownfield remediation excavated soil contaminated with halogenated volatile hydrocarbons under a former degreasing pit. Since even Bauer's low headroom equipment could not be used due to the extremely low ceiling, Bauer Umwelt partnered with a subcontractor to develop a special drilling rig that could pass through the low and narrow entrance to the building.

The project was then executed with tried-and-tested remediation technology. With the aid of the bore grid plan, the specialists determined the precise coordinates and depths of the individual bore holes. The rotary drilling rig rotated the casing into the ground and the soil in the casing was removed using special drilling tools such as drilling buckets or augers. The process was repeated until the final depth was reached. At the site in Wuppertal, the final depth was around 10 meters and included weathered rock. After the contaminated soil was completely removed, the bore hole was filled with a clean sand-gravel mixture. In one part of the site in Wuppertal, a filling binder was also used to stabilize one of the building's pillar. In a total of 60 drilling operations, Bauer

Umwelt replaced about 170 m³ of soil in the building. Despite the extraordinary conditions, the contaminated brownfield site was transformed into a usable space that can be redeveloped in the near future.

A new beginning on historic soil

Diamaltpark in Munich's Allach-Untermenzing district has historic significance. Starting in 1903, this factory complex produced "diastatic malt extract," a revolutionary ingredient that made it possible to produce bread and baked goods in the large quantities we are accustomed to today. The three listed buildings in the middle of the former factory site are now reminders of the glory days of Diamalt AG. In the future, they will serve as a landmark for a new district that is being built around the vacant site. Diamaltpark will be home to 750 apartments, three day care facilities and a large central green space. Bauer Umwelt carried out extensive remediation work in order to prepare the site of the former baking ingredient factory for redevelopment. A total of around 264,000 t of contaminated soil was excavated, temporarily stored and taken to disposal sites in 10,000 truck loads, an extremely challenging task from a logistics perspective.



This 4.5 t water purification system from Bauer Umwelt was lifted by helicopter from an excavation pit in downtown Munich.

In harmony with surrounding buildings

Living next to a brownfield site is often not very pleasant. Worries about contaminants or the dilapidated state of abandoned plants only add to the site's bleak appearance. And once remediation begins, there might be equally justifiable concerns about noise, dust and toxic emissions. "So it's all the more important that we explain our procedures to everyone affected or interested as far in advance as possible," says Samer Hijazi. Some companies are not very transparent about their methods, but he believes in taking the opposite approach: "Open communication throughout the project is absolutely essential." The local residents are involved right from the start and, depending on the level of contamination, takes a wide range of special precautions. For example, the latest technology is used to extract and purify the contaminated air during the drilling process. Numerous other capabilities are also used, such as highly absorbent noise control systems as well as intelligent measurement and equipment technology. Much is already possible today and Bauer Umwelt is working hard to develop further solutions for the future of brownfield remediation.

Bauer Umwelt's environmental technologies help clean sites where water and soil have been polluted by industry. Replacement boring was carried out for a customer in Wuppertal under extremely cramped conditions.

Netherlands To remediate the existing Amstelveen tram line in the south of Amsterdam, Bauer built approximately 1,200 GEWI® piles. The tram line was shut down temporarily for the works. **Top**

Specialist foundation engineering all over Europe

United Kingdom One of the deepest mines in Great Britain will be built in the next few years in North Yorkshire. To build circular diaphragm wall shafts between 60 and 120 m deep, three BC 40 cutters on MC 96 and MC 128 duty-cycle cranes, as well as three BE 500 and BE 550 complex desanding plants from BAUER MAT were used. **Left**

Switzerland For a new international research and development center for F. Hoffmann-La Roche AG in the city center of Basel, roughly 5,000 m of cased cast-in-situ piles were installed down to a depth of 35 m. **Top**

Austria For remediation and enhancement of the road safety of a highway bridge over the River Danube in Linz, around 10,000 m of piles were installed. For the deep foundations of a total of four pier sites for two bypass bridges, Bauer also drilled approx. 1,600 m piles inside sheet pile wall boxes, which were previously installed in the River Danube. **Left**

Bulgaria To expand the subway in Sofia, Bauer built a secant pile wall comprising of 22 individual piles, with a length of 42 m for a ventilation shaft with a diameter of 6 m. **Right**

Slovakia For the foundations of a 35-story residential building in the city center of Bratislava, Bauer drilled 3,300 m of piles using the continuous flight auger method. The excavation pit in the building core was also secured with a mixed-in-place wall. **Bottom**

Georgia For a recreation center with a hotel on the exclusive Batumi Boulevard by the Black Sea, the deepest and largest pile ever drilled in Georgia was installed at a length of 62.3 m and a diameter of 1,500 mm. **Top**

France A mixed-in-place cut-off wall was built to remediate a dike on the Rhône in Provence. For this purpose, the elements were installed in the existing dike along a length of 570 m and down to a maximum depth of 23 m. A BG 40 was used for the works. **Right**

Hungary For a new sports center in the heart of Budapest, roughly 2,000 m² of diaphragm wall was built down to a depth of 20 m in tight space conditions. The earth works involved excavating around 11,000 m³ of soil down to a depth of 18 m below ground level – not an average excavation depth for Hungary. **Bottom**

Sweden To secure a tunnel portal for the new subway in Gothenburg, Bauer built a pile wall consisting of roughly 60 piles down to a depth of 35 m to the left and right of the subway line. **Top**

Schachtbau Nordhausen

Schachtbau technology for Europe's largest river remediation project

A kilometers-long tunneling project in a Kazakh mine, a 120 meter-long bridge for the North Cape in Norway: SCHACHTBAU NORDHAUSEN GmbH regularly makes a name for itself with impressive projects. This time it is not overseas but in the German Ruhr region that the traditional company from Nordhausen is involved in a similarly spectacular building project, during which Europe's longest sewer has been lowered incrementally since 2009, renaturalizing the River Emscher. Schachtbau Nordhausen is delivering and installing the pump technology required for this.

The Emscher is the main river in the Ruhr region, Europe's third-largest conurbation after Paris and London. It is only in the past few years that the water in some tributaries has become clean enough again that animals like the rare kingfisher are returning. This is in spite of the fact that contamination started over 100 years ago, when the river and most of its tributaries were turned into sewers. They carried the industrial waste water away from the coal mines and steelworks into the River Rhine. The Emscher and its tributaries were straightened and routed into a solid concrete bed. As a result, toxic industrial waste water flowed openly through towns and cities for decades. Added to this was the stinking household waste water. The once clean Emscher became Germany's dirtiest river.

It was not until 1992 that the unexpected happened: Emschergenossenschaft, the responsible regional water industry association decided to restore the Emscher and its tributaries to their status as a natural river system – along a length of around 350 km. The end of heavy industry in the Ruhr region represents a new opportunity for the Emscher. Once

The pumping station is a massive construction project that is fully equipped with machinery provided by Schachtbau Nordhausen.

all coal mines ceased production, the waste water in the region is to be banished from the river and underground once and for all. An immense project, as never before have kilometers of pipelines been laid underground retrospectively in such a densely populated conurbation.

The engineers have to install thick waste water pipes under developed land. To this end, they are using new technologies from modern mining. This involves three huge pumping stations with a total output of 172,000 m³/h – "that is equivalent to 1.6 tankers per second," is how Schachtbau project manager Kay Exel describes the scale. When it comes to materials, anything installed underground must be sturdy and durable.

From the air, the 50 m-wide shafts of the pumping stations look like huge settling pits – but the technology itself is over 40 m underground. The pumping stations serve as a form of lift for the waste water and deliver it upward through pipes. This is necessary because the sewer has a greater slope than the terrain along the Emscher from Dortmund in the east to where the Emscher joins the Rhine in Dinslaken. If the waste water is not to reach a depth of 75 m after 51 km from its starting depth of 8 m, it must be pumped at regular intervals.

The two pumping stations in Bottrop and Gelsenkirchen have been completed after two years of construction. Schachtbau Nordhausen will start construction in Oberhausen at the end of 2019. The Emscher is to be free of waste water again in the near future. The concrete bank reinforcements will then be a thing of the past.

The remediation of the Emscher system is a challenge of immense scale – in every respect. Schachtbau Nordhausen's team of experts has provided support with the technical implementation of many plants.

Now that the pumping stations in Gelsenkirchen and Bottrop have been completed, all eyes are on Oberhausen, where the largest of the three pumping stations is to be built.

Schachtbau Nordhausen

Change in management

Juergen Staeter (second from the left) retired on September 1, 2019, and handed over the role of Chairman of the Schachtbau Management Board to Michael Seifert (left). Along with Thomas Staeter (second from the right) and André Ponndorf (right), he makes up the new senior management team at the company.

After nearly 47 years in the company, including 26 as Managing Director, on September 1, 2019, Juergen Staeter took his well-deserved retirement and handed over the role of Chairman of the Management Board to Michael Seifert, who has been with the SCHACHTBAU Group for 27 years and became a member of the Management Board in July 2016. "The Supervisory Board of Schachtbau Nordhausen would like to thank Juergen Staeter for his many years of service to the company and wish him all the best", said Michael Stomberg, Chairman of the Supervisory Board of SCHACHTBAU NORDHAUSEN GmbH. With Juergen Staeter's departure, the Management Board now consists of three members. Alongside Michael Seifert, who has the role of Chairman and continues to be responsible for Mining and Plant Engineering, André Ponndorf, Head of Mechanical Engineering and Thomas Staeter, Managing Director of SCHACHTBAU NORDHAUSEN Stahlbau GmbH jointly took over the Management Board of SCHACHTBAU NORDHAUSEN GmbH as of September 1, 2019.

70th German Well Builder Symposium

A huge success with Bavarian flair

For two days, everything in Schrobenhausen revolved around the topics of well construction, geothermal heat and subsoil investigation, during the 70th German Well Builder Symposium at BAUER AG on February 28, 2019. The organizers, the Federal Specialist Group for Well Construction, Specialist Foundation Engineering and Geotechnics of the Central Association of the German Construction Industry (ZDB) and the GERMAN WATER and ENERGY GROUP (GWE), which is part of the BAUER Group, were delighted with the excellent turnout for the conference, which was accompanied by an exhibition and held in southern Germany for the first time.

A highlight: the Bavarian evening with live music in the Old Welding Shop at BAUER AG.

Around 250 guests from all over Germany, as well as from Austria and Switzerland, took part in the two-day series of presentations. They listened to informative speeches by ten speakers on a wide range of industry-specific topics, such as the importance of exploratory drilling, the requirements for drilling fluids, questions of jurisprudence and talks on subjects like well regeneration or horizontal wells. There were also lively discussions at the more than 20 exhibition booths, where visitors learned about a wide variety of industry-specific products and services. A highlight for many attendees was the trip to the BAUER Maschinen GmbH plant in nearby Aresing, which offered in-depth insights into the production of Bauer's specialist foundation engineering equipment. The anniversary event ended with a Bavarian-themed evening with excellent live music.

BAUER MAT Slurry Handling Systems

1,000th desanding plant

BAUER MAT Slurry Handling Systems based in Immenstadt in the Allgäu region is the Bauer Group's specialist for mixing and separation technology. In early April, subsidiary manager Alexander Konz, sales manager Timo Seidenfuss and Kurt Ostermeier, head of product management Mixing and Separation Technology at BAUER Maschinen GmbH, were delighted to announce that a BAUER MAT BE 500-C – with the serial number 1,000 – was to be handed over to Frank Schwarzer, Managing Director of Tunnel24. "MAT plants are robust, have a long service life and are efficient. And if our customers need help, they can rely on Bauer's well-established global service network. For us as a distributor, those are good starting points for safeguarding our good reputation and building on this – because happy customers are loyal customers," says Frank Schwarzer.

The BE 500-C desanding plant, with a throughput capacity of up to 500 m³ per hour is to be used in a microtunneling project in the Middle East. "Thanks to its compact dimensions, it is optimally suited for pipe drives and construction projects using microtunneling," explains Kurt Ostermeier. The basic system used was a BE 425, which, in addition to tunnel construction, is also ideal for slurry-stabilized drilling, cutting or grab work. The plant, which usually has a 75 kW engine, was equipped with a more powerful 90 kW pump engine.

In early April, the 1000th desanding plant from BAUER MAT Slurry Handling Systems was handed over to the customer. It will be used in a microtunneling project in the Middle East.

Working without exhaust emissions

Klemm drilling rig with electric drive

Mechanical foundation engineering requires highly specialized construction machinery in an urban environment, especially within existing buildings. The KLEMM KR 704-2E compact drilling rig has been developed precisely for this purpose. The electric drive allows work to be carried out extremely quietly and without exhaust emissions. The KR 704-2E series with electric motor has existed for years, but it has been completely redesigned to comply with the new drilling rig standard and to add other features, such as automatic adjustment to different power supply frequencies (50/60 Hz). The rig is ideal for use in confined basements, where a diesel engine is unsuitable because it would generate exhaust emissions. At Bauma 2019 in Munich, the rig was presented to an international audience.

With a minimal base carrier width of 750 mm and the option of using telescopic drill masts, the drilling rig is able to maneuver itself into buildings with narrow doorways and low ceiling heights. Specialist foundation engineering tasks, particularly micropiles for foundations and the underpinning of existing foundations using high-pressure injection columns, can therefore be performed under difficult conditions. Under these cramped conditions, the (radio) remote controllability of the drill rig offers many advantages. All functions, i.e. driving, setting up and drilling, can be performed by remote control. To optimally adapt the rig to the drilling task in hand, several drill mast structures and a wide range of Klemm drilling accessories are available. The first drilling rig of this type is already being used on a construction site.

Klemm drilling rig KR 704-2E

Specialist foundation engineering all over Germany

To reinforce the **Rosshaupten** dam at Forggensee Lake in Bavaria, a total of 13,500 m² of diaphragm wall was built with a thickness of 1 m down to a depth of 68 m. The works featured an MC 64 duty-cycle crane with a diaphragm wall grab as well as an MC 96 with a trench cutter. **Right**

Using a BG 30 and a BG 15 H and applying the front-of-wall method, a retaining structure was built down to a depth of 18 m in the center of **Munich**, between the town hall and Frauenkirche church. **Top**

Near **Vilseck**, Bauer renovated a total of three embankments during a full closure of the railway section. Roughly 42,000 m² of mixed-in-place elements were produced using an RG 27 S and an RG 25 S as well as two RG 19 T. **Right**

To sustainably alleviate congestion caused by truck traffic in downtown **Rosenheim**, a bypass road called the Rosenheim Westtangente (west bypass) is being built. To build the new major bridge, approx. 15,000 m vertical drains and 253 large-diameter bored piles are required in Rosenheim marine clay, an extremely sensitive soil stratum with low load-bearing capacity and a high water content. **Top**

Since October 2018, Bauer Spezialtiefbau has been working with the environment division of Bauer Umwelt to excavate an 18 m-deep trench for the planned Dreiländergalerie shopping mall in **Weil am Rhein**. In addition to a mixed-in-place wall and a secant pile wall, approximately 400 anchors are being fitted and roughly 220,000 t of excavated material are being moved. **Bottom**

A new building project combining urban living and a green environment is being built in **Stuttgart**. In total, Bauer installed 3,300 m² of composite retaining wall with 127 soldier beams down to a depth of 18 m. **Top**

The UpperNord Tower adds a new highlight to **Dusseldorf's skyline**. Bauer constructed around 6,000 m² of retaining structure, using the low-vibration mixed-in-place method. In order to secure the excavation, about 5,300 m of anchors, with three to six strands and a drilling length of up to 24 m were additionally produced. **Right**

During line closures by Deutsche Bahn, the tracks near **Diez** in Rhineland-Palatinate were expanded, the drilling levels required were produced and foundation piles, pile walls and tie backs were constructed over the course of a total of 10 weekends. **Left**

In **Schwörstadt**, as part of a deodorizing plant for a gas transmission network operator, Bauer constructed roughly 3,500 m² of tied-back sheet pile wall for site profiling and 700 running meters of pile foundations. The work was performed under strict safety precautions because some of the nearby high-pressure gas lines were still in operation. **Top**

After decontamination and demolition of the existing structure, 1,550 m² of pile walls and 1,680 m² of contiguous pile walls with shotcrete gap filling were built for the Huyssen Quartier in **Essen**. The spatial restrictions in the city center were a particular challenge. **Top**

An impermeable retaining structure is being built for the new medical association building in **Hanover**. For this purpose, Bauer is building a mixed-in-place wall in front of an existing building, a secant pile wall and jet grouting. **Bottom**

The underground car park for the major project at Quartier Heidestraße in **Berlin** is being built in a trough excavation pit, with walls being produced using the mixed-in-place method. Bauer is carrying out the horizontal sealing of the approx. 16,000 m² excavation pit in the form of a silicate gel base using an RG 19 T. **Top**

For the construction of a new business and residential park with an underground car park in **Hanover** Lahe, 655 piles were installed down to a depth of 16 m as a pile wall. This retaining structure was built using double rotary head drilling method with a BG 39. **Bottom**

When drilling a test pile trial for the Elbtower **Hamburg** mega-project in the new HafenCity district, the Bauer team set a new record and installed the deepest pile in Germany, at 111.4 m. **Top**

To remediate the contaminated site at the **Schwarze Pumpe** industrial park, all specialist foundation engineering and soil replacement measures are being implemented jointly by Bauer Resources and Bauer Spezialtiefbau. For soil support, approx. 1.3 km of sheet pile walls are being fitted and a further 147 individual sheet pile wall boxes are to be built over the course of the works for excavation of over 286,000 t of soil. **Left**

Publication Info

Published by: BAUER AG
86529 Schrobenhausen, Germany
Phone: +49 8252 97-0
E-Mail: public.relations@bauer.de
October 2019 – BAUER REVIEW
One issue per year

Content and editorial managers:
Michael Stomberg, Anna Leib (responsible), Verena Kaspar, Ruth Wallner, Katharina Weinmann, Christopher Wolf

Layout/pre-press: E. Eck

Photos: A. Leib, V. Kaspar, L. Moosheimer, R. Wallner, B. Natzer, K. Rysavy, J. Rysavy, G. De Giuseppe, U. Morgenstern, L. Denke, H. Lander, M. Peter, G. Anacker, Ramez Ayad, iStock, Adobe Stock, R. DeBerardinis, rcfotostock, Filmatik, Roche, Schwaiger Design, employees of the BAUER Group, Bauer archive

Printing: Kastner AG, Wolnzach, Germany

Cover:
Project team members at cutting operations for the rehabilitation of the Rosshaupten Dam at the Bavarian Lake Forggensee.

Back:
BAUER BC 50 cutter on MC 128 duty-cycle crane at sampling in Saskatchewan, Canada.

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