MC Report

Stuttgart 21 sets the future in train
MC tunnelling expertise in great demand

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Dear Reader,

It was just a year ago when we last featured a tunnel project as the focus of our magazine. Then it was the repair of the Wallring Tunnel in Hamburg. This time around we are dedicating our headline MC report to one of the projects of the century – Stuttgart 21. With Tunnelling among our Fields of Expertise we have been able to provide a wealth of know-how with regard to the associated subprojects and construction phases, thus contributing to the success of this enormous undertaking. Various MC technologies and product systems have been used, including special products for soil conditioning, superplasticisers for lining segment production, injection systems for waterproofing the tunnels and, last but not least, a completely new, cement-free annular gap backfill grout – an innovation successfully developed in harness with the special-purpose consortium ARGE ATCOST 21. You can read more about this megaproject starting on page 8 of this edition of MC aktiv.

That said, the other features in our current issue are equally interesting in their own right and I commend them to you: From the refurbishment and aesthetic upgrading of industrial buildings and the record-setting repair of a subsiding bridge in Brazil to our unique concrete cosmetics and concrete technology know-how, each the subject of an article that has a story to tell. As usual, we close our year-end edition with our long-service awards in recognition of those whose loyalty and dedication have contributed so much to the successful development of MC over the past decades. For this, I – on behalf of my colleagues on the Management Board – would like once again to express my deepest gratitude to you, our people.

Finally, I would like to wish all our readers the very best of seasonal goodwill and a prosperous, successful and above all a healthy and happy New Year!

Kind regards,

Dr.-Ing. Claus-M. Müller

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12 Replica drift built at Zollern colliery

Cover

View of the Filder Tunnel before the third shield TBM drive. Turning the tunnel boring machine for the last pass represented a major challenge. A large turning cavern was built especially to allow the TBM to be turned around underground. An unleached gipskeuper was encountered in the rock strata surrounding the lower Filder Tunnel. Since this essentially consists of a swellable anhydrite, a solution was required that would reliably eliminate the risk of swelling and ground uplift. MC-Bauchemie and PORR Bau GmbH developed a cementless annular gap backfill grout which, after extensive testing, was used for the Filder Tunnel boring operation, the first application of its kind anywhere in the world.

Photo: DB/Arnim Kilgus

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The tenth annual edition of the study course series “CROM – Certified Rehabilitation of Manholes” will once again be available as of February next year. Since 2010, more than 700 employees from planning and engineering offices, tendering sewerage network operators and specialist rehabilitation firms in Germany have taken part in the CROM courses.

The collaborative seminar series jointly provided by TU Kaiserslautern (Kaiserslautern University of Science and Technology) – under the direction of Prof. Dr.-Ing. Karsten Körkemeyer from the Faculty of Construction Engineering and Management – and MC-Bauchemie offers sound expert knowledge on manhole and shaft rehabilitation in theory and practice. “We are delighted at the response to date and are also more than a little proud that our training course concept is still so well received – so much so, that CROM is now perceived as a kind of seal of approval for manhole rehabilitation in the marketplace,” says Professor Körkemeyer.

TU Kaiserslautern and MC-Bauchemie were pioneers in this field and developed and marketed this series of courses at a time when the topic of manhole rehabilitation was still somewhat neglected in terms of training and certification. “Together with TU Kaiserslautern, we have developed a unique concept that offers an unprecedented mix of in-depth knowledge transfer and hands-on practice,” says Sven Messmann, Global Product Manager ombran/Underground Sewer Systems at MC-Bauchemie. The aim of the series of courses is to improve the quality and safety of manhole rehabilitation measures from planning to implementation. The special feature of the CROM courses is that all content is first taught theoretically by experts from both academia and the field, and then applied, extended and consolidated in a series of practical modules. “Every course participant thus also has the opportunity to practice all the essential steps and skills of the rehab process,” says Sven Messmann.

MC summer festival in Bottrop

Attended by around 600 employees and their families, the MC summer festival took place on the Am Kruppwald site in Bottrop on 7 September, 2019. The weather could not have been kinder – although rain had been forecast, the skies not only remained dry, the sun also made a lengthy appearance, sending the temperature to a comfortable 20 °C so that attendees young and old could remain "al fresco" as they enjoyed the many culinary delicacies on offer.
After a construction period of five years, two new energy-generating units of the Polish coal-fired power station Opole II were commissioned in September 2019, ensuring a secure electricity supply to 4 million private households in the years to come. MC not only contributed its know-how from its Thermal Power Plants FoE (Field of Expertise), it also had significant input in the elaboration of the external design.

The operator PGE had the interior and exterior surfaces of the two cooling towers – each measuring a good 182 m high – coated with MC surface protection systems and visually enhanced with artistically styled musical notes from a Polish folk song from the region.

Cooling tower inner shells protected
The general contractor, Polimex, and the coating subcontractor Beroa/Domination had already gained good experience with MC’s systems, in particular during a similar project involving Europe’s largest thermal power site of Belchatów in Poland’s Łódź region.

The transparent epoxy resin sealant MC-DUR 1277 WV, which also acts as a primer for other coatings (meaning that fewer coats are required) was used as the concrete curing agent. MC-DUR 1277 WV delays evaporation of the water during the curing of fresh concrete and so increases the mechanical and chemical resistance of its surface. Then the highly acid-resistant epoxy resin sealant MC-DUR VS NR 3 was applied in two coats over a surface area of around 40,000 m² inside the cooling towers. The pigmented, UV-resistant top-section sealant MC-DUR VS PUR was then applied over the upper third.

Striking visuals, top protection
For the design of the 45,000 m² external surfaces, the client PGE chose an artistic concept from among competing ideas submitted by local schools, with rainbow and sun motifs and musical notes from the Opole region folk song “Poszła Karolinka do Gogolina” (“Little Caroline has gone to Gogolina”). The hyperboloid cooling towers made application of the external design more difficult and posed a real challenge for all those involved – one that was, however, overcome with total success.

The decision was made to use a pigmented surface protection system from MC for this – now available with a technically improved formula under the product name MC-Color Flair. It is characterised by very high resistance to fading, UV radiation and weathering, yet is open to water vapour diffusion and is also extensively dirt-repellent. The prefabricated components of the columns and cross-members of the supporting structure for the water distribution system within the cooling towers had been factory-coated with MC-DUR 2496 CTP. This special, fast-curing resin sealant based on KineticBoost-Technology® had been successfully used for the first time four years earlier for the repair of an older cooling tower in Opole and has since been applied as a coating for many such cooling towers worldwide.

The operators are delighted with both the technical quality and the visual design of the two giant cooling towers in Opole and are pleased to have been instrumental focusing attention not only on Poland’s energy industry but also the country’s folklore.
Industrial structure aesthetically upgraded

Located in the middle of a residential area in Assendelft in North Holland, the façade of the district heating plant of local energy utility HVC Group has now been not just repaired but also aesthetically upgraded. Thanks to MC-Color Proof vision and MC-Color Flair pure, the once barren façade has been transformed into a minor work of art.

Façade repaired with Nafufill KM 220
After expert substrate preparation, the first step was to reprofile and level the entire outer façade of the building using Nafufill KM 220 fibre-reinforced fine cement mortar in a wet spraying process. This created the perfect surface for the further sealing and coating work required. Nafufill KM 220 is resistant to temperature, frost and de-icing salts, offers high resistance to carbonation and impresses with its excellent application properties, with possible layer thicknesses ranging from 2 to 30 mm.

Durable protection
In the final phase, the surfaces were provided with high-quality surface protection in the form of MC-Color Proof vision. The two-component, transparent high-performance coating keeps the colour design fresher for longer and offers permanent protection against graffiti, dirt and grime. Roller-applied, it too is UV-stable, weather-resistant and carbonation-retarding while also being open to water vapour diffusion. Since the refurb there is nothing left to remind onlookers of the former grey concrete block. To the delight of the client, the community and, of course, local residents, a colourful, oversized work of art has been created that provides for a significant upgrading of the living environment.

Sporting a sympathetic design and top-quality protection, the district heating complex in Assendelft serves as a fine example of how industrial buildings can be visually improved and harmonised with their surroundings.
MC News

High-quality concrete surfaces for Hamburg’s HafenCity

HafenCity in the proudly Hanseatic City of Hamburg is currently seen as the largest inner-city urban development project in Europe. With around 140 different construction sites underway, the volumes involved are gigantic. In total, the building work will provide for more than 2.4 million m² of gross floor space. And wherever upgrading exposed concrete surfaces becomes part of the project remit, MC’s concrete cosmetics products are invariably the go-to first choice.

Here on the left you can see the construction site of the Southern Überseequartier with the finished Elbphilharmonie concert hall, and on the right the Intelligent Quarter and the HafenCity University.

The city of Hamburg is setting new standards with the development of this new municipal space along the river Elbe: Over an area of 157 ha, a lively city-within-a-city with a maritime flair all of its own is being created, combining work, home life, culture, leisure, tourism and retail. By the end of 2019, 68 individual construction “subprojects” will have been completed and a further 71 are already underway or in the planning stage.

MC involved on numerous sites

The concrete cosmetics of MC have been and are being used in numerous of these construction projects, for example in SKAI HafenCity, the “Southern Überseequartier”, HafenCity University and the so-called “Intelligent Quarter”. As different as the property developers responsible for the individual projects are, they unanimously decided to rely on MC’s know-how in concrete cosmetics. In addition to reliable on-site service and high product quality, the extensive range of system products for a wide variety of applications has also been a key factor in this blanket approval. In Hamburg’s HafenCity, the challenges range from repair work such as closing anchor holes, pores, cavities and joints in intricate ceilings and complex walls, to the visual upgrading of fair-faced concrete surfaces and further concrete cosmetic work in demanding areas such as columns, balconies or underground car parks. Different fillers and colour shades were required for, in particular, colour matching and the removal of defects on exposed concrete surfaces.

Superfine concrete cosmetics with Emcefix

The products of the Emcefix family are therefore particularly in demand and constantly in use on the various construction sites of HafenCity. As the demands on concrete surfaces increase, so too do the demands on concrete cosmetics. If the surface is to be truly flawless, the Emcefix system of MC, consisting of a bond coat and coarse, fine and superfine fillers, will invariably provide the solution required. All products are polymer-modified and ready for use immediately after mixing with water. The Emcefix-Spachtel G coarse filler, for example, is suitable for concrete repairs such as patching imperfections both large and small, and the reprofiling of deep flaws and spalled areas up to 50 mm deep. Emcefix-Spachtel F lang fine filler is available in seven different colours and is mainly used for surface skimming and the precision filling of standard and fair-faced concretes in layer thicknesses of up to 6 mm. And the superfine filler in the family, Emcefix-Spachtel F extra fein, is available in three colours and is mainly used for the full-surface filling and skimming of standard concrete and fair-faced concrete with layer thicknesses of up to 3 mm.

Thus, MC’s concrete-cosmetic products contribute to the high quality standards being regularly delivered by the contractors involved in the HafenCity project.

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Photo left: In the foreground the Strandkai (Beach Quay) construction site, in the background the completed Marco Polo Tower and the Hamburg Cruise Center.

Photo right: Futura Campus building (left) and the construction sites of the so-called Creative Blocks (right).
MC’s high-performance superplasticisers are integral to the concrete used to build the foundation, core, columns and ceilings of the Sky Fort Business Center.

MC know-how integrated in Bulgaria’s highest skyscraper

The Sky Fort Business Center is an office high-rise currently under construction in Sofia. Measuring 202 m, it is destined to be the highest building in Bulgaria. Due for completion in 2021, it will boast 49 storeys and a floor space of around 80,000 m². Both the planning engineers and the constructors involved in the project have put their reliance in MC’s expertise.

The Sky Fort is located in the heart of the Bulgarian capital and will provide modern offices with a panoramic restaurant offering an incredible view of the city and the surrounding area. The building also has three underground floors providing parking for around 850 vehicles. The skyscraper was designed by AAA Architects (both of Sofia). The company Structo was commissioned with the planning work and is collaborating closely with the construction company Bulcarp.

Creep deformation test successfully passed

Back in the planning phase in 2015/6, the parties involved consulted various companies to find the right partner for the required concretes, with strength class C 35/45 needed for the foundation and C 50/60 required for the building core, columns and ceilings. Due to seismic and structural challenges, tests were required to determine the creep deformation of the concretes. Ultimately it was the MC formulations which won through against all the competition. MC was the only supplier able to develop the right recipes, the properties of which were confirmed by an independent materials testing institute. “Having achieved the necessary test results, we were duly selected as a supplier for this project,” says lead engineer Nikolay Monev, the man taking care of the technical aspects of the work on behalf of MC Bulgaria.

High-specification concrete

Despite the large volume of the foundation totalling 20,000 m³ with a depth of more than 3.5 m, the temperature in the core had to be kept to below 60 °C. MC therefore developed a concrete formulation that combines a special cement with the concrete admixtures MC-PowerFlow 2695 and Centrament Retard 370 to ensure a low hydration temperature. With this peaking at 51 °C, the specified value was never in danger. MC-PowerFlow 2695 is the primary admixture incorporated in the concrete used for the skyscraper. The high-performance superplasticiser based on the latest MC polymer technology takes effect after a short mixing time, delivering good, sustained liquefaction as well as high early strength. MC-PowerFlow 2695 can be used to produce concretes exhibiting low tack combined with very good workability and pumpability as well as high-quality surfaces. Centrament Retard 370 setting retardant was used to counter the hot temperatures of the Bulgarian summer, enabling solidification of the concrete to be delayed so as to extend its workability and ensure sustained pumpability. The superplasticiser Muraplast FK 19 and MC-Top B, the surface-hardening dry mortar for industrial floors, were used to lay the floor of the underground car park, covering a total area of 30,000 m². This resulted in good homogeneity and a decrease in the internal frictional forces in the concrete, as well as a reduction of the effort involved in placing, spreading and compacting the mix. Still on the up, this ambitious structure has yet to reach its final height. The opening of what will then be the highest building in Bulgaria is scheduled for June 2021.

Lead engineer Nikolay Monev, MC Bulgaria, keeps a firm eye on the concreting work.
The Stuttgart-Ulm project, also known as Stuttgart 21 (S21 for short), is one of the largest infrastructure undertakings in the recent history of the Federal Republic of Germany. In future, it will add the metropolitan region in Swabia to the high-speed “Magistrale for Europe” rail link, while also serving as an important hub within the North-South and East-West Trans-European Transport Networks (TEN-T) criss-crossing Central Europe. The breakthroughs of the Filder Tunnel in September and of the Albvorland Tunnel at the end of October 2019 marked the successful conclusion of an important phase in this major project, not just for Deutsche Bahn, but also for MC and its tunnel specialists.

When Deutsche Bahn AG celebrated the symbolic breakthroughs of the Filder Tunnel on 9 September and of the Albvorland Tunnel on 29 October 2019 – with many of those involved in the five-year construction period as well as political representatives from the state administration, the federal government and the EU in attendance – the team of tunnel specialists from MC also had every reason to cheer. After all, MC was able to contribute a wealth of know-how of its Tunnelling Field of Expertise and thus make a notable contribution to the success of this mammoth undertaking.

A German megaproject

With a spend of around 8 billion euros, the transformational Stuttgart 21 transport and urban development project will greatly benefit the local region through the creation in the near future of a major hub in the national – and international – railway network. More than 100 km of new, fast railway track, three new stations and an intelligent traffic management concept will set new standards in domestic German and European rail transport going forward. And there will also be major benefits on the urban planning side: About one square kilometre of current or former track sections on the edge of Stuttgart’s city centre are to be put to good use in the project, extending the downtown area by around 40 percent. The client and developer overseeing this project is Deutsche Bahn. The Federal Republic of Germany, the State of Baden-Württemberg, Stuttgart’s integrated public transport authority VRS, the state capital Stuttgart, the airport company Flughafen Stuttgart GmbH and the European Union are also participating in the financing of the project. Seen in its entirety, S21 is made up of the following subprojects: The lowering of Stuttgart main station, construction of the Stuttgart railway ring track and construction of a new Stuttgart-Ulm line, which includes several tunnels. MC was significantly involved in the latter two measures in particular.

MC’s expertise in mechanical tunnel excavation in high demand

The heading operation with lining segment installation was conducted using a full-thickness-cutting shield TBM featuring multi-mode earth pressure balance (EPB) for face support. The Filder Tunnel was only one of several major tunnel projects involving MC that were mechanically excavated – the Albvorland Tunnel and the Bossler Tunnel passing through the Albaufstieg (Swabia’s Jura uplands) were also on the list. Various MC technologies and product systems were used in all the tunnel construction projects, including special products for soil conditioning, superplasticisers for lining segment production, injection systems for waterproofing the tunnels and, last but not least, a completely new, cement-free annular gap backfill grout – an innovation successfully developed in harness with the special-purpose consortium ARGE ATCOST 21.

Due to the geological conditions, the machine-excavated Filder Tunnel is divided into an upper and a lower section with two tunnel tubes each with a diameter of 10.87 m passing through an overburden of 20 to 220 m. With a total length of 9,468 m, it is the longest tunnel of the S21 project and, after completion, will be the longest double-tube railway tunnel and the third longest tunnel in Germany.

A similar tunnel construction approach was also adopted in the case of the Albvorland Tunnel. Here again, two tunnel tubes with a diameter of 10.87 m and an overburden of between 8 and 63 m were excavated over a length of around 8,000 m. In the third major tunnel
project, passing through the Albaufstieg Jura uplands at Aichelberg, two tunnel tubes – each with a diameter of 10.87 m and up to 280 m of overburden – were excavated to create the Bossler Tunnel serving the new track section from Wendlingen to Ulm. With a length of 8,806 metres, it too will constitute one of the longest railway tunnels in Germany.

Geological challenges
An unleached gipskeuper, consisting essentially of swellable anhydrite, is located in the rock strata surrounding the lower Filder Tunnel. Rock containing anhydrite can be found in several regions of the world, and one such is the steep slope of the Filder plateau to the south of Stuttgart. If rock containing anhydrite comes into contact with water, the volume increases by more than 60 %. This results in enormous swelling pressures which could lift the tunnel and the surrounding terrain and subsequently lead to damage to buildings and structures located above it. For the lower Filder Tunnel, the TBM was operated with an open shield, the main contact with the delicate gipskeuper strata thus being with the shield shell, the cutting tools and the annular gap backfill grout. The use of water in the more sensitive contact zones was expressly prohibited. In the case of the shield shell and the cutting tools, this was not a problem, but Deutsche Bahn demanded a specific solution for the grout that would reliably obviate the risk of swelling and ground lift.

The globally unique solution developed for S21
The consortium ATCOST 21 responsible for constructing the tunnel therefore turned to MC, an approach that led to the joint development of a bespoke geopolymer. Geopolymers are inorganic binders that do not contain cement and whose structure can be traced back to the reaction of aluminosilicates in alkaline media, resulting in the formation of inorganic polymers. The special feature of the solution developed involves combining the advantages of a single-component (1C) grout with those of a two-component (2C) grout through the flexible use of an activator. The basis takes the form of a modified 2C backfill grout containing a non-reactive starting aggregate predominantly present in a grain structure. Blast furnace slag and fly ash serve as the binding agents to which an activator has to be added to initiate the solidification reaction. The grout also contains complex phosphates which influence the solution equilibrium of the anhydrite in such a way that swelling is inhibited. This phenomenon can be described by the law of mass action and has been proven in trials and suitability tests. MC and PORR Bau GmbH have since patented this globally unique technology. This annular gap backfill system solution has been given the name MC-Montan Grout AA 03; it exhibits optimum bedding properties with high sulphate resistance to provide the tunnel tube with true durability.

Proven in practice
In view of the high requirements and the omnipresent media attention surrounding S21, renowned testing institutes were consulted together with ATCOST 21 in order to scientifically investigate the feasibility of the proposed solution. The Institute for Building Research at RWTH Aachen University (ibac) was commissioned with the mineralogical petrographic investigations to determine whether possible reactions with the anhydrite could occur in the annular gap. Continued on page 10
High-performance superplasticiser in lining segment manufacture

MC products were also used for the concrete castings installed in the Bossler Tunnel. SEMPER BETON GmbH & Co. KG produced the concrete for the lining segment factory of the consortium ARGE PTS Bossler Tunnel, for which purpose it used a high-performance superplasticiser of the MC-PowerFlow series. It is based on the latest polycarboxylate ether technology from MC and ensures both high early strengths and high-quality concrete surfaces coupled with above-average water savings and economical dosing.

The engineering office Brameshuber & Uebachs Ingenieure GmbH subsequently prepared the environmental analysis report. Together with the Faculty of Building Materials Technology at the Ruhr University Bochum, the material-specific technical aspects of the grout were investigated in order to ensure its application suitability measured against state-of-the-art criteria. The special sensitivity of the issue is demonstrated by the fact that the tests took more than two years in total and were only successfully completed after large-scale trials under practical conditions on the actual construction site. Subsequently, the system solution was duly approved for use for S21 projects by Deutsche Bahn and the consultant engineers.

The tunnel-builders very quickly recognised the enormous advantages accruing from this modified 2C mortar compound once they began to apply it in the grouting operations for which it was designed. Despite the grain structure of the starter aggregate, activator addition was made possible before pilaster strip entry through the provision of an additional mixing section, thus ensuring effective backfilling of the annular gap as specified. The use of a non-reactive starter aggregate has the advantage that the application open time is exceptionally long, thus ensuring maximum operational flexibility in such an environment. The new cementless annular gap grout proved so successful in the S21 megaproject that it has been in great demand worldwide ever since.

**Optimised bedding properties**

In addition, the experience gained from the development of the modified 2C annular gap grout was also used to adapt a classic 1C annular gap mortar at the Albvorland Tunnel between Wendlingen and Kirchheim unter Teck. Because the rate of TBM advance had increased there, a faster means of grouting of the tunnel tube had become necessary, something that was beyond the conventional 1C mortar being used. For this purpose, MC-Bauchemie developed the consistency modifier MC-Montan Grout 05. As an additional component, it is added to the mortar via a mixing section during the injection phase, but prior to pilaster strip entry, ensuring optimum bedding properties. As with 2S1, it also eliminates the risk of subsidence where heading performance is accelerated. The modified grout was applied continuously in parallel to the soil conditioning work over a length of 8 km at the Albvorland Tunnel.

**Efficient heading with soil conditioners from MC**

Along the route of the upper Fildertunnel, the tunnel boring machine mainly encountered Stuben sandstone, which has a high proportion of sticky clay and high-strength sandstone, with the concomitant danger of rapid tool wear. In the case of the Albvorland Tunnel soil conditioning was again a major challenge as the TBM had to safely cross under the A8 motorway with an overburden of only 8 m of clay and clay-marl stone. And in the case of the Bossler Tunnel passing through the Jura slope of the Albaufstieg in the third section of the Stuttgart-Ulm project, the rock encountered during heading operations was of very low strength in places and featured fault zones with water ingress. A closed shield machine was deployed on all three tunnel sections, with the excavated soil being used to support the working face as the TBM advanced. As mentioned above, the tunnel boring method is based on EPB technology, which is applied especially in difficult geological formations and in inner-city areas. The MC-Montan Drive product series from MC was used as the soil conditioning agent for all the mechanically excavated tunnels of the new Stuttgart-Ulm line. And the MC-Montan Device CT (Cell Tube) foam generator was employed for the efficient production of a high-quality and durable foam, enabling operations to continue with minimal interruption, minimal maintenance and minimal specific consumption values.

**Ideal lubrication**

The most widely used soil conditioning agent was MC-Montan Drive FL 04 (Foam Liquid), an environmentally compatible and readily biodegradable foam concentrate with a defined proportion of clay additive. The product is ideally suited for soil conditioning in EPB tunnelling as well as in rock formations with a high clay content and a high likelihood of clogging. Economical in use, MC-Montan Drive FL 04 prevents deposition and agglomeration and increases the lubrication effect by dispersing the clay minerals. By repellng spoil and preventing accumulation at the cutter head, the agent also reduces TBM power consumption and cutting tool wear. Thus the soil conditioning solutions from MC were able to increase heading efficiency in all three of the tunnel projects mentioned as well as satisfy strict cost-efficiency requirements.

**Summary**

For the Stuttgart 21 megaproject, MC was able to contribute both its expertise and its bespoke product systems for tunnel construction from its Tunnelling Field of Expertise, all very much to the satisfaction of its clients. In cooperation with planning engineers and construction companies, the tunnel experts at MC also developed innovative solutions optimally adapted to the various requirement profiles and challenges encountered on site, thus further facilitating the smooth progress of the tunnel projects.

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Repair instead of demolition – Jaguaré Bridge in São Paulo

On 15 November 2018, a section of Jaguaré Bridge along the Marginal Pinheiros expressway in São Paulo sank about two metres. The structure therefore had to be closed and secured by hydraulic supports.

Given that the bridge is part of a main artery serving the metropolis of São Paulo, the city administration decided – after a thorough investigation – against demolition and replacement. Instead, the bridge was to be thoroughly refurbished and structurally reinforced. Right from the start, the authority responsible was advised by MC as a company widely reputed for its know-how and innovations in bridge construction.

Major challenges
The main challenges lay in lifting, stabilising and reinforcing the sagging bridge section in the shortest possible time. There were numerous cracks to rectify, structural repairs were required at both the upper and lower faces, and the roadway also needed to be extensively refurbished. High-quality MC solutions and technologies were applied in all phases of the work instituted to tackle these problems. The multifunctional concrete admixture Muraplast FK 300 was used to restore the pier foundations and the concrete carriageways commonly encountered in Brazil. All the cracks requiring repair were sealed with the special resin MC-Injekt 1264 compact – both to prevent aggressive, damaging substances from penetrating the concrete structure again in the future, and to restore the static structure of the concrete.

Increased safety
In order to cope with future traffic loads, it was decided to install additional means of structural reinforcement. Since this was not possible with conventional measures such as the provision of further beams or supports, the highly effective MC-CarbonFiber system (formerly MC-DUR CFK) was used. This consists of carbon fibre-reinforced straps applied to the surface or glued in slots as means of secondary bridge reinforcement. In the case of Jaguaré Bridge, surface-glued MC-CarbonFiber Lamella (formerly MC-DUR CFK Lamelle) reinforcing straps were provided on both the upper face and the undersides of the bridge in accordance with specifications drafted by the structural engineers involved.

Mutually complementary systems
Safety and durability are of paramount importance in such undertakings. Hence, all parties involved decided to use MC’s excellently coordinated, high-quality product systems in the other areas of the bridge requiring refurbishment. For example, the structurally enhancing special concrete replacement Nafufill KM 250 and the special mortar Zentrixfix CR were used for the reprofiling of the concrete. Offering outstanding application properties and workability, both produced results well above the standards specified.

A shining example of engineering excellence
After a possibly record-setting repair time of just five months, Jaguaré Bridge was reopened to road traffic in April 2019, providing a shining example of engineering excellence and also of how project success invariably depends on ensuring the seamless integration and interplay between planning, execution and quality of the systems used. And it has become a model for further projects. As a precaution after this incident, the authorities responsible put in place a comprehensive inspection programme for all bridges – and have already had another bridge repaired using the same methods and approaches employing MC’s proven systems.

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On the premises of the Zollern Colliery Museum in Dortmund, a “walk-in, hands-on mine” was opened to visitors in 2018. At the beginning of 2019, this exhibition, steeped in history, was expanded by the construction of a replica coal drift to make the visitor experience even more realistic. The surface of the drift tunnel was stabilised and modelled with products of the MC-RockMortar (formerly Oxal RM) family, the sculpting and repair mortars of MC.

Mining is integral to the heritage of the Ruhr region. The fact that coal is no longer being extracted from the area has changed nothing in that respect, with the era being kept alive by museums such as that of the Zollern colliery. The anthracite coal mine in the northwest of Dortmund, which was closed down in 1967, consisted of two pits that joined together underground. In a project that was completed in the summer of 2019, the former training mine of Westerholt colliery in Herten was rebuilt here in order to provide a particularly authentic insight into the everyday life of the miners.

A hands-on mining experience courtesy of MC-RockMortar
In addition to the usual information boards, there are also many “hands-on stations” in the training mine. In the middle of January 2019, the museum added another highlight within just a few days: a deceptively realistic coal drift recreated with MC-RockMortar. Projections and light give the impression of a long, deep tunnel – even though the actual training mine is located above ground. The idea is to give visitors an impression of what it was like to work in such dark, narrow drifts. Original sounds from the mining industry and a vibratory plate imitating the vibrations of coal mining further enhance the museum experience.

Versatile high performer
The project, supervised by Andreas Hoppenrath of the LWL Industriemuseum organisation, was carried out by BETON.ROCKS from Halle/Saale. The BETON.ROCKS team led by Giorgi Gugunava consists of sculptors, designers, classically trained craftsmen and machine technicians. It has created numerous artificial worlds in the past, ranging from simple rocky landscapes to detailed reproductions of old cultural sites and witnesses of days gone by.

The team has often worked with MC’s microsilica-modified MC-RockMortar sculpting and repair mortars, which include the fine-grained MC-RockMortar L (formerly Oxal RM-L) for particularly intricate designs and the coarser-grained, higher compressive strength MC-RockMortar H (formerly Oxal RM-H) and MC-RockMortar HS (formerly Oxal RM-H HS) mortars.

MC-RockMortar was also the product of first choice for the Zollern colliery project. Offering excellent application properties and resistance, these special single-component mortars can be applied both by hand and by wet spraying. The mortars are ideal for the delicate sculpting and modelling of lifelike rock, stone or wooden surfaces. They are therefore often used for the artificial depiction of natural worlds, e.g. in zoos or amusement parks.

Deceptively realistic
At the Zollern colliery, too, the highest demands were placed not only on the creativity of the sculptors and craftsmen but also on the material. Initially, creating the black, shiny coal surface of the simulated drift was the biggest challenge. Thanks to MC-RockMortar, the end result was deceptively realistic to the delight of the museum operators and visitors alike.

View of the drift tunnel prior to commencement of the sculpting work.
MC-Bauchemie has launched the single-component, fast-foaming injection resin MC-Injekt 2133 for waterproofing applications. Among other things, it is suitable for stopping water flows in both buildings and construction pits.

It was more than 30 years ago that MC-Bauchemie introduced onto the market its two-component injection resin MC-Injekt 2033, a product specifically created to fill cavities and stop water ingress into buildings.

With the new single-component injection resin MC-Injekt 2133, MC-Bauchemie has now developed a reliable product that requires no mixing or extensive preparation, enabling it to be used both easily and instantly. MC-Injekt 2133 is also phthalate-free, i.e. contains none of these potentially harmful plasticisers.

Immediately stops pressurised water
MC-Injekt 2133 is immediately ready for use, serving as a single-component plug in water-bearing cracks. The injection resin reacts quickly to water contact, foams and increases its volume by a factor of 60 within seconds, quickly stopping the flow of even pressurised water. Its pot life is unlimited, thus ensuring maximum time and consumption efficiency.

In order to achieve a durable seal, post-injection with MC-Injekt 2300 top / 2300 rapid is recommended after application of MC-Injekt 2133. With this 2-step injection method, MC-Injekt 2300 top / 2300 rapid reacts reliably in the protection of the foam structure to provide a permanent seal.

Geopolymer concrete – concrete without cement

The use of alkaline-activated binder systems is becoming increasingly important in concrete technology. Aside from ecological aspects such as the reduction of CO₂ emissions in binder production, the improvement achieved in respect of certain concrete properties is also gaining in significance. Alkaline-activated binder systems with comparatively low calcium contents are often referred to as ‘geopolymers’. The reactions of geopolymer binder systems required to achieve sufficient strength differ significantly from those of normal Portland cement (PC) binder systems. In PC-based systems, the phases formed are mainly of the calcium silicate hydrate kind, whereas in geopolymer systems the formation mechanism tends primarily to produce inorganic, three-dimensionally cross-linked aluminium silicate networks.

Geopolymer concretes are particularly suitable for (steel-reinforced) concrete components likely to be exposed to high levels of acid or sulphate attack, such as sewerage pipes or components in sulphate-containing (ground) water. In Australia, extensive experience has already been gained with the use of geopolymer concretes in various applications. For example, in the construction of Toowoomba Wellamp Airport (see photo), Earth Friendly Concrete (EFC) from the company Wagners was used to the greatest possible extent. It was produced with a binder system made from granulated blast furnace slag, fly ash and activators and concrete admixtures from MC especially adapted to the application.

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The photo illustrates how MC-Injekt 2133 is applied and how it stops water ingress into structures and components.

Take a look at our product video:
https://youtu.be/G7WPwaA0VBY
Between August 2017 and December 2018, new parking spaces for around 360 vehicles were provided on the site of the Zollverein coking plant, part of the Zollverein colliery, a world cultural heritage site in Essen in Germany’s Ruhr region. The ambitious new structure in the form of an open parking deck covered with a landscaped roof was built using concrete release agents, curing agents and concrete cosmetics from MC.

The building is a car “park” in two senses of the word – first there is its pure functionality as a repository for temporarily vacated vehicles, and then there is its innovatively greened roof slab, which serves as a small park with paths and seats, allowing people a place to stroll and relax. A rising reinforced concrete structure consisting of columns and wall sections supports the approximately 190 x 47 m reinforced concrete slab. The parking level itself was also designed with high aesthetics in mind. The single-storey deck was slightly lowered and blended with embankments to give the impression that the almost 9,000 m² roof slab was floating above ground level. In order to reinforce this impression, the architectural and planning team of Kadawittfeldarchitektur GmbH from Aachen opted for prefabricated concrete elements with multiple bends, which were assembled to form a peripheral roof edge.

Reliable demoulding
The contract for the construction work was awarded to Dressler Bau GmbH, Essen, with which MC has an excellent long-standing relationship. The proven concrete release agent Ortolan Basic 761 from MC was used in the manufacture of the precast elements for the wall and ceiling areas as well as for the columns. Solvent-free, low in odour and quickly biodegradable, it offers excellent environmental credentials. It is easy to use, weather-resistant and ensures clean demoulding, with a correspondingly high quality of concrete surface resulting. For the roof edge, the planning team chose a black-dyed concrete with a fine grain containing mica in order to achieve an appearance reminiscent of the anthracite coal mined at Zollverein from 1847 to 1986.

Effective colour-matched protection
In addition to Ortolan, the architectural team also opted for Emcoril Protect M Lite from MC for curing the cleanable coating and for all other in-situ concrete measures in the floor, wall and ceiling areas. As a protection against evaporation, it ensures a good barrier effect, facilitates optimum hydration progress in the near-surface concrete layer and minimises the formation of early shrinkage cracks. In order to meet the planners’ demands for exceptionally high surface quality, some areas were also repaired and colour-matched with the concrete cosmetics of MC's Emcefix product system.

And with very good results: The huge, almost floating landscape roof was opened in spring 2019 after 15 months of construction and is another real eye-catcher on the former coking site, a location that already has more than its fair share of amazing visual attractions.
Long-service awards

Following an old and established custom, the first Thursday in the month of December always sees the MC Group’s latest long-service awardees honoured by MC’s Management Board at a ceremony, followed by a traditional banquet at the Gasthof Berger restaurant in Bottrop. Taking place this year on 5 December 2019, the ceremony was attended by MC employees from various countries who were celebrating their 10th, 25th and 40th anniversaries. MC’s three Management Board members shook hands with each attendee, expressing their appreciation and thanks for the loyalty and commitment to the company evidenced by their long service. Each was also given a gift in keeping with the time they have been an MC employee. Both honoured and gratified, the awardees were visibly pleased to receive both the kind words and the gifts. After the ceremony, the rest of the evening was given over to a delicious three-course dinner enjoyed in an informal atmosphere. In addition to the award ceremony in Bottrop, other MC locations around the world also held long-service anniversary celebrations.

10-year anniversary
Johann Schuh (AT)
Nikoley Monev (BG)
Daniel Medina (CH)
Isabel Meik (CH)
Stefan Scheck (CH)
Daniel Stimminghann (CH)
Stephan Abel (D)
Martin Buschinger (D)
Stephan Fälchle (D)
Sven Heinrich (D)
Mieczyslaw Pacanowski (D)
Katharina Ruland (D)
Andreas Sewald (D)
Sven Steppa (D)
Christoph Werab (D)
Marcel Bloon (NL)
Manuela Kwint (NL)
Krzysztof Tobolski (PL)
Paweł Wizerbowoski (PL)
Ivan Vlaskovic (SRB)
Aibek Amanbaev (RU)
Nikolay Boyko (RU)
Alexandr Gorykov (RU)
Vitaliy Khachatryan (RU)
Ivan Mahlaev (RU)
Dmitriy Popov (RU)
Igor Savin (RU)
Katariina Genyioova (SK)
Loret Ernum (UAE)
Dang Thi Bon (VN)

25-year anniversary
Peter Kiernayr (AT)
Frank Albitz (D)
René Barth (D)
Werner Clauß (D)
Roman Craja (D)
Josef Frauenkron (D)
Jerome Gamoni (D)
Stefan Gebhardt (D)
Bernd Hahmann (D)
Wolfgang Hienert (D)
Ulrike Hippler (D)
Thorsten Ingenhaag (D)
Lars Jankowski (D)
Jens Kleinau (D)
Mathias Lehnigk (D)
Hartmut Leye (D)
Reinhard Martin (D)
Holger Riebeling (D)
Daniela Wnendt (D)
Koltai Csoaba (HU)
Béla Rapp (HU)
Balogh Tibor (HU)

40-year anniversary
Waldemar Franke (D)
Barbara Petersen (D)
Silvana Schäkermann (D)
Wolfgang Vogel (D)
Günter Warkowski (D)
Sylwia Apanowicz (IN & UAE)
Daroslaw Demski (PL)
Tadeusz Wasag (PL)
Cosmina Dobre (RO)
Daniel Sandu (RO)

Congrats to the long-service awardees of MC Russia

On 19 November 2019, Evgeniy Sokolov, Managing Director of MC Russia, congratulated seven employees on reaching their 10th anniversary at the company. From left to right: Vitaliy Khachatryan, Alexandr Gorykov, Ivan Mahlaev, Nikolay Boyko, Evgeniy Sokolov, Aibek Amanbaev, Igor Savin und Dmitriy Popov.
Floor-coating system for car parks

In contrast to conventional flexible car park coatings, MC’s solution consists entirely of TopSpeed components based on KineticBoost-Technology®. The result is a certified OS 10 system which, thanks to its modified reaction kinetics, can even be applied in humid conditions and at temperatures from 2 °C to 35 °C. It is faster, more resilient and more durable than anything you might expect from conventional flexible floor coatings for car parks.

View all the advanced advantages at a glance:

mc-topspeed.de