



MC Report

Concrete admixtures at work

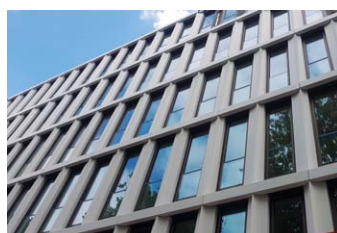
Key considerations in the formulation of concretes

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Dear Reader,



Without concrete, our modern building culture and infrastructure would be unthinkable. It is the most widely used of all construction materials and its applications are hugely diverse. The erstwhile three-material system consisting of cement, aggregate and water has meanwhile developed into a multi-phase complex that offers many advantages to clients, concrete manufacturers and applicators

alike. The primary condition for success is that the individual components – cement, concrete additives and admixtures – are properly and effectively coordinated. This makes it all the more important to have sound concrete technology expertise at your fingertips, so as to ensure that stable and robust concretes are always the reliable outcome. In our MC Report of this MC aktiv, we shed light on what is important in practice when using concrete admixtures.

Robust, reliable and sometimes also visually appealing solutions are the focus of the remainder of the issue. In recounting our latest project reports, our intention once again is to provide you with an impression

of the range of product systems we offer, the fields of application we cover and the extent of our know-how in relation to the production, protection and repair of concrete and masonry structures: From construction of the new Kaiser Hof commercial centre in Cologne and the comprehensive overhaul of the IBAG factory building in the creation of a residential complex, to the waterproofing of a railway tunnel in Italy and the construction of wind turbines in Thailand. Further articles relate amongst others to new product systems from our company, the official start-up of our joint venture in Ethiopia, the IRP seminar in Vietnam and career paths at MC. The magazine ends as usual with a summary of the latest developments in the personnel field.

Enjoy the read!

Yours,

Dr.-Ing. Claus-M. Müller

P.S.: As I am sure you are aware, we can only present a small selection of features in any one issue of MC aktiv. If you would like to be kept more regularly up to date with MC's activities, please follow us on Facebook, LinkedIn or Xing!

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Cover

Concrete needs to be durable and stable, resistant to weathering, acids and ageing, especially free-flowing and occasionally even self-compacting. And all this while also offering the best possible surface finish and consistently high quality. If these exacting demands are to be reliably met, the use of concrete additives and admixtures becomes unavoidable. Their correct application requires the knowledge of experienced concrete technologists such as those from MC-Bauchemie – professionals capable of coordinating the requirements of the construction process, the placement conditions and the specified concrete properties.

Photo: MC-Bauchemie/istockphoto

Credits

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Kick-off in Ethiopia

On 19 and 20 February 2019, LICON and MC-Bauchemie celebrated the official launch of their joint venture in Addis Ababa, Ethiopia, with customers and employees joining VIP guests and participants from all sides of the construction sector.

The first event on 19 February was attended by 60 representatives from government, various public authorities, the construction industry, planning and engineering offices, and architects. Dr. Egg Argaw Asha of the Ethiopian Construction Project Management Institute (ECPMI) welcomed MC's engagement in Ethiopia and stressed its importance for the further development of the construction industry.

Then, on 20 February 2019, an event was held for the distributors and applicators that work hand-in-hand with LICON. The approximately 80 participants showed great interest in MC, the new joint venture structure and the first insights into new MC technologies as provided by Moritz Koch, Business Development Manager Africa, who will continue to actively support MC as it pursues expansion in Ethiopia. In the afternoon of 20 February, the employee event took place in the traditional Yod Abyssinia restaurant, attended by 85 LICON people. LICON's Managing Director Demissie Heilemariam Abebe said with delight

apparent in his welcoming speech that "we are now officially part of the MC family". This MC affiliation was underlined by all present wearing MC T-shirts and caps, which LICON had produced especially for this event. Nicolaus Müller expressed his heartfelt thanks for the warm welcome received before introducing the MC Group and emphasising his pleasure at the prospect of collaborating with LICON and its employees. The following dinner was accompanied by traditional Ethiopian music and dance. And to the great delight of the hosts, the MC team from Germany took the opportunity to perform – as best they could! – a few Ethiopian dances.

MC acquires majority stake in LICON

At the end of November 2018, MC acquired the shares in LICON Manufacturing PLC held by CONMIX Ltd., a building products manufacturer domiciled in the United Arab Emirates. It also purchased a number of shares owned by minority shareholder LICA PLC as part of the package. LICON



was founded in Addis Ababa in 2009 and since then has been producing plasters, renders, tile adhesives, mortar and concrete admixtures as well as repair materials for the Ethiopian construction market. The company currently employs over 80 people in production, R&D, administration and sales. "For some years now, Ethiopia's construction sector has been undergoing above-average expansion. We want to participate in this

strong growth in what is one of Africa's most populous countries and, in so doing, make a contribution to improving the quality of construction in Ethiopia," says Nicolaus Müller, Managing Director of MC. This is to be achieved, among other things, by introducing new product systems and technologies from MC.

For further information, please go to our website:
<https://bit.ly/2HTAknc>



IRP seminar in Vietnam

Over 40 applicators from companies in India, Malaysia, Singapore, Sri Lanka, Thailand and Vietnam attended the IRP seminar at MC-BIFI in Hanoi, Vietnam from 26 February to 2 March.

IRP stands for Injection, Repair & Protection. Hence this technical seminar is aimed at applicators whom MC trains the use of its product systems in the areas of injection, concrete repair and surface protection. On the agenda of the three-day event were introductory basics relating to the various facets of injection technology, its mechanisms and its areas of application, as well as presentations covering damage diagnosis, substrate preparation and the repair and protection of concrete. The lectures were accompanied by practicals in which the application of different MC product systems was demonstrated, with everyone getting a chance to gain some hands-on experience. At the end of the seminar, the participants took a one-hour test to show what they had learned, with an IRP certificate being awarded designating them as IRP specialists – a qualification that enjoys a high standing in Asia.





CROM training course once again well attended

In February 2019, more than 70 sewerage network operators, planners and applicators took part in this year's series of CROM courses – Certified Rehabilitation of Manholes – at MC-Bauchemie in Bottrop and Esslingen.

For further
information, go to
<https://bit.ly/2HXgh6v>



Injection training in Brisbane

On 6 and 7 March 2019, we held an injection training course for advanced applicators in Brisbane, Australia, together with our partner BCS Building Chemical Supplies. 20 professionals from seven different companies took part in the event so as to get to know MC's injection technology in theory and practice and further extend their expertise.



Group photo (back row, left to right): Peter Krpelan (Slovakia), Zinovii Onyshko (Ukraine), Markus Weinzierl (Austria), Ian Owen (UK), Demissie Heilemariam Abebe (Ethiopia), Nicole van Houwelingen (Netherlands), Peter Truhan (Slovakia); (front row left to right): Uwe Strauch (Application Engineer CI), Aleix Sala (Spain).

Concrete Industry & Buildings induction training

From 25 February to 1 March 2019, we held our international induction training course in Bottrop covering the basics of the Concrete Industry & Buildings sector for new MC employees, with twelve colleagues from nine countries taking part. The agenda included the principles of concrete technology and an introduction to the various product groups of the Concrete Industry & Buildings division, from concrete admixtures, screed systems, cosmetics and surface retouching treatments to the waterproofing of buildings.



MC activities on International Women's Day

Anna Kaja, HR officer at MC, and Niklas Färber, an MC trainee, marked International Women's Day on 8 March 2019 by greeting everyone at our Bottrop site, handing out roses to our female colleagues, and conveying their best wishes on behalf of MC. We recorded the entire event on video.

To view the video,
go to
<https://bit.ly/2FuM3Vu>



Architectural concrete with potential

The development of steel-free reinforced concretes opens up ever greater design freedom for architects worldwide. Creative opportunity that just a few years ago would have been inconceivable has resulted in steady growth in the use of high-quality architectural concrete – as illustrated by the new Kaiser Hof office complex in Cologne.

The Kaiser Hof is a new, exclusive office building on the historic Kaiser Wilhelm Ring in Cologne. One of its striking features is the ingenious façade covering approx. 5,000 m², which has been elegantly designed with lightweight panels made of glass fibre-reinforced architectural concrete. Differently aligned pilasters in the bright outer façade create an extraordinary pattern of shadows that changes permanently with the incidence of light. The Kaiser Hof thus provides one of the true visual highlights of the Cologne cityscape. In all, the Kaiser Hof's façade consists of 1619 three-dimensionally shaped concrete elements and 137 flat panels.

Steel-free reinforced concretes

Creative, organic and vivid building envelopes made of curtain walling have experienced growing popularity over the years. However, this construction method requires elements that are as thin-walled, lightweight and freely formable as possible. Classic steel-reinforced concrete cannot be used due to the minimum concrete coverage required. Consequently, steel-free reinforced concretes are being used, for which no conventional minimum concrete coverage of the rebar is required. These facilitate the creation of delicate concrete structures offering all the advantages of lightweight construction. As alternative reinforcement systems, short fibres, textile mats or rods made of alkali-resistant glass or carbon are used. MC has long been involved in the development of this technology. The façade of the new building at MC's Bottrop site was also clad with concrete elements made of textile-reinforced concrete [see MC aktiv 3/2018].

Novel material

The Kaiser Hof required a particularly smooth surface compliant with the highest grade of fair-faced concrete (SB 4), coupled with a matt appearance and enhanced weather resistance. The free-form elements were produced with the glass fibre concrete BetoLamina®-Cast, which was developed by Steinbeis Innovation Centre FiberCrete in Chemnitz, Germany. In addition to very good mechanical properties and outstanding durability, the glass fibre concrete exhibits exceptional exposed/fair-faced concrete quality. It also exhibits high early and 28-day strengths and exceptional durability. Due to the complex geometry of the façade elements, excellent flowability combined with high mix stability of the fresh concrete was essential. The optimised additives required were therefore developed in close cooperation with the concrete technologists of MC's Research & Development department.

The creation of these special façade elements through the smooth interaction of project partners Steinbeis Innovation Centre, Medicke Metallbau GmbH of Glauchau, application company Fiber-Tech of Chemnitz and MC illustrates what can be done with the huge design potential that architectural concrete offers.

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MC developed specially optimised additives for the project to ensure the excellent flowability and high mix stability in the fresh concrete required to achieve the complex geometry of the façade elements.





The tunnel was sealed with a curtain injection using the elastomeric hydro-structural resin MC-Injekt GL-95 TR.



Tunnel waterproofing in Campania

In Avellino, Italy, an ageing railway tunnel urgently needed to be sealed against water ingress – while allowing normal operations to continue as far as possible. Thanks to its world-leading injection technology, MC was able to provide exactly the fast and reliable solution required.

Avellino is located in Italy's Campania region, some 40 km east of Naples. And it is here that the "Galleria Giglio" lies along the Benevento – Codola rail route. The tunnel, almost 160 metres long, 5 metres wide and featuring a pointed arch and masonry shoulders, was built in the 1930s. Having fallen into some considerable disrepair, the structure urgently needed to be sealed, as groundwater was already pushing through the walls from the sides and significant surface water was penetrating from above through the bricks of the ceiling. Although there is no overhead line installed in the tunnel to complicate matters, the ingress of water and the falling bricks loosened by the moisture had damaged both

the fabric of the structure and the rails, thus endangering rail traffic.

Thermit S.R.L., based in Naples, was commissioned to carry out the waterproofing work, with MC's know-how input very much part of the project. Working together with Ricardo Quiroz, Business Development Manager at MC, and Markus Treinen, Global Target Manager Injection, Thermit was able to develop a waterproofing system tailored to the job in hand.

Watertight solution

This consisted of a curtain injection seal using MC-Injekt GL-95 TR, a soft elastomeric hydro-structural resin. With its low viscosity and brief, controllable reaction, it offered the twin benefits of exceptional penetration into the masonry and rapid sealing. MC-Injekt GL-95 TR has been specifically developed both for the injection-based waterproofing of masonry and concrete with permanent water contact and as a secondary horizontal or vertical repair barrier to prevent penetrating moisture in masonry. Its elasticity also ensures that the tunnel in Avellino remains sealed despite the movement generated by rail traffic. A further key factor for the customer was that the hydro-structural resin is approved

for waterproofing barriers in contact with groundwater.

Injection work with operations ongoing

The injection work began on 26 August 2018 and was carried out on the basis of a 50 x 50 cm grid with a depth of 30 cm and a diameter of 18 mm per hole. About 6 kg of the special resin was injected per hole. MC-Injekt GL-95 TR is compatible with old masonry structures and can even be applied where space is tight. As a consequence, there was no need to stop rail traffic passing through the tunnel. Instead, the work was shifted to night time when train frequency was light, with the results then being inspected during the day. The waterproofing project was successfully completed in just three weeks, since when rail traffic has been travelling through Avellino's Galleria Giglio without disruption or danger.

The injection work was carried out on the basis of a 50 x 50 cm grid with a depth of 30 cm and a diameter of 18 mm per hole.



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Fresh wind for Thailand's energy mix

In Thailand, a large wind farm was built between August 2017 and February 2019, comprising 90 turbines with a tower height of between 140 and 180 metres. The German contractor called upon MC's know-how in order to ensure safe and secure tower anchorage.

The Thepharak wind farm located in Huai Bong district, some 260 kilometres north-east of Thailand's capital city Bangkok, was constructed over a period of around one and a half years. It boasts some of the highest wind turbine towers in the whole of Asia. The German construction company Max Bögl Wind AG was awarded the contract for the project and began shipping 262 overseas containers from Germany's Oberpfalz region (Upper Palatinate) to Huai Bong, some 17,000 kilometres away, in August 2017. These contained the entire material for the construction of the world's first mobile manufacturing plant for wind turbine towers, enabling production aligned to German quality criteria to also be carried out in Thailand.

Solid anchorage systems

MC-AnchorSolid E280 was the first choice for anchoring and bonding the bearing blocks* for the first tower ring on the foundation of the enormous wind turbine masts, and also for filling the resulting cavities. This highly reactive anchor adhesive was successfully tested at the Max Bögl headquarters in Germany and proved to be particularly durable and resistant. As a ready-to-use, two-component anchor adhesive based on epoxy resin, it is especially suitable for securing threaded rods and reinforcing steel in both dry and water-saturated, crack-free concrete. MC-AnchorSolid E280 is approved as an anchor bonding adhesive according to European Technical Assessment ETA-15/0506 and has been tested compliant for use in C20/25 to C50/60 concrete for anchoring threaded rods and attachment rebar. Despite the demanding climatic conditions that prevail in Thailand, with

outside temperatures of up to 40 °C and high humidity, it has been verified as meeting all requirements in terms of strength and tolerance.

Logistical challenge

Although the construction company had decided to manufacture the structural components directly on site in Thailand, the MC-AnchorSolid E280 still had to be supplied from the MC production site in Bottrop, Germany. This was quite a logistical challenge because the material always had to be delivered just in time by ship, plane and truck to a rural area in the hinterland of Bangkok, a location of poor accessibility by road. However, thanks to very close cooperation between the MC offices in Germany and Singapore, these challenges were also successfully overcome. The final erection and equipment installation work including rotor blade assembly was completed by the beginning of February 2019, with connection to the grid occurring in the following month. The new wind farm takes the Thai government another good step closer to delivering on its commitment to increase the share of renewable energies in power generation to 30 per cent by 2036.

* These blocks serve to align the first tower ring of the wind turbine mast so that it is absolutely straight. The space between the foundation and the first ring is then grouted to create a rigid support.

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© Max Bögl Wind AG



MC-AnchorSolid E280 was used, among other things, for anchoring and bonding the bearing blocks* for the first tower ring on the foundation of the wind turbine masts.



Concrete admixtures at work

Concrete admixtures have become an integral part of modern concrete technology. They have paved the way for concrete construction into new areas of application and made construction more economical in a great many fields. However, concrete admixtures are often blamed for problems in concrete construction – prematurely, as it often proves. There is no doubt that the interaction of the various input materials used in the formulation of concrete has become more complex over the years. The erstwhile three-material system consisting of cement, aggregates and water has meanwhile developed into a multi-phase complex requiring effective coordination and tuning of the cement, additive and admixture components. Their correct application needs the knowledge of experienced concrete technologists – professionals capable of intermatching the requirements of the construction process, the laying conditions and the specified concrete properties. This article offers a number of examples of how this is done in practice.

Development

Admixtures have become an integral part of modern concrete technology. Without them, developments in this field would have followed a completely different direction. By assisting in the advent of novel types of concrete, such as self-compacting or ultra-high-strength grades, they have opened up new areas of application for concrete construction and also made this more economical in many fields. Looking back, we find the first DAfStb (German Committee for Reinforced Concrete) code of practice for free-flowing concrete regulating the use of plasticisers on the construction site was issued in 1986. With the development of PCE-based plasticisers, this code is now out of date. Laying times of three to four

hours can be easily achieved these days. At that time, there was talk of so-called “superplasticisers”, which improve the flowability of fresh concrete without significantly impairing its cohesiveness. Flowing concrete was understood to be fresh concrete with good flowability and sufficient cohesiveness. Concrete plasticizers, superplasticisers, air-entraining agents, stabilisers, retarders, solidification and hardening accelerators, sealants and pressing agents are the main functional promoters used in practice today. At around 80 per cent, liquefying admixtures (plasticisers and superplasticisers) account for the largest share in terms of volume. This is illustrated by the chart on page 9 which shows the sales development of liquefying admixtures in Germany

and the development in the share of PCE-based superplasticisers. The development of concrete admixtures is closely linked to the steady and ongoing further development of concrete technology. The requirements for kilometre-high towers in hot desert states are different from those for concrete offshore platforms in the polar seas. However, the introduction and implementation of Germany's primary concrete standard (EN 206-1 in conjunction with DIN 1045-2) with the extension of the consistency classes up to a slump rating of F6 have also led to the further development of admixtures. The trend observed worldwide is towards easily workable, softer concretes. The following are just a few examples of the advantages of using admixtures:

- Concretes produced with superplasticisers are easy to work, reduce the degree of compaction required and thus also diminish the noise nuisance on inner city construction sites.
- Stabilisers enable the laying of underwater concrete without segregation. Thus, sealed excavation pit bottoms can be produced in an environmentally friendly manner without pumping out groundwater.
- Air-entraining agents enable concretes to withstand extreme frost and the kind of attack caused by de-icing salts.

New superplasticiser systems are available today that effectively reconcile



Concrete work in the construction of new facilities at MC-Bauchemie, Bottrop, in 2016.



opposing requirements (low w/c value, good consistency over 90 min and very good early strength development enabling stripping after just 24 h). This makes the addition of superplasticiser on site unnecessary, reduces the occurrence of error and saves valuable time. Yet concrete admixtures are occasionally blamed for problems in concrete construction – prematurely, as it often proves. There is no doubt that the interaction of the various input materials used in the formulation of concrete has become more complex over the years. The erstwhile three-material system consisting of cement, aggregates and water has meanwhile developed into a multi-phase complex requiring effective coordination and tuning of the cement, additive and admixture components. As a rule, fresh concrete today is assessed only on the basis of its consistency (slump rating or compactability) and the information on the delivery note. This means its rheological behaviour cannot be adequately described and evaluated. Other relevant performance characteristics such as “stickiness”, pumpability and, in particular, mix stability cannot be determined

with this initial examination. Their correct application therefore requires the knowledge of experienced concrete technologists – professionals capable of intermatching the requirements of the construction process, the laying conditions and the specified concrete properties.

Mix stability values

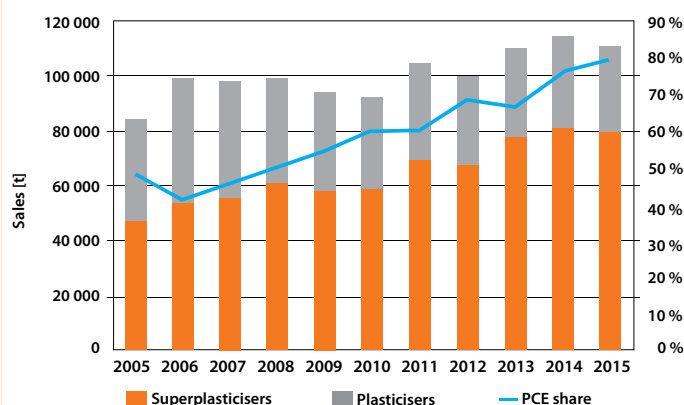
Segregations occurred in canal lock chamber walls (during the construction of the Wusterwitz lock), causing the Federal Institute for Hydraulic Engineering (BAW) to implement a range of ad hoc measures, including recommendations regarding the use and handling of PCE-based superplasticisers. These ad hoc measures were introduced in May 2015 as regulations supplementary to the “Additional Technical Contract Conditions for Hydraulic Engineering Structures of Concrete and Reinforced Concrete (ZTV-W LB 215)”. In BAW Bulletin 01/2015 “Problems with the mix stability of concrete” and the A1 supplement from 2018, it is stated that the vibration energy introduced has a very significant influence on mix stability. The

resistance of the concrete is affected by many factors such as consistency, choice of an appropriate aggregate grading curve or sufficient glue content. Nevertheless, it was assumed at the time that “the use of superplasticisers based on PCE can have a particular influence on the stability of the mixture”. In general, stabilising admixtures can exert a positive effect on sedimentation stability. This presupposes ensuring optimum metering of the stabiliser, as fluctuations in

the amount added (too high or too low doses) can lead to a reduction in stability. Too short mixing times and/or too low mixing intensity can also lead to an inhomogeneous concrete composition and impair mix stability. This may occur if admixtures (e.g. superplasticisers) have not been sufficiently solubilised during production in the ready-mix concrete plant, causing excessive dosing to occur.

Continued on page 10

Sales development of concrete admixtures in Germany



Source: Deutsche Bauchemie e.V.



Slump test with a readily self-compacting concrete: Comparison between an unstable (photo left) and a stable (photo right) concrete.

Continued from page 9

But what is actually meant when we refer to the stability and robustness of a fresh concrete mix? A stable, fresh concrete is one that is appropriately resistant to segregation; i.e. when exposed to expected vibration, pumping and working effects, the mix remains sufficiently homogeneous so as to ensure that the essential properties of the hardened concrete are reliably achieved.

Sedimentation stability (as part of mix stability) refers to the sinking of the coarse aggregate. The fresh concrete must remain stable to the extent that there is no or only limited unwanted separation between the glue or mortar phase and the coarse aggregate. The tendency of individual components of fresh concrete to separate from each other is referred to as segregation propensity. This phenomenon essentially depends on the effects acting on the concrete and its ability to withstand those effects. Water separation (bleeding), which eventually causes porous solution to accumulate on the surface of the fresh concrete, is invariably regarded as an undesirable form of segregation. Robustness, on the other hand, refers to the ability of a concrete to react "benignly" (predictably) to unplanned influences, such as fluctuations in water content, batch-related variations in the source materials, changing environmental conditions, delays

in the construction process or accidentally prolonged vibration. In summary, a stable fresh concrete can be described as follows:

- Minimal water separation, bleeding
- Minimal segregation of cement glue/mortar
- Minimal sedimentation of coarse aggregates
- In the case of air-entrained concrete, minimal foaming

First of all, a concreting schedule has to be worked out which defines the stresses arising from layer thickness, placement openings, free fall height, length of horizontal movement (drifting), vibration energy (type and duration), immersion points of the vibrating equipment, etc.

A robust concrete aligned to this can be produced, e.g. by selecting a suitable aggregate grading curve and a sufficient binder or glue content on the basis of extended suitability tests. Elements incorporated into a recommended extended suitability test may include:

- Determination of the air entrained over a simulated transport period
- Test after initial mixing and then again after 10 min extended mixing time
- Test after extended compaction time
- Testing with elevated fresh concrete temperature

Test methods

The previously described properties of mix stability or segregation propensity cannot yet be conclusively defined using generally recognised test methods. Work is currently being carried out at the Institute for Building Materials in Hannover (ifB) with the aim of establishing practical tests of these relevant fresh concrete properties. One such approach is aligned to introducing a sedimentation test to determine the mix stability of concrete under the influence of vibration. The focus here is on the development of a mobile "sedimentation device" suitable for construction sites, which enables variable control of the compaction parameters. Initial prototypes of the so-called "sedimentation pot" are already available.

Concurrent with the development of the test procedure and the trial-ling of the test apparatus, a number of further fundamental questions concerning the requirements and the testing of fresh concrete are currently being discussed, for example in a "Fresh Concrete" working group set up by the DAfStb. Present discussions are revolving around questions such as what constitutes complete compaction.

- The complete compaction of the fresh concrete is one of the basic prerequisites for reliable achievement of the desired hardened con-

crete properties and thus represents one of the most important process criteria in concrete-laying.

- As the consistency class increases, the compaction effort required for complete de-aeration decreases. The compaction method chosen must also be aligned to the consistency of the fresh concrete.

These and other open questions regarding the compaction parameters, such as duration and intensity (frequency/amplitude) with a given compactor, still need to be clarified before theory can be transferred into practice.

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Industrial culture reimagined

The IBAG factory building in Neustadt an der Weinstrasse was one of Germany's first reinforced concrete buildings. Having been allowed to fall into increasing disrepair, this architectural gem was extensively refurbished and converted into a high-quality residential complex in 2017, with a wide range of products from MC making a significant contribution to its successful transformation.

Listed ruin

Built in 1911 according to plans penned by architect Karl Fischer, the huge IBAG factory was one of Germany's first ever skeleton-built "iron concrete structures", predating the advent of steel reinforced concrete construction. It was used among other things for the manufacture of agricultural machines. However, its useful life in this domain ended in 1997. When the one hundred year old building was finally listed in 2011, the great production hall was little more than a steel skeleton with a cracked concrete shell. Hence, the damage catalogue proved to be extremely extensive: Parts of the concrete columns were carbonated through to behind the reinforcement, in some cases the stability of the arched roof spanning the production hall could no longer be guaranteed, and columns were missing in the side aisles. An initial assessment estimated the damaged areas to equate to 10 per cent of the concreted expanse, revised up to 15 per cent in the course of the renovation project.

Concrete repair systems from tip to toe

Unperturbed by the dilapidated state of the structure, Regioplan GmbH of Giessen ultimately acquired the building with a view to converting it into high-quality living space. The engineering office KuA of Darmstadt was entrusted with the planning work – and with Wayss und Freytag Ingenieurbau AG of Frankfurt, the same company was awarded the refurbishment contract that was actually responsible for construction of the factory building in 1911. The concrete repairs started at the roof of the production hall and extended down to the columns.

Three arched roof segments were so badly damaged that they had to be completely shuttered, reinforced and re-concreted. The products of the MC Nafufill series were the first choice for the subsequent renovation measures. The variant selected for repairing the concrete components was Nafufill KM 250, a fibre-reinforced, structurally strengthening PCC concrete replacement characterised by its high carbonation resistance, de-icing salt resistance, chloride-resistance and excellent fire protection properties. Nafufill KM 103, a PCC fine filler for interior and exterior use, was used for the finishing touches. In order to also safeguard the surfaces over the long term, it was decided to apply MC-Color Flex pure as an effective concrete protection coating with a crack bridging capability down to -30 °C.

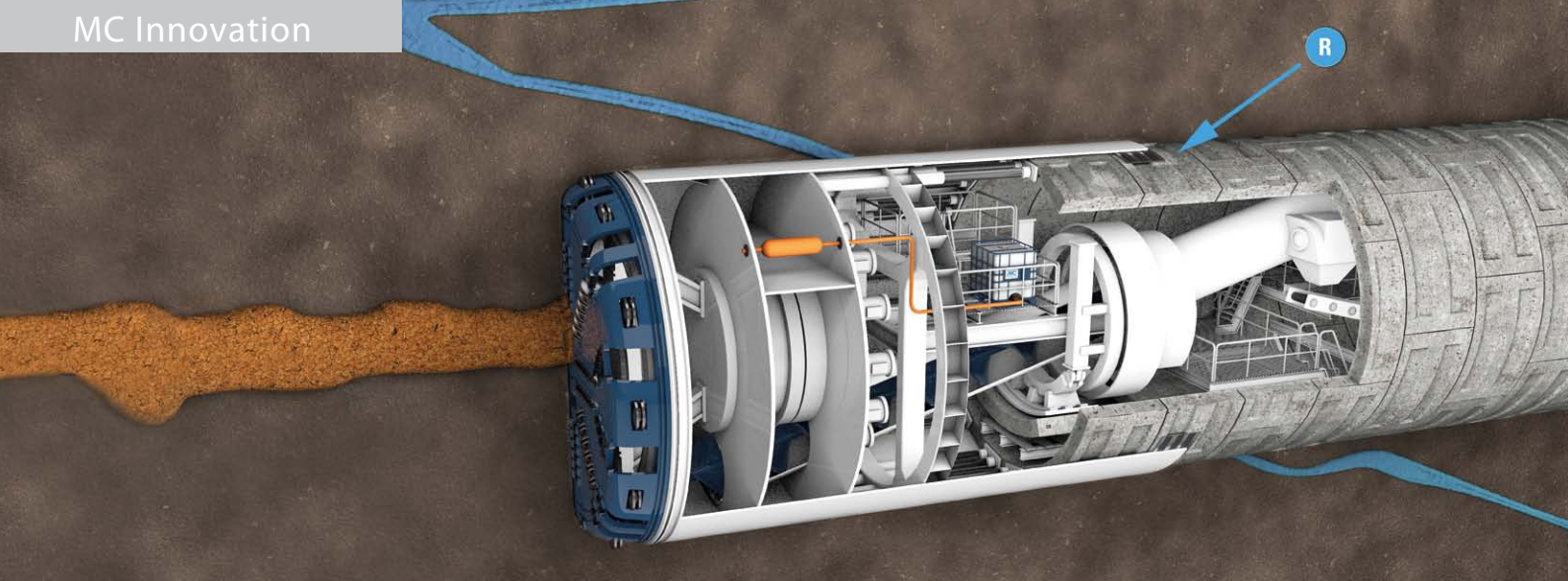
Creative conversion of a former industrial facility

Between February and November 2017, a total of 6,200 m² of concrete was repaired during the refurbishment of the IBAG factory building, using 200 tonnes of mortar. All the work was carried out in close consultation with the heritage protection authorities. Third-party monitoring of each stage of the project was performed by Gemeinschaft für Überwachung im Bauwesen (GÜB). Two-storey maisonette apartments with variable floor plans, garden sections and spacious roof terraces are currently being installed in the reimagined hall. Thanks to root and branch concrete restoration, the IBAG factory building has been preserved as a historical monument to industrialisation in Germany.

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A total of 6,200 m² of concrete was repaired in the IBAG building refurb, with 200 tonnes of mortar and filler from the Nafufill series applied as a major part of the project.



Cross section of a tunnel boring machine: The activator is added to the grout supply device and the mix is then injected into the annular space (marked R).

New cementless TBM backfill grout

Together with PORR Bau GmbH, MC has developed a new TBM backfill grout based on a geopolymer that is suitable for use in swelling rock formations. This cementless annular gap filler prevents swelling pressures, is sulphate-resistant and provides a permanent bedding for securing the tunnel tube.

In tunnel boring, segments known as tubbings are positioned to create the tunnel tube. The action of the tunnel boring machine is tolerated to create a clearance between the existing rock and the tubbings. In order to enable transmission of the drilling forces and reduce surface subsidence, this annular gap has to be completely filled with grouting materials in a process generally referred to as backfilling, with the materials used falling into one of two categories – single-component (1C) and two-component (2C) grouts. The 1C grouts contain cement, additives, aggregates and water. Concrete admixtures are used to create specific application properties. 2C backfill grouts consist of cement, bentonite and water. Here stabilisers are used to provide for the necessary application properties while ensuring a working time of 48 to 72 hours.

2C grouts are suspensions made up with large amounts of surplus water, allowing them to be pumped over distances of several kilometres. They are thus comparatively easy to use. In Asia, 2C backfill grouts have been in use for many years. They were applied for the first time in Germany for the Emscher Project. And here too, MC-Bauchemie worked closely with PORR Bau as a key player in developing the required formulation. MC supplied all the necessary additives and provided the application engineering support.

Limits of conventional TBM backfill systems

Both methods – 1C and 2C – have their advantages, but cannot be used for boring swellable rock, e.g. that containing anhydrite, because both are cement-based and release excess water to the surrounding substrate. If anhydrite comes into contact with water, gypsum is produced as the reaction product. This reaction is accompanied by a volume increase of around 60 per cent.

The associated swelling pressures are so enormous that elevations at the earth's surface can occur and underground structures can be permanently damaged or even destroyed. When working in strata containing anhydrite, therefore, it is essential to prevent the release of surplus water from the

grout to the surrounding rock. This is not possible with cement-bound materials.

A backfill grout suitable for anhydrite rock

MC-Bauchemie and PORR Bau have thus developed a completely new kind of annular gap filler based on a geopolymer. Geopolymers are inorganic binders that do not contain cement and whose structure can be traced back to aluminosilicates. The binder of the new backfill grout consists of granulated blast furnace slag and fly ash. Aggregates are used to stabilise the mix. An activator is added to the supply device via which the backfill grout is introduced into the annular space. This triggers the binder reaction. The grout also contains a variety of phosphates that suppress anhydrite swelling. The concrete-like properties of this TBM backfill grout enable production in a ready-mix concrete plant located at the construction site. The long processing time of the material gives tunnel builders more flexibility, as without addition of the activator the grout can be stored for long periods without deterioration. This novel grout material is currently being successfully used in the anhydrite-bearing unleached gypsum keuper of the "Stuttgart 21" project.



View of the backfill grout as applied under pressure between the tubing segment and the rock in a haulage shaft.

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The main areas of application are the surfaces of intermediate floors of multi-storey car parks and weather-exposed parking decks such as that of a supermarket in Netphen, where an area of 4,500 m² was covered with the OS 11a-rated coating system now available from MC-Bauchemie.

New surface protection systems for car parks

MC-Bauchemie has upgraded its portfolio of car park coatings. In addition to the OS 8- and OS 10-rated coating systems for floor surfaces, the company is now offering new OS 11a- and OS 11b-rated compound coatings for the protection and repair of multi-storey car parks and parking decks.

The new systems have been developed for higher levels of loading stress and attack in multi-storey car parks and come with increased crack-bridging capability. Crack-bridging, trafficable surface protection systems are required wherever the risk of cracking arises. They are also indispensable where existing cracks show significant variation in width due to temperature and load changes.

With the new, duly tested OS 11a and OS 11b coating systems, MC-Bauchemie now offers planners, operators and owners further possibilities for floor coating in multi-storey car

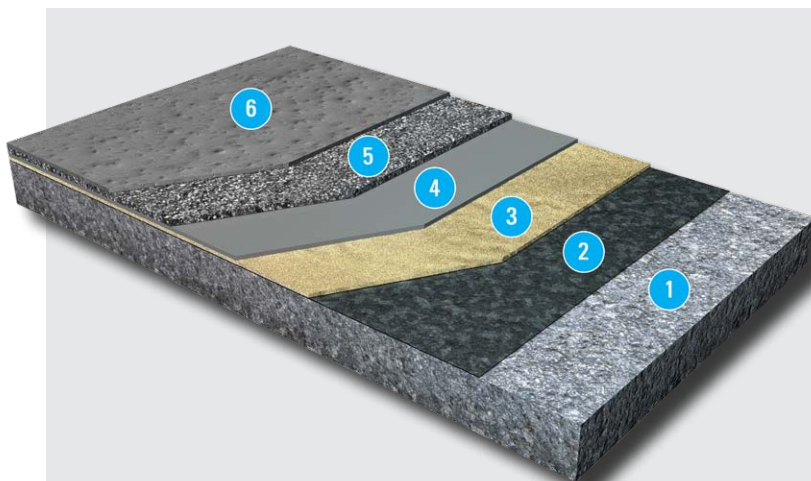
parks with zones at risk of cracking. The main areas of application are the surfaces of intermediate floors in multi-storey car parks and those of weather-exposed parking decks.

Dynamic crack bridging

The OS 11a system is a two-layer combination comprising a primer coat and an optional scratch coat with MC-DUR 1311 VK, a seal coat with MC-DUR 2211 MB, a wear layer with MC-DUR 2211 WL including a broadcasting of quartz sand, and a top seal with MC-DUR 1311. The OS 11b system is a single-layer system that has a similar structure, but in

which the sealing and wear coats are combined to form one layer. Both composite systems are proven to exhibit a dynamic crack-bridging capability of 0.3 mm. They are flame-retardant (fire rating Bfl-s1) and offer a slip resistance of R11, rising to V4 with a scattering of quartz sand of 0.3 - 0.8 mm aggregate.

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Overview of the OS 11a coating system

The new OS 11a two-layer system offers a higher degree of wear resistance compared to the new OS 11b single-layer system. Both coating systems exhibit enhanced crack-bridging capabilities.

- 1 Concrete substrate/floor slab
- 2 Primer MC-DUR 1311 VK
- 3 Scratch and blowhole filler MC-DUR 1311 VK
- 4 Seal coat with MC-DUR 2211 MB
- 5 Wear layer with MC-DUR 2211 WL
- 6 Top seal with MC-DUR 1311

Career paths at MC

From back office to field sales

Daniel Wiene (35) switched last December from the sales back office to the field sales organisation of the Concrete Industry & Buildings (CI) division of MC, assuming area management responsibility for Münsterland, Lower Rhine and parts of the Emsland region. A qualified structural engineer, he has been with MC since March 2017, working before the change in the Technical Helpdesk department.

"I had an interesting range of responsibilities with the Technical Helpdesk and had a lot to do with customers, field staff and colleagues from logistics, operations and product management," says Wiene, who since joining MC very quickly familiarised himself with the CI product portfolio and fields of application. "I am very grateful to my colleagues from these areas for their assistance and cooperation as I tried to find my way around," says the new sales representative, who finds he is still benefiting from this intensive process of induction.

The offer

CI's sales management had already taken note of his talents. So when a vacancy came up in the Münsterland region, those responsible were quick to act. "Jan Höhnle [ed.: CI Sales Manager, West Region] approached me and asked if I wanted to take on the role of area manager," says Daniel

Wiene. Rolf Cremer, who has been in charge of the territory for many years and is still today responsible for selected customers, had previously suggested Wiene for the position. As a native of Münsterland, Wiene was both honoured and delighted to accept the position.

Born in Borken and now living in Heiden having recently become a father for the second time, he had previously worked as a journeyman in an architectural and furniture joinery for seven years after training as a carpenter and cabinet maker. While working, he also attended evening classes and, after four years of study, successfully passed his finals to become a state-certified structural engineer.

The motivation

"I was attracted to this new position because it involved new realms of responsibility: I can now also advise and support customers personally on site and am able to see the application of our products on the ground," says Wiene when asked about his motivation for this step change in his career path.

His customers and prospects include precast plants, building contractors, screed layers and building waterproofers outfits. Even though he is still in the introductory phase, he hopes "that my customers will always look upon me as an essential cog contributing to their daily planning and execution work." He is very ambitious in his new role. In general, he would like to further increase the level of awareness of MC and be perceived not only as a problem-solver, but also as a friend and helper on an everyday basis: "My customers need to know that they can contact me at any time." Clients and colleagues alike have come to know Daniel Wiene as an open,

very competent, can-do and utterly reliable person - qualities that are so important in field sales. We wish him the very best of luck and every success in all his endeavours.

No fixed career ladders

Daniel Wiene's example once again illustrates the variety of career paths available at MC. Jost Reichenberg and Julia zur Loye have made similar progress in the Infrastructure & Industry division in recent years.

At MC there are no fixed career ladders. Rather, each employee has the chance to shape his or her individual progress in and future with the company.

Daniel Wiene (35) switched from our sales back office to field sales in December 2018.



Welcome to the team

Steve McCormack (48) assumed the position of Managing Director MC UK on 1 March 2019. A qualified building engineer, he first joined MC Ireland as a sales representative in January 2004, later to be promoted to the position of Sales Manager. Since 2016, McCormack has held the post of Managing Director MC Ireland. His primary objectives for the UK market will be to ensure the continued success of the IN business while also establishing a thriving CI presence.



Markus Weinzierl (42) joined MC and Botament in Austria as Managing Director on 1 February 2019. During the previous 13 years he enjoyed considerable success as Director of Sales and Distribution for a well-known Austrian cement manufacturer. He brings with him an excellent network of contacts in the concrete industry, in the building merchants trade and at numerous construction companies, and intends to boost MC Austria's CI business, especially in the field of admixtures, while further expanding its IN and Botament operations.



Dipl.-Ing. Lars Langmaack (49) joined MC-Bauchemie on 1 January 2019 as Technical Director TBM heading up the company's Tunnelling Systems unit. In this function, he is responsible for product and system development as well as the provision of comprehensive technical consulting services to construction companies and clients worldwide. For the previous five years, he had been Head of the TBM division at another company specialising in tunnel construction applications.



MC honours its trainees

After successfully passing their examinations and being taken on by MC, Luca Brink (Building Materials Inspector IPK), Jan-nik Elspaß (Paint Laboratory Analytics Assistant), Laura Eichler (Industrial Manager IN/B ombran), Sebastian Engel (Chemical Assistant Powder Facility), Maurice Fröhlich (Chemical Assistant Emulsion Facility) and Marcel Petry (Chemical Assistant Powder Tower) were presented their graduation certificates by instructors Michael van der Leij, Stefan Polinowski, Elena Fadejew and Gerd Große-Kreul, with Managing Director Nicolaus Müller presiding, at an awards ceremony held on February 28, 2018.

For further information,
go to ...
<https://bit.ly/2JqReLp>
(German only)



MC's Managing Directors in dialogue with school students

74 school students from Bottrop, Essen and Dinslaken visited MC on 11 February 2019 as part of the "Dialogue with Youth" programme. They gained first-hand insights into the work of MC, while making the most of the opportunity to ask questions and enter into dialogue with Dr.-Ing. Claus-M. Müller and his son Nicolaus, both Managing Directors of MC.

For further information,
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<https://bit.ly/2ITOea1>
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