Tallest buildings in the world are standing on Bauer piles. Burj Khalifa in Dubai holds the current record, but Bauer Spezialtiefbau has already completed the foundation of the Kingdom Tower in Jeddah, Saudi Arabia, the second-tallest tower, and structural engineering work is underway. This issue contains a whole section just on this foundation and the large towers. But not all things reach for the sky. Bauer engineers have an ideal and efficient solution for every problem, no matter how small, in specialist foundation engineering. These “standard projects” are also presented in a separate section.

The headline feature of this issue showcases the varied tasks that have come our way in recent years in special foundation engineering and in all things related to Bauer techniques. It describes projects in extreme situations and unusual technical challenges such as a drilling rig for research work on the sea bed. Technical innovations play an important and integral part in the life of Bauer engineers. This fact was presented at the Bauer Maschinen in-house exhibition and also formed a key topic of the talks at the “Schrobenhausener Tage” lecture event, which was organised by Bauer Spezialtiefbau. Almost all of these lectures introduced new construction methods. This time, the theory of innovation was also deliberated – thoughts that were presented by Thomas Bauer, Chairman of the Management Board, in a speech.

A BG 25 was used for 219 piles supporting the walls of a 44 m long connecting tunnel between the underground car park and Souq Waqif in Doha, Qatar.

252 diaphragm panels were drilled to a depth of up to 19.5 m over a stretch of 1.6 km for the 26.5 km² goods handling area in the harbour of Doha, Qatar.
Status report

Diaphragm walling work for the excavation pit of an office and retail building in Abu Dhabi.
We looked to the future with confidence at the beginning of 2013, hoping to once again improve our earnings. But the year presented us with some challenges and negative impacts. We reported a loss of EUR 19.4 million at year-end – the first since 1999. Total Group revenues rose by 5.1 per cent to EUR 1,504 million, despite a positive number of orders in hand at the beginning of the year, and we also felt confident as several projects were nearing completion. We had four major projects on our books right at the beginning of the year: the foundation work for the tallest towers in the world and in Europe, the Kingdom Tower in Saudi Arabia and the Lakhta Tower in Russia, the dam remediation of the Center Hill Dam in the USA and the foundation work for the Hong Kong-Zhuhai-Macau bridge. However, none of the projects commenced as planned due to various reasons. The biggest individual problem materialised in the Resources segment. Our well drilling project for the water supply of the City of Amman in Jordan did not go at all as planned. The parties involved in the construction project were unable to agree on matters, project conditions were complicated, we were faced with huge delays and had to provide extra services. In the end, we had to write off the outstanding receivables, which was the reason for the considerable loss incurred by the segment and ultimately the Group.

A closer look at the individual segments shows that Construction was able to considerably increase total Group revenues by 12.4 per cent to EUR 731.3 million. The delays of the major projects, which created significant losses in the case of the Center Hill Dam project, the overall weak markets and negative political effects as well as the bad weather in the first quarter all contributed to after-tax earnings dropping from EUR 8.6 million to EUR 5.5 million year-on-year. Fortunately, the Equipment segment managed to increase total Group revenues by 6.7 per cent to EUR 628.7 million, despite a rather negative start to the year. The number of orders received was poor in the first three months and this situation only improved after the Bauma in April. Developments in some markets, particularly in China, India and South America, were also rather weak. Furthermore, increased competition had a negative impact on earnings and we received hardly any orders for our large and customized machinery, such as trench cutters, in 2013. Capacity utilisation at our plants is still insufficient as well. As a result, after-tax earnings were merely EUR 5.1 million (previous year: EUR 8.9 million). We did not generate any profits from deep drilling rigs in the large machinery business in 2013. We successfully delivered the 100 tonne machinery ordered in 2012 to the Chinese customer. The total Group revenues of the Resources segment fell by 24.2 per cent to EUR 199.2 million. The major project in Jordan was one of the main reasons for this negative result. The weak demand for well construction materials and the small number of orders for our exploration companies, which were affected by the weak mining markets, also had a negative impact. At the beginning of 2013, we were still counting on winning the contracts for two major projects, which unfortunately did not materialise. Resources reported a total loss of EUR 31.4 million at year-end.

We implemented a “slim down” in answer to all of the problems and concerns in 2013 and launched a cost-cutting programme of around EUR 20 million, which will help us to face the future on a better footing. However, not everything was negative in 2013. At the Bauma in Munich, we received very positive feedback on our machinery strategy, which is divided into a value and premium line. We received the Bauma Innovation Award for our undersea drilling process. We moved into the new plant in Tianjin, which once again provides us with an excellent basis for the future. Our efforts to ensure the quality and customer service of our machinery are very well received. We successfully completed the foundation of the new tallest building in the world, the Kingdom Tower in Jeddah as well as the foundation of the tallest tower in Europe in St. Petersburg. We started 2014 with a good number of orders in hand. Although the order situation in the Construction segment was positive, our problems with the Center Hill Dam project in the USA had a negative effect. The Equipment segment made it through the year quite successfully and once again completed special projects such as the sea bed drilling rig MeBo200. The cooperation agreement with Saxon for the joint development of an onshore deep drilling rig with a 375 tonne hook load was a major step and further opportunities are in the pipeline. We are still realigning the Resources segment. The materials business is back on track and the environmental business is going well and is providing good opportunities for the future. The after-effects of the loss in Jordan and the weak mining markets are having a negative impact on our business. Despite all these problems, we remain confident that we are going down the right path with our Group strategy, products, services and business structure. Our product range meets key future requirements such as the great demand for infrastructure due to continuing urbanisation, for raw materials and for solutions to potential environmental issues. We are therefore looking toward the future with confidence.

I would like to thank all of our employees for their great work and huge commitment and our customers and partners for their loyalty and positive cooperation, which I look forward to continuing.
Almost all photography was black and white back in the 1950s when Bauer was engaged in sinking wells and pile boring. Six decades later, in the times of digital photography, the spectrum of work has also developed in every possible respect. Today, Bauer companies operate all over the world and their varied tasks paint a colourful picture. Construction methods, which fitted into just three short brochures in the middle of the last century, have evolved as have the types of orders and multi-faceted "circumstances" which commonly relate to logistics and living conditions in the various regions of the world.

Today, the old construction reports, which once did not say much more than "Bauer drills a well" or "Bauer constructs excavation pits" are replaced by reports with eye-catching headlines. They describe exploratory drilling rigs for the sea bed or the remediation of a ski jump, the foundation of a telescope on one of Mexico’s tallest mountains or the world’s largest reed bed treatment plant in the oil industry, the transport of construction machinery over the ice roads in North Canada and the valleys of the Himalayas. You might even read headlines like: "Brown coal crawler crane overturned – SPESA comes to the rescue." Engineers who lead extraordinary projects have to work in a variety of different areas, including management, in addition to their specialised fields and construction tasks. Time and again, the past three or four decades – from around 1980 – have provided us with new challenges, we have learned a great deal and gained experience.

Bauer employees have always been familiar with a multitude of cultures and often have to master difficult situations. Life on a construction site often appears unusual to Europeans, both in terms of housing and catering. A camp in the western developed world, in Canada for instance, is entirely different to a camp in Chinese mountains along the road to Tibet. Safety and medical care are two other aspects of daily life on a construction site.

This multitude of tasks hardly ever gets a mention over the purely technical data in project descriptions. Employees working in regions whose climate puts an increased strain on the body, from tropical and polar regions to extreme altitudes where altitude sickness is a real issue, go through a strict preparatory programme implemented and managed by the HSE Health, Safety, Environment segment. Florian Daubenmerkl, Head of HSE: "A digital world map shows all risks for each country." Prior to such deployments, employees go through extensive talks and the medical examination aims to determine their physical condition. Their deployment is only authorised once the physician has given his or her approval. Daubenmerkl: "We have the G35 examination which determines if an employee is fit for the tropics, as the old saying goes." The individual undergoes tests to establish if he or she will be able to work in extreme heat.
and high humidity. The physician administers the necessary vaccines and prescribes preventive medicines. First aid facilities are also provided on all construction sites.

**Mountain air in Mexico**

Bauer employees often work in the highest regions on Earth and things were taken to an extreme in Mexico. The foundation of the world’s largest radio telescope with a 52 metre diameter was laid on the 4,600 metre high summit of Cerro la Negra. The Mexican government organisation Instituto Nacional de Astronomía operates the system in cooperation with the University of Boston. When a local specialist foundation engineering company ran into problems due to the extremely difficult soil conditions (loose basalt blockwork), Bauer received a request. The contract was secured in less than two weeks and the work took almost three months to complete. Bauer Spezialtiefbau used a BG 25, provided by Bauer Maschinen Mexico, for executing fully cased bores. Only the head engineer and operator came from Germany. All other staff were hired locally from the region of Puebla, a city 100 kilometres away where VWs are built.

that is already located at an altitude of 2,200 metres. The team also spent their nights at this altitude. The transport of the drilling rig proved to be the hardest logistical problem of all as the rig had to make the twelve kilometres up the mountain on its own chain – low loaders would not have been able to drive up the steep hair-needle bends.

**Zugspitze: Construction engineering**

Even in Germany, some tasks involve snow-covered mountains, albeit not quite such high ones. In 2011, the Technical Services Division of Bauer Spezialtiefbau was contracted to carry out safety work inside the German Telekom telecommunication plants on the Zugspitze. Some anchors in the buildings on Germany’s tallest mountain, which is protected as an ancient
monument, dating back to the early 1980s had to be checked as their force measuring devices no longer functioned properly. Under the watchful eye of the Technical Services Division, the Bauer subsidiary SPESA Spezialbau und Sanierung drilled the bores for new anchors. Extensometers were installed, which will control the movements of the mountain and buildings in the future, as well as temperature sensors and new crack monitors, as the permanent ice is also receding on the Zugspitze.

**Oxygen in Tibet**
The “Tibetan Railway” in 2001 was another major high altitude project for Bauer Maschinen. Operators and fitters as well as 35 drilling rigs were supplied to assist with the construction of the 1,140 kilometre long railway connecting the western Chinese province of Qinghai with the Tibetan capital Lhasa.

The route passes through largely uninhabited regions and mountain deserts. The structure was supported by 12,000 piles reaching 25 metres in depth. Almost 90 per cent of the route is above 4,000 metres, and at the Tanggula Pass it reaches as much as 5,080 metres – a challenge for the technical equipment, but even more so for the staff. The thin mountain air places a great strain on the human body. Oxygen chambers were installed on site to treat altitude sickness immediately. All work had to stop during winter due to the extreme cold.

**Diavik near the Arctic Circle**
Snow and ice also played an important role in the Diavik project in North Canada. Together with a partner, Bauer Maschinen processed this major contract in two phases during which employees experienced life near the Arctic Circle. New diamond mines in the North West Territories are accessed with a method that involves encircling the craters of the old volcanos, which are situated in a lake, with a dam and sealing them with diaphragm walls. Once the water has been pumped out, diamonds can be extracted in a surface mine over a period of 20 years. The transport to the construction site is a logistical masterpiece in itself and the customers’ extensive experience helped in this respect. The heavy machinery – securely packaged for a long journey to one of the coldest regions on Earth – could only be transported to the construction site during winter from Yellowknife over ice roads on frozen lakes.

This work took a lot of strength and effort. Even the camp’s entertainment and sports activities provided little solace. Among what could be called “general conditions,” the great importance placed on environmental protection remains the most vivid memory. All work stopped as soon as grizzly bears came near the construction site, the whole team had to retreat to containers and they were only allowed to resume work once the animals had left the site.

**Camp in the desert**
Construction workers are faced with entirely different issues in the desert – the heat rises up to 50 degrees Celsius in the summer. In 2011, Bauer Umwelt launched a pioneering major project in Oman together with its subsidiary Bauer Nimr Oman. The Sultanate has decided to use a large-scale reed bed treatment plant to biologically treat polluted water from the oil industry. PDO, an oil company whose majority share is held by the government, awarded the contract.

The biological treatment plant was constructed near the most productive oil field in the world. Two million cubic metres of soil had to be moved during the construction and Bauer Nimr planted 2.2 million reed plants in an area of 880 hectares (the equivalent of
1,230 football fields) in just a few years. More than 200 construction machines, excavators, loaders and crawlers were in operation on the construction site during peak times.

Graded basins create a natural slope within the plant and the polluted water cascades through treatment basins where it is biologically filtered. The residue contains salt, which is deposited during evaporation, which, in turn, is used by the industry. The first stage of the project already proved so successful that the contract was extended during the construction phase. In 2013, 95,000 cubic metres of process water flowed through the plant each day.

The working conditions of a six-day week are not easy. During the main construction phase, around 400 people worked at the site, and 80 core staff remain on site at all times. Most of the workers come from Oman, one fifth from Europe, another fifth from India and the rest from Nepal, Pakistan, Australia, Indonesia, Lebanon, Sri Lanka and Sudan. The construction site can be reached by plane from Muscat; then it takes another hour by car from the airport specially constructed for the oil fields. All desert roads are unpaved, and the Nimr contract also included the construction of a paved road from the desert road to the construction site. There is not much luxury to be found in camp. There is a canteen for the
Europeans and another for people from Eastern cultures. A large TV room, almost a cinema, was set up for the nightly entertainment, and a football and volleyball field provide some sports and fun. Extremely strict health and safety regulations were in place to protect employees’ life and health. Access was gained via a checkpoint and all car movements were monitored within the vast site. Nobody was allowed to leave camp at night as it would have been too dangerous for cars to break down in the desert on the unlit and insufficiently marked roads.

**Bottlenecks in the Himalayas**

Logistics and living conditions are also paramount issues for projects in the Himalayas. Bauer Spezialtiefbau received a contract for three dams in the mysterious mountain state of Bhutan. Starting in 2012, it was to construct the foundations for Punatsangchhu I, Mangdechhu, and Punatsangchhu II. This is how Arnulf Christa, the country manager responsible for Bhutan, and engineer Stephan von Auer, who managed the Punatsangchhu I construction site during the year it took to complete, describe the conditions...

The Kingdom of Bhutan hit the headlines even in Europe when the young king placed the happiness of his subjects above all in his government philosophy. An area of around 38,000 square kilometres (just slightly bigger than North Rhine-Westphalia) is home to a population of just over 700,000. Technological progress is not passing this country by. India, its direct neighbour, uses its hydro-electric power and invests in power stations there. Logistics are the most difficult aspect of these projects. In 2004, Bauer machinery, dismantled into the smallest possible units, was transported through narrow valleys to DhauliGanga in the Indian Himalayas. But experience can only help up to a certain point – each individual step has to be learned again and again. The whole stretch is driven first, and some parts of it are measured with a folding metre stick and measuring tape to establish the minimum turning curves of the articulated trucks, overhanging rocks, tunnel clearances and the weight-bearing capacities of bridges.

The machinery is shipped to Kolkata (the former Kalkutta) where they are loaded on to low loaders that are too small. Unlike in Europe, where articulated trucks with up to twelve axles are used, Indian trucks have only three axles. The trucks need to have a movable rear axle to master the bends in the mountains. Customs is another issue: both vehicle and driver must be registered in Bhutan, which is a complicated feat of administration.

From the harbour, the trucks have to drive 1,000 kilometres through India and another 120 kilometres through Bhutan until they reach the construction site. As the drivers love to get to their destinations as quickly as possible, even though there is Bhutan with its windy roads to think about, the sensitive machine components as well as containers, which we cannot load ourselves, often arrive damaged. This leaves us with insurance problems. The drivers must make their way through the valleys of Bhutan at night so that they do not run out of daylight on the mountain passes. The road to Punatsangchhu I goes across a pass at over 3,000 metres and there are several passes on the roads to the other construction sites. Two large excavators, one of them with a grab and one with the largest Bauer cutter, were transported from Germany. The crawler drive and operator’s cab had to be dismantled as the weight had to be minimised to 40 tonnes per low loader to ensure safe passage across the bridges on route. Larsen Tubro, the main contractor, also delivered a cutter to the construction site. Project Punatsangchhu I, around two and a half hours by car from the capital Thimphu, is the construction of a 1,000 MW hydroelectric power plant. Larsen Tubro constructed the main dam on the bedrock of the 70 metre deep inward-sloping excavation pit. To lower the water level, Bauer sealed the upstream cofferdam with an up to 90 metre deep diaphragm wall made by a cutter. The river bed was redirected through a tunnel whilst the foundation was being constructed. Larsen Tubro, the main contractor, engaged Bauer to provide 5,400 metres of ground injection, 2,000 cubic metres of tubes à manchette grouting and 8,000 square...
metres of cut-off wall. The work was carried out in day and night shifts. Around 20 employees came from Germany, especially the experts, some of which were freelancers, and some of the rig operators were from the Philippines and Spain. The majority, around 80 employees, were from India. Only few came from Bhutan itself.

**Catering in Bhutan**

Although the customer offered to provide catering on site, it was unsuitable for Europeans as it was too spicy, contained too little meat and was not varied enough. General hygiene was also less than ideal. The mountain water is not pure enough and is collected in cisterns.

The local markets also sold an insufficient product range for the taste of Europeans. There is a small range of beer, white bread, butter, long-life milk and eggs as well as a few European and American standard products, but most of it is imported. Bhutan has to import much of its food to supply its population. We found a solution for the on-site canteen: The wife of an Austrian...
employee trained a cook from Bhutan. He and his wife were then hired and the purchasing of foodstuff organised, making life a lot more pleasant.

Medical supplies and care barely met the standards required in view of the dangerous work on site. Medical care was ensured during the day with an ambulance standing by and ambulant care was provided on site during the night. Employees started to trust the Indian physician when it became apparent that he could interpret the composition of the German medication.

The Europeans were housed in an apartment block half an hour’s drive by car from the construction site. They created a lounge for themselves and spruced up the place. There was electricity so that they could run a fridge, washing machine, cooker and freezer and even a large flat screen TV. There was little entertainment on days off.

Employees keen to explore could drive into the countryside or to the capital to experience the culture of this exotic country in the form of its temples and buildings. Anyone keen to read can always take a whole digital Kindle library with them in this day and age. Working in these foreign countries is always an adventure in some of the most exotic places of this planet.

Pile bores at sea

Living conditions take on a whole new meaning when working at sea. Water is a key element in special foundation engineering, groundwater in itself plays an important part. In addition, countless contracts have been completed in harbours, on rivers and canals. However, the open sea has only recently gained in importance.

For some years now, BAUER Maschinen GmbH has been carrying out drilling operations on the sea bed and it founded the Maritime Technologies Division. The first contract in 2011 involved lowering a bored pile to the sea bed on which a tidal turbine was to be placed.

The Scottish Sea near the Orkney Islands provides good conditions for this type of power generation. Bauer Spezialtiefbau executed the job and Bauer Maschinen constructed the drilling rig. However, the first attempt to execute the project failed and it was only completed successfully the second time around. The pile was to be lowered from the jack-up platform with a top drilling unit, but the consulting engineers had overlooked one major natural force: the platform, which was on stilts, started swaying so violently that operations had to be aborted.

In response, Bauer engineers designed an entirely new drilling rig that is lowered to the sea bed and hydraulically operated from a ship. It took just a few months to complete the drilling rig BSD 3000 (Bauer Seabed Drilling Rig). The special ship was held in position based on GPS by a system of multiple drives. At a depth of around 37 metres, a 23 metre long mono-pile with a diameter of two metres was grouted in an eleven metre deep rock socket with high-strength mortar. The one-megawatt turbine will be installed approximately twelve metres above the sea bed – a depth at which it is able to make optimum use of the tidal flows.

Survival training

Before being deployed, employees had to learn about health and safety at sea. Firstly, all employees had to pass a kind of safety qualification, then the captain provided the whole team with detailed instructions whilst wearing their life jackets prior to starting work. Employees must complete the intensive, one-day “Sea Survival Training” before being allowed to work at sea. The dangers at sea are re-enacted at the Warsash Academy in Southampon, the British maritime academy for the commercial shipping industry.

The first and foremost and life-saving rule when falling into icy sea water is to preserve energy! The survival training shows employees how to survive in a group before help gets to the scene. The group climbs into an inflatable life raft whilst wearing protective neoprene suits. This life raft is folded up and stored on deck of the ships and inflates as soon as it is thrown overboard and comes into contact with the sea. The key rule is to always stay together as a group – individuals have no chance of survival. A “natural leader” will always crystallise in dangerous situations. Everyone listens to him or her if the life raft has to be righted again after turning over and he or she sets off the flares, which all have a different meaning. The training shows some mercy in one respect: the water in the hall is set to swimming pool temperature instead of emulating the icy waters of the Atlantic.

MeBo for research

Compared with the deployment off the shores of Scotland, developing a sea bed drilling rig almost appears to be “child’s work”. This mainly requires Bauer’s drilling and controlling know-how – the use at sea is up to the research team. In 2013, BAUER Maschinen GmbH developed the new MeBo200 for the Centre for Marine Environmental Sciences MARUM in Bremen. The drilling rig is controlled from a research vessel, has pressure compensation, can be lowered down to 4,000 metres and is able to extract 200 metre long drilling cores from the sea bed.

Bauer developed and constructed the special drilling rig, which is inserted in a six metre high frame and weighs 10 tonnes as well as its hydraulic control unit. The frame contains two racks for the 3.5 metre long drill pipes and it is also large enough to hold the drilling cores. Once placed on the sea bed, the drilling rig’s retractable supports...
Underwater drilling technology near Scotland, the special ship is depicted below.
provide the necessary stability during the drilling operation. BAUER Group had already constructed a predecessor to the MeBo200, which had been developed by Prakla Bohrtechnik in Peine in 2004 and was also commissioned by MARUM. This machine could be used down to a depth of 2,000 metres and was able to drill between 50 and 80 metres into the sea bed.

In the summer of 2014, MARUM presented the machine to the public in front of scientists and the media. “This drilling rig is going to strengthen our international lead in underwater research,” commented Michael Schulz, Director of MARUM, before unveiling the ten tonne construction in Bremen and project manager Dr. Tim Freudenthal pointed out the new dimensions. The former director Prof. Gerald Wefer, who took many years to develop MARUM, drew everyone’s attention to the cooperation of the 35-strong MARUM team with the Bauer engineers.

Stefan Finkenzeller, the group manager of the Maritime Technologies Division of BAUER Maschinen GmbH, supervised the construction. During the public presentation, Prof. Dr. Sebastian Bauer, Managing Director of Bauer Maschinen, introduced the Schrobenhausen part of the machine. He also talked about the economic interest in the research. The drilling cores provide information on minerals and deposits.

**Jump remediation**

The remediation of a jump was a first for Bauer. Winter sport fans are familiar with the sport facilities in Oberhof in the Thuringian Forest. Top-class sports in Oberhof were on everyone’s lips in West Germany even before the fall of the wall. Some parts of the two parallel jumps needed a complete overhaul after decades of use. Their future use was also re-designed: The jumps will mainly be used for training purposes until further notice.
SPESA’s experts completed the work in four construction phases between June 2013 and September 2014. A shotcrete slab was constructed and tied back with anchors and soil nails at a 37 degree inclination to stop the slope of the normal jump from sliding. A concrete/steel support wall was constructed next as a boundary for the large jump. Due to elevation differences in the landscape, the slope between the large and normal jump was secured with soil nails and shotcrete. The landing hills of both jumps were fixed with wire mesh matting and steel nails. The team had to use rope guards on the steep slopes.

An old mine and UNESCO

Schachtbau Nordhausen conducted extraordinary remediation work in Goslar under the watchful eye of UNESCO. In 2010, together with its subsidiary Mitteldeutsche Montan GmbH (MMG), the company started to restore the disused inclined conveyor of the old mine at the Rammelsberg mountain near Goslar. The more than 1,000 year old ore mine is one of the oldest in Germany. It still produced copper, lead and zinc ores until 1988. UNESCO made the old town of Goslar as well as the surface and underground mine into World Heritage Sites.

In the past, the ore processing plant, which is constructed on the hillside, could only be reached via numerous steps, meaning that many visitors could not access the production sites. After the restoration of the inclined conveyor, access is now available to all. The slow journey up a 110 metre incline provides a beautiful view of the valley of Goslar.

Planning covered the restoration and start-up of the inclined conveyor and had to comply with the requirements for ancient monuments as well as UNESCO’s national heritage guidelines and the safety requirements for hoisting plants and inclined conveyors. Schachtbau Nordhausen started this complicated work in the spring of 2011. The windlass made by Bleichert, a company from Leipzig, in 1935 is the centrepiece of the inclined conveyor – “an impressive testimonial to machine engineering” according to those responsible for the project. The windlass was restored to full functionality and fitted with a new safety break. The old band brake was decommissioned but remained in place.

Brown coal excavator

One could call it a major disaster when a brown coal excavator – one of the largest pieces of machinery in operation in Germany after all – overturns. When a brown coal excavator overturned in the open cast mine Tagebau Vereinigtes Schleenhain in the summer of 2012 due to a landslide, an incident which also damaged the attached tripper car, SPESA was one of the companies called upon to recover it. Companies and experts from the mining and machine engineering sectors as well as soil mechanics consulting firms were called together under the management of MIBRAG Mitteldeutsche Braunkohle AG. The large and heavy machines were rescued in several individual steps using three large cranes over a period of several months. Large components were dismantled, deformed components discarded and large quantities of soil removed. The 950 tonne excavator was recovered with a strand jack system. The specialist firm used four rope tension devices, so-called strand jack units, that were tensioned between anchor points and the excavator. SPESA constructed the anchors and the counter bearings for the anchor points of the strand jack units. The safety of all rescue personnel was top priority. IT-supported measuring equipment was used for monitoring the whole operation to be able to react immediately, if necessary.

The colourful world of special tasks
A new railway line is being constructed between Würzburg and Frankfurt for a part of the line that will replace the old Schwarzkopf tunnel stretch. This work is being commissioned by Deutsche Bahn and its construction company DB ProjektBau GmbH. BAUER Spezialtiefbau GmbH, Alfred Kunz Untertagebau, Baresel GmbH, Schälerbau Berlin and Leonhard Weiss GmbH & Co. KG have formed a cooperation for completing the special foundation engineering work. Klaus Wecker is the construction manager at Bauer Spezialtiefbau. This is Bauer’s biggest contract in Germany in many years, totalling around EUR 43 million.

There are two basic reasons for the “Schwarzkopf Tunnel Bypass” project: on the one hand, the Schwarzkopf Tunnel, built in 1856, no longer meets modern requirements. Passenger trains – including ICEs – can only pass through the tunnel at half throttle, at a speed of 70 km/h. On the other hand, freight trains require a second locomotive to climb the steep slope from Aschaffenburg to Heigenbrücken in the direction of Würzburg.

Over large parts of the line, Bauer Spezialtiefbau carries out those open construction tasks that do not relate to tunnelling operations. The 2,600 metre long Falkenberg Tunnel, which replaces the Schwarzkopf Tunnel, is the largest tunnel ever to have been constructed using tunnelling methods. The three other tunnels are new designs and will provide a more gentle incline in the future. The line passes the Falkenberg Tunnel, the Hirschberg Tunnel, the Metzberg Tunnel and last but not least the Hain Tunnel.

The excavation pits for the tunnel sections constructed openly are secured with pile, nailed and retaining walls. In addition to this, a pile foundation over a total length of 35,000 metres is being built for the embankments of the new railway line using the CFA method. Soil nailing is also being implemented over a length of 550 metres along the existing railway tracks as well as all struts and 95,000 metres of temporary and permanent anchors.

The machinery and drilling equipment was tested to its limits by the soil conditions. The piles, with diameters of between 900 and 1,500 millimetres, are built in hard diorite, gneiss and red sandstone. They reach a depth of 25 metres, where they are embedded into the extremely solid rock to a depth of ten metres. This rock has a density of approximately 100 MPa to 270 MPa. Special rock drilling equipment was made at the Bauer workshops, but wear and tear on the teeth of the drills is extremely high.

Two BG 40, two BG 28 and one BG 20, five anchor drilling rigs and several small drilling rigs for soil nails and shotcrete systems were used. The construction of the new railway line will take from au-
Schwarzkopf Tunnel

2013 to the end of 2017. The main part of Bauer Spezialtiefbau’s work will be completed in autumn 2015. Portal pits and shotcrete walls up to 30 metres high were constructed for the tunnel portals in preparation for the tunnelling work on the tunnels. Most of this work was carried out by BAUER Spezialtiefbau GmbH as well as the Bauer subsidiary SPESA Spezialbau und Sanierung GmbH. The work on the “Schwarzkopf Tunnel Bypass” project was one of the largest contracts in the history of SPESA. The main construction work involved the erection of retaining structures with shotcrete lining and protecting the site against landslides with shotcrete and soil nails. All shotcrete work was carried out using the wet-spraying process with a manipulator and various base carriers such as telescopic forklifts or excavators. Small-diameter drilling rigs and excavators with attached drill masts were used for the soil and rock nails. Depending on the subsoil and types of nails, hydraulic top or down-hole hammers were used for drilling. Deutsche Bahn provides residents in the area around the large construction site with regular updated information about the progress of the work. A large number of visitors at an open day left positive feedback: although the construction brings with it noise and restrictions, rail services will be less noisy in the future. A panoramic hiking path with open views over the railway construction site has also been created. During the preparatory period, a construction road was built through the forest so that the large construction machines did not have to drive through the residential areas of the municipality of Hain.
Peter Teschemacher – at the helm of Bauer Spezialtiefbau for more than 25 years

Germany and the world

He is an expert in the world of specialist foundation engineering. And he has experienced his work all around the world. For more than 25 years, Peter Teschemacher has been at the helm of BAUER Spezialtiefbau GmbH and became its Managing Director in 2007. Seboh Balian, Hans-Joachim Bliss, Arnulf Christa, Walter Haus, Harald Heinzelmann and Alexander Hofer join “te” – his initials – on the Management Board.

Peter Teschemacher was born in 1951, took his A-levels at a Humanistisches Gymnasium, a traditional German grammar school, and studied civil engineering at the Technical University of Munich after serving his compulsory military service. After working at an architect’s office in Stuttgart for almost three years, during which time he managed large building construction projects, he started at Bauer in the summer of 1980. His long-term goals included “the prospect of becoming self-employed in the design sector”. However, he did not work much in design at Bauer before he was deployed to construction sites in foreign countries.

Under Erwin Stötzer, the former head of structural engineering and statics, Teschemacher was sent to the Steel Plant Jubail project in Saudi Arabia as its construction manager in spring 1981, but returned after just a few months. However, “Stötzer had other ideas”. These “other ideas” led Peter Teschemacher back to large construction sites during a time when Bauer’s business was booming in the Middle East. The way to tap new countries was to “seek a project and found a local subsidiary in the country”. Around Christmas 1981, Bauer received a request for groundwater control at an underground command centre in Jeddah. What a good idea! The festive season suddenly felt unimportant. The design was delivered on 24 December 1981, the contract was awarded to Bauer on 26 December and the drilling work for a large water control facility with deep well started on 1 January 1982. This was followed by projects in Abu Dhabi – the Saudi-Bahrain Causeway and the Carpark in Medinah. The first Kuwait war took the Bauer employees in Kuwait by surprise – “suddenly, we were surrounded by Scud missiles.” The staff were asked if they wanted to return home. Although they remained, materials supply dried up and the Arabian customer helped out.

During the development phase of the international business, Bauer often lacked basic experience and staff had to improvise and learn a lot: “We were in the Muslim area of Medinah and needed the permission of the Arabian Prince and had to stick to prayer times.” Some of the machines were new and largely untested and “we had a brand new team.” Peter Teschemacher realised that solid teams had to be created and that the equipment had to be developed further. Some problems could not be foreseen from Germany: “We were inexperienced in using our cutters in confined spaces on the construction sites and the equipment got in each other’s way.” A lot of things were still being developed and the vertical alignment of the trenches as well as the quality of the concrete were an issue. The mechanics’ lack of experience showed when equipment was damaged. The challenges in Arabia also presented Bauer plant and engineering with lots of new issues: “We were pretty brave to do what we did back then!” In 1984, Bauer also started its first project in Kuala Lumpur in the Far East.

In view of his many varied organisational tasks, most of them in the field of staff procurement, Peter Teschemacher had long since assumed an executive position. BAUER Spezialtiefbau GmbH – the whole Group back in those days – was restructured in 1989.

Peter Teschemacher now managed the international construction business division and implemented the concept of outsourcing as much responsibility as possible and creating an increasingly decentralised management. A network slowly developed under this form of leadership – an effective strategic step: “Top management specifies the general conditions, but employees around the world have to be able to work on their own. This involves some risk, but gives people more freedom and job satisfaction.” Cooperation within the network was expanded.

When Teschemacher became the Managing Director of BAUER Spezialtiefbau GmbH in 2007, he continued to pursue
his concept in Germany as well: “I am all for cutting a straight path through a sometimes uneven environment.” Continuity and predictability are important to him. There are no special provisions for non-tariff services, but careful improvements are made. Everything should be transparent and traceable at all levels: “We take a clear view in terms of pay, which we negotiate once a year.” His employees admire him for this. Werner Lemal, the Chairman of the Works Council of BAUER Spezialtiefbau GmbH, regards Teschemacher’s attitude as an advantage in all negotiations. Teschemacher also has his ideas for the work on construction sites. He does not approve of construction managers and management being separated from the specialists divisions and the work they carry out. He aims to treat his employees as “all-rounders”: “A specialist site manager piles must also be able to be a site manager in general! Why should we not entrust our people with this extra responsibility? We have to focus on the work at hand and not encumber our employees with new management systems and theories all the time.” Teschemacher’s opinion on the “Increasing productivity” solution presented by a corporate consultant was: “This is important, but we are already working on it.” He sees opportunities for increasing efficiency in the peripheral areas as well: “We have to improve inventory management and logistics amongst many other things.”

Management in Germany often looks entirely different than in the rest of the world. “A number of problems arising abroad are non-existent in Germany.”

Each country has a different legal and financial system, that is one reason alone why all foreign managers need to be independent.

Peter Teschemacher developed Bauer’s foreign organisational structures step by step without any models or templates. Permanent communication is a basic requirement for effective global cooperation. The monthly GF-E-Mail in German and English to all Bauer Spezialtiefbau employees is a key element. The text would roughly fit on two A4 pages and is sent inline instead of as an attachment, so that employees can read it on their Blackberrys when on site. This up to date report provides information on the current situation, capacity utilisation in the individual areas, the latest acquired projects and organisation.

Peter Teschemacher places utmost importance on the Management Meeting, which he initiated as far back as the 1990s and which takes place in a different part of the world every year. There are two variations of this meeting these days – one for Germany and one for the many international companies. Teschemacher uses these meetings for strengthening the team spirit within the global network. Executive employees of the other Bauer segments, in other words Equipment and Resources, take part in all of them. These meetings show that personal contact is much better than contact by phone and e-mail – nothing beats the personal touch after all. There are clear rules: absence is unacceptable, punctuality is non-negotiable and flights must be booked in economy class. The meeting is based on talks, but this is just the beginning. The real idea is to exchange knowledge and transfer know-how about methods, the use of machinery, different soil conditions, etc. “The basic idea is for people to meet, talk to each other and get to know each other better.” Teschemacher’s opinion when it comes to announcing achievements: “Achievements have to be credited to those people who worked for them. They do not reflect the performance of the man at the top...”

And whilst on the subject of achievements: Peter Teschemacher is very keen on water sports. He grew up near Lake Ammersee where he learned how to sail at an early age. But his achievements as European and German Champion are a long time in the past. He has been getting back to the idea of competitive sports recently and is planning to participate once more in sailing competitions with his over eight metre long H-boat. This type of boat requires a crew of three and he can easily fill its ranks with members of his own family – his wife Elisabeth and children Uli, Sonja and Tobias.
A building is usually classed as a prototype – a statement that is even more fitting in specialist foundation engineering than structural engineering, where often the same type of house is placed in rows. You have to list all methods and projects if you want to describe specialist foundation engineering – a long list of key words indeed. Walter Haus, Head of Domestic Operations Germany of BAUER Spezialtiefbau GmbH, quickly gets to the subject of different dimensions when trying to describe this topic: “Bauer is often judged by its major projects and, of course, we are proud to assist in resolving major tasks all over the world. But we are just as proud of optimally resolving small projects to the customer’s satisfaction. We believe that our strength lies in the execution of large construction sites and those contracts that we class as standard projects.”

Walter Haus points out the multitude of tasks and know-how required by Bauer Spezialtiefbau: “We are not just focusing on large infrastructure projects! In most cases, we work directly for the customer or as a partner in a joint venture. We often provide services. In the majority of cases, our partners are small construction companies that have a specialist foundation engineering problem that has to be solved quickly and with little expense.” Walter Haus pinpoints the focus of Bauer Spezialtiefbau’s organisation in Germany in this respect: “We work on all shapes and sizes.” To give you an idea of this statement in numbers: Bauer carries out major projects, some of which with a volume up to EUR 40 million. On the other side of the scale, however, some projects may only involve figures in the lower ten thousand euro range.

Bauer primarily presents itself as a partner of small and medium-sized customers with regional structure projects: “We are close to the market throughout Germany.” Bauer Spezialtiefbau has divided its organisation in Germany into three major regions. South Germany’s head office is in Dachau in close proximity to the state capital Munich. It is supported by the sales office in Esslingen just outside of Stuttgart. West Germany’s head office is in Essen, supported by the office in Oberursel near Frankfurt. The head office for North Germany is located in Nordhausen in Thuringia and its sales office in Berlin. The soil improvement business, whose central office is in Nordhausen but which processes small and medium-sized projects throughout all of Germany, has its own organisational structure. The engineers at the regional offices follow their local markets and are therefore extremely close to the customer. The Projects Division, under the management of Hans-Gerd Haugwitz, deals with major tasks, usually infrastructure projects.
A BG 15 was hoisted into the inner yard for the construction of town houses around Türkenstrasse in Munich.

Special foundation engineers know how to work in confined spaces – access road to a rig at Reichenbachstrasse in Munich.

Even when things get tight; pile bores can still be drilled with CFAs at Frauenstrasse in Munich. Above

The foundations of the exterior walls of Asam Church in Schrobenhausen-Sandzell were re-strengthened using the jet grouting method. Left
The regional structure also helps to accommodate the varying attitudes in the diverse regions of Germany – “You have to talk the language of the people!” This experience has been re-confirmed time and time again. It also comes as no surprise when a person with a typical character from Berlin has great problems getting a foot on the ground in Hamburg, despite a lovable nature and oodles of charm.

Bauer sales engineers also occasionally come across customers who prefer smaller regional companies and deliberately avoid major corporations. Walter Haus: “We sometimes find it difficult to come across as an SME because of the vast number of services we offer. It is therefore extremely important to create a relationship based on trust with our customers.”

One look at Bauer Spezialtiefbau’s range of tasks in Germany shows that major projects make up around half of its sales. This gives it the advantage that it has a better capacity utilisation in the long term. The other half is made up of smaller regional projects. The di-
A closer look at so-called “standard projects” shows that the majority are foundations for small and medium-sized projects and projects for strengthening existing foundations. Flood protection has become increasingly important in recent years. Especially the measures on the largest rivers such as the Isar, Danube, Elbe and Rhine have been creating an unwavering stream of orders for MIP technology, which is an ideal method for strengthening dykes and dams.

In Walter Haus’ opinion, Bauer Spezialtiefbau’s flexibility is another great advantage when it comes to the regions: “We are able to react within hours and provide competent advice and can follow this up by deploying our machinery and completing an order in just a few days.” Unlike many other providers, which concentrate on just a few tasks such as piles, diaphragm walls or anchors, we provide a comprehensive range of specialist foundation engineering methods.” Bauer’s portfolio also includes jet grouting, MIP, soft gel blankets and various specialist methods. Bauer engineers are therefore able to offer an economic solution for each project and do not have to resort to alternatives because the required method could not be executed. Thanks to the varied portfolio of all specialist foundation engineering methods, Bauer Spezialtiefbau is able to provide a “tailored solution” to suit all customer requirements and to optimise its planning.
We call them tower blocks or high-rise buildings, but the rest of the world calls them towers or skyscrapers and they shape today’s megacities in every continent. No matter how high a tower reaches for the sky, its top is closely linked with its base. A solid and secure building always starts with a solid foundation. Bauer Spezialtiefbau has laid the foundations of numerous skyscrapers in cities around the globe, including the tallest in the world over the last decade. Skyscrapers have been around since the end of the 19th century when construction companies started using the newly developed steel skeleton construction method. The experiments started in the USA where the City of New York has been left with one of the most breathtaking skylines as a result.

A sea of skyscrapers stretches as far as the eye can see from the viewing platform of the Empire State Building. The example of New York also explains the “basics”: Conditions for foundations are ideal in New York. Tourists strolling along Fifth Avenue may be surprised to find pure rock at the edge of Central Park but most often do not realise the connection between these rocks and the skyscrapers. However, Manhattan is built on this ideal, solid and natural foundation.

In other regions around the world, skyscrapers are erected on less perfect or rocky ground. Be it in Dubai, Singapore or Kuala Lumpur, Hong Kong or Saigon – extensive foundations have to be constructed in all of these places, most of them on deep piles, to create a platform that can securely carry the load of a heavy building.

The chase for the record of the tallest tower in the world started in the 1930s in New York and Chicago in the USA once the steel skeleton construction method made it possible to build higher and higher. The Empire State Building in New York kept the record of the tallest tower for 44 years before the 442 metre tall Sears Tower in Chicago – now renamed to Willis Tower – took away this title in 1975. This skyscraper wore
the crown for 23 years. In 1998, Petronas Towers, the twin towers in Kuala Lumpur, became the top attraction of the capital and created a highlight for all of East Asia. The next prominent record breaker was the “Taipei 101” building in Taiwan.

The main reason for building taller and taller structures was the expensive land prices in the rapidly growing North American cities. Today’s reasons are more varied and have a lot to do with prestige. Politicians and private constructors aim to set accents in the city and architects plan their buildings so that not only their height but also their appearance have a maximum wow-factor.

Towers often help to create the flair of a city. New York’s skyline is still one of the most memorable, but many other cities are also defined by outstanding buildings. From London to Sydney and Singapore – towers send out a message. Shanghai, for instance, is not remembered for its tallest buildings, but for the sleek Oriental Pearl Tower with two spheres on three pillars. Germany’s tallest buildings cannot compete with global standards, but at least the financial capital Frankfurt, sarcastically called Mainhattan, has its own character amongst the large cities thanks to its bank towers of which quite a few are built on Bauer piles.

The Petronas Towers in Kuala Lumpur
Bauer Spezialtiefbau, most of the time in cooperation with its local subsidiaries, has laid the foundations for many of these skyscrapers in recent decades. Although Bauer did not lay the actual foundation of the Petronas Towers in Kuala Lumpur in 1993, it was involved in preparing the subsoil. The twin towers are standing on karstified limestone and each tower’s foundation required an individual concept due to differences in the subsoil. This soil type was particularly difficult to improve in the form of a cavity filling before the foundation components could be laid. Bauer executed these soil improvements with the first BG generation, the BG 7 and BG 11, with the help of oil drilling racks and roller bits down to a depth of 170 metres.

Architect Cesar Pelli managed the lay-out of the towers featuring Islamic shapes and geometrical principles. The ornamental shapes of the towers and their crowns look like modern, almost futuristic, minarets. The sky bridge, which connects the two towers at a great height, is a static element. The world-famous and memorable twin towers also left their mark on Hollywood which has used them many times as a popular film backdrop.

“Taipei 101” in Taiwan

The “Taipei 101” project on the island of Taiwan, whose design reminds of a horsetail, was the tallest building in the world from 2004 to 2010. The construction of the 508 metre tall building with 100 floors started in 1999. Bauer was involved in the foundation work, but withdrew from the construction site when it was put under pressure by political forces in the background. A vast number of large machinery – four rotary drilling rigs, vibration units and anchor drilling rigs – had been supplied for the original contract received.

Burj Dubai – Burj Khalifa
A few years later, Burj Dubai set a new record. BAUER Spezialtiefbau GmbH was awarded the contract for the foundation together with the local company Middle East Foundations, which also used Bauer machinery. First of all, pile tests had to be performed on a large scale. Then 200 piles with a diameter of 1.5 metres and a depth of up to 50 metres and 650 piles with a diameter of 900 millimetres and a depth of up to 36 metres were produced. The contract totalling EUR 14 million was completed by mid-2004.

When Burj Dubai was opened at the beginning of 2010, it was the tallest building in the world, standing 828 metres tall with 163 usable floors and 57 lifts. At the opening ceremony, it was renamed to Burj Khalifa, the name of the President of the United Arab Emirates from Abu Dhabi. People standing high up on the viewing platform in Dubai can feel the tower’s movement, a slight swaying, when they close their eyes. Visitors with a fear of heights are advised not to think about this. The architecture is based on the “hy-menocallis”, a flower whose long petals stretch out from the centre. This flower grows in various tropical and subtropical regions around the world. The tower emulates the flower with its wings arranged around a central point. The building was erected on a Y-shaped layout and this principle was adopted several years later in the plans for the Kingdom Tower. In this plan, the engineers maximise the relation between height and building area and create favourable wind force effects, views and lighting conditions.

Kingdom Tower – the next record breaker
During the course of 2013, Bauer Spezialtiefbau constructed the foundations for two of the tallest buildings – Lakhta Tower in St. Petersburg, the future tallest building in Europe, and Kingdom Tower in Jeddah, Saudi Arabia, the new tallest building in the world. A consortium is constructing Kingdom City on a large area in the north of Jeddah. Kingdom Tower will be the crowning glory of the numerous modern buildings and lighting conditions.

Soil improvement...

... for the Petronas Towers in Kuala Lumpur
the first building in the world to ever break the one kilometre barrier. Work is to be kept so cost-efficient that the construction will end up costing less than the Burj Khalifa.

The layout of the record tower forms a regular triangle with three protruding wings. This plan is the reason for the differently sized foundation piles. The wings require 154 piles with a diameter of 1.5 metres and a length between 49 and 89 metres as well as 44 piles with a diameter of 1.8 metres and a length of up to 50 metres. The central area requires 72 piles with a length of up to 110 metres and a diameter of 1,500 millimetres.

These piles brought up a technical question on site: would it be possible to build a unique kelly bar for the 110 metre long piles? The soil profile of the construction site was sent to the Bauer Maschinen designers who responded that it was indeed possible to create a quintuple kelly bar. Saudi Bauer executed the piles for the three wing constructions whilst this part was being developed. A quadruple kelly bar and kelly bar extension as well as BAUER BG 40 rotary drilling rig were used for producing the piles with a depth of up to 89 metres.

The construction and production phases took around ten weeks to complete, after which the new quintuple friction kelly bar was delivered to the construction site in mid-2013. A special frame was constructed that provided extra protection for the kelly bar, and especially the most sensitive inner kelly bar section of which two were delivered, during transport. According to project manager Harald Heinzelmann, the new kelly bar “performed excellently from the start” when used for the deep piles in the central area. This outstanding drilling performance was complimented by an optimal vertical alignment. Polymer replaced the usual bentonite as a stabilising fluid during the drilling process. Whilst employees in Arabia were fighting with the desert heat, others in Northern Europe had to cope with temperatures as low as minus 30 degrees during the construction phase.

The records keep coming

Kingdom Tower will not be the last record skyscraper ever to be constructed as the race for building the tallest tower continues. A lot of planning and research is going on to find solutions to detailed problems. Lifts are just one such example. The taller the building, the heavier the cables in the lift shafts. A Finnish company is currently developing lighter cables made from carbon fibres, but these are not yet ready for production.

For the meantime, the crown is therefore travelling from the tallest building in the world on the Arabian peninsula across the Persian Gulf to the Red Sea. Whereas the constructors of the Burj Dubai planned to keep its height a secret for as long as possible, the constructors of the Kingdom Tower announced their fairy tale-like goal right from the start: the tower will reach 1,001 metres. China is already planning to go higher – one can follow the continuation of this race for the tallest tower on the internet.

Lakhta Tower in St. Petersburg

Apart from Moscow, the City of St. Petersburg on the Baltic Sea (called Leningrad for almost 70 years) is one of the most historically significant metropoles in Russia. The energy group Gazprom erected the tallest tower in Europe with a height of 462 metres as its representative head office there. The original plans were for the Okhta Tower, named after the suburb where it was to be built. But then the construction site had to be shifted to another location, the suburb of Lakhta. Despite all the changes that had to be made, the Bauer team and project manager Petra Peter persevered and were ultimately awarded the contract for the highly challenging foundation. The structure will now be supported by 262 piles with a diameter of two metres that reach 84 metres in depth. An underreamer was constructed and used for the deepest parts during the construction phase. The BAUER drilling rigs BG 40 and BG 28 were used. Bauer Spezialtiefbau was also awarded the contract for constructing the foundations of the podium building, which is part of the overall concept, as well as the multi-storey car parks. More than 1,000 piles were sunk into the ground down to a depth of 35 metres in 2014.

Bauer performed excellently even under difficult conditions during the construction of the foundation of the Lakhta Tower in St. Petersburg
In May 2014, the exhibition grounds at Bauer’s head office, where BAUER Maschinen GmbH exhibited a number of innovations, once again attracted specialist foundation engineering companies from throughout the industry. Dieter Stetter, the Managing Director of Bauer Maschinen, and Christian Gress, Sales Manager, welcomed 1,750 guests from all continents and 69 nations. Even the few May showers could not dampen the high spirits of the assembled experts. Bauer’s event organisers were left with very positive feedback from numerous specialist talks at the end of the four-day long exhibition.

The large machinery such as drilling rigs and cranes once again formed the backdrop for all new developments by the Bauer Maschinen group companies. The rotary drilling rigs of the BG series have been core products of Bauer Maschinen’s portfolio for four decades. Innovations for various applications were exhibited in both the PremiumLine and ValueLine. Today, Tier 4 motors come as standard with almost all machinery.

**PremiumLine rotary drilling rigs**

The BG 46 PremiumLine is the top machine of its series and is designed for heavy pile bores up to three metres in diameter and large depths down to 100 metres. A 563 kW diesel engine (Tier 4 final), a solid mast with a total height of almost 35 metres and a main winch with a line pull of 450 kN make it possible to reach such enormous drilling dimensions. The BG 46 was used as a base carrier for a BC 35 trench cutter at the in-house exhibition. The modification for the cutter requires only a few additional components. Two large hose reels on the upper carriage make the machine look even more impressive. Trench depths of 100 metres can be reached thanks to these reels for hydraulic and mud hoses.

The BG 39 PremiumLine presented by Bauer Maschinen is a machine with a typical kelly drilling configuration with an attached BV 1500-7C casing oscillator for heavy oscillating work. The BG 39 can reach drilling depths of up to 91 metres. A new main winch with a line pull of 355 kN and a rope speed of 64 m/min was attached for this purpose. The full line pull and speed right down to the full depths are maintained thanks to the single-layer construction with a wide winch drum and two hydraulic drives.

The BG 18 H PremiumLine was one of the smaller PremiumLine machines on show. It is “small” in more ways than one – as it was shown in a low-room version standing just 12 metres tall. The attachment of an upper mast section also transforms the BG 18 H into a standard drilling rig with a construction height of 19 metres.

**ValueLine BG series**

ValueLine machinery is optimised for the kelly drilling method. The BG 11 H ValueLine is the latest and smallest version and is assembled on the CAT 320 E standard base carrier. The BG 11 H mainly targets the US oil and gas industry. This industry places importance on compact dimensions, manoeuvrability, a low transport weight of 34 tonnes (including kelly bar and rotary drive) combined with the ability to execute various preparatory drilling processes such as cellar drilling, conductor pipe drilling, mouse and rat hole drilling. The BG 11 H can also be used for normal bored pile work down to a depth of 40 metres. The BG 26 ValueLine is the bestseller of the series. It was exhibited with a...
BV 1180 casing oscillator, which gets its power from the machine’s on-board hydraulics and can be operated by the driver inside the cabin.

**Bauer duty-cycle crane – MC series**

MC duty-cycle cranes are perfect multi-purpose machines for numerous specialist foundation engineering applications. An MC 96 model – the 100th machine in the MC series – was exhibited in combination with the large Leffer casing oscillator VRM 3000 at the in-house exhibition. The complete unit, including pile grab for a three metre bore diameter and casing oscillator weighs in at 200 tonnes in total. Excellent stability, powerful engine performance and strong, fast winches are key to successful operations, particularly in a traditional grab market such as Hong Kong. Several MC 96 are already in operation in this difficult market to the fullest satisfaction of the customers.

**Klemm and Prakla innovations**

The large number of visitors around the Klemm Bohrtechnik machinery confirms that the company has been accepted in the market and that visitors had an interest in the three KR series machines on show. Prakla, a traditional manufacturer of well drilling rigs, exhibited its popular well drilling rig RB 50 FM with mast extension. Prakla acquired Agbo shortly before the in-house exhibition and many visitors were surprised to see an AGBO G 300 well drilling rig at the Prakla booth. The company Hausherr presented the largest blast-hole drilling rig ever built. The other Bauer Maschinen Group companies MAT, ABS, Eurodrill, Pileco and Fambo all showcased interesting innovations at the in-house exhibition.

**New from RTG Rammtechnik**

Bauer Maschinen’s subsidiary presented a large selection of its products at the exhibition. RTG Rammtechnik GmbH exhibited two pile drivers, the RG 21 T and RM 20, both with innovative new features. The newly constructed accelerated hydraulic hammer HRS on the RM 20 improves the quality and efficiency of the pile driving process. The automatic coupling system ACS on the RG 21 T makes it possible to quickly and safely change attachments such as vibrators and rotary drives.

**Sri Lanka** The construction company Walker Piling (pvt) Ltd. used a BAUER BG 20 H for constructing piles with a diameter of 1,000 mm for a bridge foundation.

**Japan** Our customer Jafec (Japan Foundation Engineering Co., Ltd.) constructed around 120 piles for a hospital with 14 floors and two basements in Tokyo using the BG 28 and BG 30.

**Bangladesh** Abdul Monem Ltd. carried out the soil improvement for a bridge ramp using a RG 19 T with vibration hammer.

**Austria** – Porr Bau GmbH constructed piles using a BG 40 and the CFA method during work on the ÖBB Group head office at Vienna Central Station.

**Italy** An intersection is being built on the A 4 orbital motorway near Milan for the Expo 2015. Our customer Fondamenta constructed a 22 metre deep pile wall.
Iran In West Azerbaijan, the Gilban Ghala Consortium Urmia used a BC 40 trench cutter on a BG 40 for installing a cut-off wall for the Iran Nazloo Dam down to a depth of 70 metres.

Denmark In Copenhagen, Züblin Spezialtiefbau worked on Project Nordhavnesvej, a road tunnel in the harbour area. Züblin used several BGs up to BG 40 for constructing the piles for the walls of the almost 23 metre deep foundation, which are driven into the limestone down to a depth of 6 metres.

Great Britain Our customer Bachy Soletanche executed piles with a diameter of 1,050 millimetres down to a depth of 20 metres at Puddington Mill Railways Station in London using a BG 46 and the double rotary system.

Germany In West Azerbaijan, the Gilban Ghala Consortium Urmia used a BC 40 trench cutter on a BG 40 for installing a cut-off wall for the Iran Nazloo Dam down to a depth of 70 metres.

Germany Our customer Mayerhofer from Simbach am Inn used a RG 16 T and the FOW method to construct a retaining wall for an extension to the supply area of the Klinikum Rechts der Isar hospital in Munich.

Sri Lanka The specialist foundation engineering company San Piling (pvt) Ltd. used several Bauer BG rigs for constructing 420 piles of varying diameters for the foundation of the Shangri-La Hotel.

Germany Bauer Maschinen solved the problem of a gravel mining company in Steilßlingen. A “perforation cutter” penetrates hard layers in various parts of the gravel pit so that the material below can be mined.

Switzerland The construction company Implenia AG from Zurich used a BG 28 H for constructing 91 bored piles down to a depth of 35 m for a bridge construction at Zurich Oerlikon railway station.

Denmark Our customer Aarsleff used a BG 36 for drilling the bores for permanent steel piles down to a depth of 17 m in the Copenhagen harbour basin. Left.

USA In Manhattan, New York City, our customer Hayward Baker Inc. used a RG 25 S with kelly extension for constructing 200 CFA piles down to a depth of 30 metres for a 13-floor apartment building.

Sri Lanka Our customer Nawaloka Piling (pvt) Ltd. used Bauer rotary drilling rigs for constructing 362 foundation piles of varying diameters for an administration building.
Specialist foundation projects on all continents

**Hong Kong** Working from pontoons, piles with a diameter of 2,300 and 2,500 mm are drilled into the rock horizon down to a depth of 90 m using four BG 40s at the major Macau Bridge project. The cranes, bentonite systems and storage units are also standing on pontoons. Right

**Malaysia** A total of 160 piles with a diameter of 2,000 and 2,200 mm will have been constructed for two skyscrapers in the centre of Kuala Lumpur by the end of 2014. BG 40 drilling rigs were used for depths down to 105 m. Below

**Australia** In 2012, Bauer constructed 564 piles during the first phase of the Legacy Way road infrastructure project in Brisbane. In the second phase in 2013, a BG 28 with shortened mast was used for executing piles and supporting piles with diameters between 900 and 1,200 mm. Right
Vietnam A rope suspended grab was used to construct two diaphragm panels as test panels for load tests up to 5,000 tonnes for the Eximbank building. The Osterberg cell system was used for testing.
**Abu Dhabi** Injection work in the form of cavity backfilling was carried out during the construction of the international airport to improve the soil. Two Klemm machines were used for the drilling process. **Above**

**Dubai** An excavation pit with a depth of 15 m was constructed with a diaphragm and a pile wall. The walls were supported with steel struts and anchors. Additional 81 foundation piles with a depth down to 44 m were constructed. **Above**

**Turkey** An 18,000 m² large diaphragm wall with a thickness between 1,000 and 1,500 mm is being constructed for the Tunnel Portal of the Strait Crossing Tunnel of the Eurasia Tunnel on the shores of the Sea of Marmara Istanbul. **Right**

**Lebanon** On the 3,800 m² area of Solidere Block 46 in Beirut, 5,000 m long pile walls, 6,500 m soil anchors, 3,800 m² of bottom sealing and 6,500 m² of shotcrete are produced for a residential and trade centre. **Above**
Angola In Luanda, a retaining wall was constructed for Torre Vitória, a residential and retail building, with a 3,718 m² large secant pile wall with 3,014 anchors and 600 mm foundation piles. Below

Mauritius A drinking water reservoir is being constructed in the Bagatelle Dam project. The work on the diaphragm wall (57,700 m² with a length of 2.5 km, with the largest trench depth being 30 m) should be completed by May 2015. Right

Egypt An 800 mm diaphragm wall with a depth down to 28 m, strutted in two layers, was constructed for the 1,200 m² large, 12 m deep foundation of the United National Bank building in Cairo. This work also required 90 foundation piles with a depth of 32 m and 2,400 m³ of bottom sealing. Below

Egypt Bores for 24 piles with a diameter of 2 m and a depth down to 53 m and 36 piles with a 1 m diameter and a depth down to 43 m were drilled for the foundation of a Nile bridge near Aswan. This work was carried out from pontoons. One pile was tested with 3,500 tonnes. Below
**Ecuador** The Daule-Vinces contract comprised a 6,200 m² cut-off wall with a depth down to 27 m, which was completed in 156 days by November 2013. Additional 7,632 m² of cut-off wall were executed by January 2014. Both walls with a thickness of 800 mm were constructed with a cable grab K 610. Below

**Russia** Foundation work involving 19,160 m of piles with a diameter of 620 and 880 mm for a gas turbine power plant in the south of the city centre of St. Petersburg was completed in 135 days. Up to four BGs were used during the construction, which was preceded by pile tests. Below

**Canada** In the period from August to October 2013, 20 bored piles with a diameter of 750 mm, 96 bored piles with a diameter of 880 mm and four bored piles with a diameter of 1,000 mm with depths between 12 and 31 m were executed for the pump building of the MLMR Syncrude mining project. Right

**USA** On Herbert Hoover Dike resealing and restoration of existing culverts had to be performed. Above

**Panama** Three out of five buildings on the eastern shore built into a steep hillside needed to be stabilised with a contiguous pile wall and additional foundation piles. 137 bored piles with varying diameters were constructed as well as two layers of anchors.
Netherlands  In Den Bosch, 104 GEWI piles were constructed on land and 948 on a pontoon during the renewal of canal systems. Below

Switzerland  Around 55,000 m³ of cement injection were executed with a BG 15 refitted for jet grouting at the Riedberg road tunnel. A Klemm KR 806 was used for pre-drilling with a diameter of 220 mm in talus material. Above
Bulgaria 13,500 lin. m of piles with a diameter of 1,500 mm and a depth down to 25 m were executed for the Struma Highway infrastructure project. The piles grip into the rock. Below

Hungary Around 2,500 m of CFA piles with varying diameters and depths between 9 and 22 m were produced with a BG 28 during the construction of the M 30 motorway bypass near Miskolc. Above

Austria In the north-eastern part of the country, 168 pressure grouted ductile piles with a depth between 10 and 15 m were constructed for the foundation of an extension to the Spannberg substation. Right

Georgia For the hydro-electric power station Skhalta, a BG 28 executed secant pile walls, first 3,248 m, 880 mm diameter, depth down to 17 m, then, in the second phase, 1,500 m, 1,200 mm thick, depth down to 15 m. Below
**Slovakia** 360 piles with depths down to 27 m were constructed for the Panorama City project in Bratislava using a BG 28 and BG 40 for two 107 m tall buildings in just four weeks and under extremely difficult conditions in terms of foundation. **Above**

**Croatia** To repair and restore the pier foundations of the Zeleni Bridge, a historical railway bridge in Zagreb, 24 piles with a diameter of 1,000 mm and a depth down to 27 m and an inclination of up to 7 degrees were executed. A test pile with a diameter of 620 mm and a depth of 26 m was also produced. **Above**

**Austria** The expansion of the railway line in a tunnel area near the ÖBB Terminal Inzersdorf required foundation piles with a diameter of 1,200 mm. Around 12,000 lin. m of piles with depths down to 25 m are being executed in three phases from autumn 2013 to spring 2015. **Right**
Bauer Resources GmbH companies have been operating in many varied markets over the past seven years. In 2007, Resources was founded from BAUER Group spin-offs with the aim to develop a third Group segment. One of the key factors that drove this decision was the acquisition of GWE German Water and Energy, which is an established manufacturing and sales company for well construction materials with an international focus.

The initial organisational structure of the Resources Group with its three divisions – Materials, Environment and Exploration & Mining Services – followed the existing structures at the time. These days, however, a new organisational structure is required to achieve the goal of becoming a comprehensive provider of services related to “water and mineral deposits” for the industry and to provide customers with improved access to the synergies within the Bauer Resources Group.

Following a certain “orientation phase”, a regional organisation with supporting areas of competence was launched at the beginning of 2014.

Customers now have an experienced local contact for every specific issue. The individual subsidiaries make it possible to account for regional characteristics within the markets and to provide individual solutions and specialities. The complete know-how and collective experiences of the entire Bauer Resources Group can be drawn on through its competence centres to provide solutions for every task.

The situation in many national markets have changed dramatically due to the financial crisis in recent years and some political uncertainties that could not have been predicted two years ago. These experiences and a market analysis created from numerous factors place the Resources Group in a good position to face the future with well-defined targets and a positive outlook.

The Resources segment focuses its activities on Europe, the Middle East and...
Mineral waste, especially waste foundry sand, is deposited in the Nieder-Olfelden landfill site. Bauer Umwelt constructed a basic, intermediate and rock seal. Above

Toxins in the groundwater and soil have to be contained with a system of dividing walls in the historical industrial town of Leuna.
The BRE subsidiary Foralith carried out the subsequent work for a 1,500 metre deep geothermal borehole at Hotel Saratz in Pontresina, Switzerland. Right

In Austria, Bauer Umwelt constructed four recovery wells with depths down to 35 metres to remove LNAPL through a groundwater layer. Below

Africa. All of the key strategic points of the subsidiaries that provide regional support are located in these regions. The Resources companies always accompany major international customers and their projects all over the world. In the new competence centre structure, the established special Resources subjects are developed further under the motto “Progress through technology.” These centres pool the environmental technologies know-how accumulated over the last 25 years as well as the unique competences regarding the construction and operation of large-scale reed-bed treatment plants for the oil industry, as successfully executed in Oman, or the drilling tasks of the company Foralith and the Jordanian Site Group. Above all, BAUER Resources GmbH’s new structure puts the company in an even better position to cover all aspects of the entire value added chain with its own value creation. From hydro-geological research to the drilling of wells, the fitting of GWE well construction materials, the production of water, the processing of both drinking and industrial process water and its return to the cycle, to the disposal of any residue created during the process – all this can be competently managed by one contact.

Bauer Nimr held a workshop on sustainable water treatment in February 2014. Dr. Tom Headley, Manager of the Bauer Wetland Competence Centre, was main speaker.

GWE German Water & Energy supplied a large volume of materials for the construction of a number of flood wells in Dresden.
Gloabalisation is presenting even HSE (Health, Safety & Environment) with great challenges. As an international group, Bauer companies are constantly deploying numerous employees abroad. We have production facilities in Europe, the USA, Asia and Africa and in large countries such as Russia and China and we carry out construction projects in many countries around the world. One of our key tasks is therefore to protect the health of our employees by ensuring safe working conditions.

According to the “International Labor Organization (ILO),” each year around 321,000 people worldwide die through accidents at work. To curb this trend, globally applicable HSE standards have to be implemented. Unfortunately, not all countries have the same HSE rules and laws. Due to the cultural differences and varying training standards, the perception of risks and hazards also differs considerably as does each individual employee’s view on these subjects. All Bauer companies are tackling this challenge by introducing high HSE standards and policies. Compliance with applicable national and international regulations are only one aspect in this regard. It is essential for a global group to implement its own high HSE standards and guidelines, to monitor compliance with them and to continuously improve them.

We ensure that this is the case by regularly inspecting and auditing our construction sites and production facilities. The inspections are conducted by our HSE specialists together with senior management. This closely integrates management into HSE procedures, thus sending a clear message to all our employees that occupational health and safety is a prime concern within the Group.

Our employees attend regular HSE training. Weekly “toolbox talks” at our construction sites and production facilities help to gain a better understanding and greater acceptance of the issue of health and safety. “Safety starts with me” is our motto that shows that each Bauer employee lives this principle.

An economic aspect has to be considered in addition to the personal safety of our employees as only well-organised and safe construction sites generate profit. A serious or even fatal accident may result in the construction site being shut down for long periods. Insufficient HSE standards therefore have a negative impact on efficiency and productivity. HSE is also closely linked with quality. Companies with high HSE and quality standards have an advantage on the international market. Our customers know that by purchasing products and services from Bauer, they are gaining a partner which is one of the most innovative companies in the world with high global occupational health and safety and environmental standards. We expect this quality standard from ourselves. And our customers can expect it, too.

Florian Daubenmerkl

Safety starts with me

The major project in Munich for significantly improving access to Schwabing from the north is called “Schwabinger Tor.” Bauer performed the specialist foundation engineering for the 12 metre deep foundation on an area of 35,000 square metres, mainly MIP walls, pile walls and ground anchors.

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