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Dr.-Ing. Holger Karutz



Alexander Olbrich

Concrete's Crucial Role in Shaping the Middle East's Building Boom

In the heart of the Middle East, a construction renaissance is underway, setting new standards for architectural ambition and sustainable development. The region has become once again a global epicenter for groundbreaking projects, with a spotlight on the vital role played by the concrete industry, specifically readymix and precast concrete, in shaping this transformative era.

One standout project that exemplifies the region's grand vision is NEOM in Saudi Arabia. This visionary city of the future is a testament to innovation, sustainability, and economic progress. NEOM's towering skyscrapers, cutting-edge infrastructure, and environmental initiatives rely heavily on the concrete industry's expertise. Concrete's strength and durability make it the material of choice for the construction of the city's structural marvels.

In this era of construction excellence, the Middle East's concrete industry is not just a supporting actor; it's a driving force behind architectural innovation and sustainability. Its durability ensures the longevity of these iconic structures, its adaptability facilitates rapid construction, and its commitment to sustainability aligns with global goals.

As the Middle East continues to redefine urban landscapes, the concrete industry stands tall as the foundation of this progress. It bridges the gap between vision and reality, propelling the region into a sustainable future while leaving an indelible mark on the world stage. But not only in the Middle East concrete is not just a building material; it's globally a symbol of ambition, progress, and the realization of dreams.

الدور الحاسم للخرسانة في تشكيل طفرة البناء في الشرق الأوسط

في قلب الشرق الأوسط، تجري نهضة بناء، ما يمهّد لإرساء معايير جديدة للطموح المعماري والتنمية المستدامة. لقد أصبحت المنطقة مرة أخرى مركزاً عالمياً للمشاريع الرائدة، مع تسليط الضوء على الدور الحيوي الذي تلعبه صناعة الخرسانة، وتحديداً الخرسانة الجاهزة والخرسانة مُسبقة الصب، في تشكيل هذا العصر التحوّلي.

يتمثل أحد المشاريع البارزة التي تجسّد الرؤية الكبرى للمنطقة في مشروع "نيوم" بالمملكة العربية السعودية. تعتبر مدينة المستقبل الحاملة هذه بمثابة شهادة على الابتكار، والاستدامة، والتقدم الاقتصادي. تعتمد ناطحات السحاب الشاهقة في مشروع "نيوم"، والبنية التحتية المتطورة، والمبادرات البيئية بشكل كبير على الخبرة بصناعة الخرسانة. إن قوة الخرسانة ومثابرتها تجعلها المادة المفضلة لبناء العجائب الإنشائية في المدينة.

في هذا العصر الذي يتسم بالتميّز في مجال البناء، لا تعد صناعة الخرسانة في الشرق الأوسط مجرد جهة فاعلة داعمة؛ بل إنها القوة الدافعة وراء الابتكار المعماري والاستدامة. تضمن مثابرتها طول عمر هذه الهياكل الأيقونية، كما أن قدرتها على التكيّف تسهّل عملية البناء السريع، كذلك فإن التزامها بالاستدامة يتماشى مع الأهداف العالمية.

ومع استمرار الشرق الأوسط في إعادة تعريف المناظر الطبيعية الحضرية، تقف صناعة الخرسانة شامخة بوصفها أساساً لهذا التقدم. فهي تسد الفجوة بين الرؤية والواقع، وتدفع المنطقة إلى مستقبل مستدام مع ترك بصمة لا تُمحى على المسرح العالمي. ولكن ليس فقط في الشرق الأوسط، فالخرسانة ليست مجرد مادة بناء؛ بل إنها رمز عالمي للطموح، والتقدم، وتحقيق الأحلام.



12

SECTIONS

Editorial	3
Imprint	6
Advertiser's List	70



26



41

CONTENTS

NEWS

- 7 A broader, strategic and forward-looking management level
New management team at Kobra Formen GmbH
- 8 Successful in-house exhibition for the anniversary
75 years Hess Group
- 10 Betolar and Fujairah Concrete Products (FCP) announced their collaboration
Launch of low-carbon concrete products in the UAE

CONCRETE TECHNOLOGY

- 12 Mechanical characteristics and deformation
Early age properties of high strength concrete

CONCRETE PRODUCTS / CAST STONE

- 18 Rekers GmbH Maschinen- und Anlagenbau, 48480 Spelle, Germany
Innovative block manufacturing systems with multifunctional block-making machines
- 26 Wasa AG, 64293 Darmstadt, Germany
All-plastic boards ensure continuity and high performance in unison
- 31 Frima GmbH & Co. KG, 26723 Emden, Germany
Replacement of the concrete block machine as part of an extensive modernization at Egner in Erasbach
- 36 Masa GmbH, 56626 Andernach, Germany
It's the filling that counts

CONCRETE PIPES AND MANHOLES

- 41 Afinitas, Clayton, MO 63105 USA
Frankston Concrete Products successfully operating the drycast market in Australia

PRECAST CONCRETE ELEMENTS

- 48 Bianchi Precast Group, 43045 Fornovo di Taro (PR), Italy
The evolution of a concrete spreader
- 52 Moldtech S.L., 41500 Alcalá de Guadaíra (Sevilla), Spain
Complete plant for prestressed beams for HS2 high speed railway project in UK
- 54 New innovations to supplement precast technologies
Decarbonizing the construction industry with structural design optimization and low-carbon concrete

CONTENTS



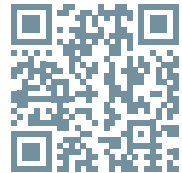
54

Eurobend GmbH, 90547 Nürnberg-Stein, Germany
60 Leading mesh welding technology at Abu Dhabi Precast LLC.

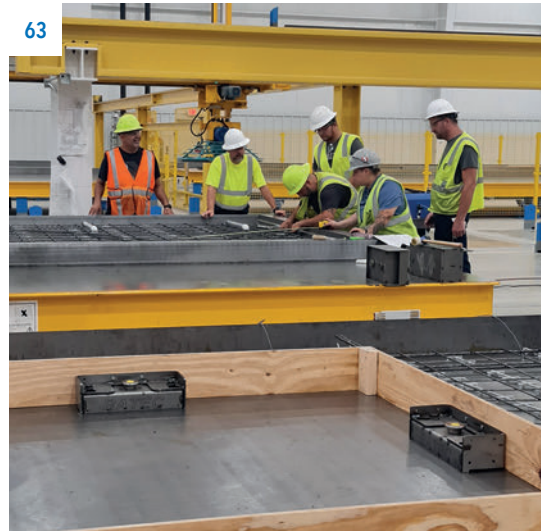
Ratec GmbH, 68766 Hockenheim, Germany
63 Magnet box in focus

mbk Maschinenbau GmbH, 88353 Kisslegg, Germany
66 Customised solutions for the modernisation and optimization of production facilities

Prensoland S.A., 08592 Sant Martí de Centelles, Barcelona, Spain
**68 Benefits of shear keyed surfaces in precast building –
Application in hollow core slabs for floors / roofs**



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63

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A broader, strategic and forward-looking management level

New management team at Kobra Formen GmbH

فريق الإدارة الجديد في Kobra Formen GmbH

With effect from 1 January 2024, the management of Kobra Formen GmbH has been strengthened and its management level has been expanded in a strategic and forward-looking manner. Andreas Gebauer-Günther, previously an authorised signatory in the internationally active company, will manage the business together with Holger Stichel and Jan Streckenbach. Heike Gießmann and Stefanie Schaarschmidt complete the management team in their role as authorised signatories.

لقد تم تعزيز إدارة شركة Kobra Formen GmbH وتوسيع مستوى إدارتها بطريقة استراتيجية وتطلعية اعتبارًا من 1 يناير 2024. وسيقوم أندرياس غيباور-غونتر، الذي كان في السابق أحد المفوضين بالتوقيع المعتمدين في الشركة النشطة دوليًا، بإدارة الأعمال مع هولجر ستيشيل ويان سترينكينباخ. ويكمل كل من هايك جيسمان وستيفاني شارشميت فريق الإدارة في دورهما كمؤمّنين بالتوقيع معتمدين.

Andreas Gebauer, who has been part of the company for 25 years, has international experience in the production of concrete block molds. For the past three years, he has been in charge of sales, including the globally operating subsidiaries, the service and design department for the development of new stone systems and logistics. He is also President of the American production site Kobra Molds LLC.

Jan Streckenbach is responsible for production, production control, design, work preparation, programming, purchasing and IT. Holger Stichel manages all processes in the Research & Development department. Finance is managed together with Heike Gießmann and Human Resources, Marketing and Employee Marketing with Stefanie Schaarschmidt.

Kobra manufactures steel molds for the concrete block industry and is a world market leader in this field. The management's focus is on continuing and expanding the company's recipe for success, which has been consistent since its inception - the development and production of innovative and high-quality molds for the concrete block industry, as well as the expansion of the company's international presence and work on new technologies to provide Kobra customers with even better support in concrete block production.



Andreas Gebauer-Günther

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Successful in-house exhibition for the anniversary

75 years Hess Group

مرور 75 عامًا على تأسيس مجموعة Hess Group

On the occasion of its 75th anniversary, the Hess Group organised the 2023 in-house exhibition. This special event not only highlighted the company's technological achievements but also emphasised the central role of networking and collaboration. The event attracted over 430 international trade visitors to Burbach-Wahlbach over two days to mark this significant highlight in the history of the Hess Group.

بمناسبة الذكرى السنوية الخامسة والسبعين لتأسيسها، نظمت مجموعة Hess Group المعرض الداخلي لعام 2023. لم يسلط هذا الحدث الخاص الضوء على الإنجازات التكنولوجية للشركة فحسب، بل أكد أيضًا على الدور المحوري للتواصل والتعاون. وقد اجتذب هذا الحدث أكثر من 430 زائرًا تجاريًا دوليًا إلى بلدية Burbach-Wahlbach (بورباخ "فالباخ") على مدار يومين للاحتفال بهذا الحدث المهم في تاريخ مجموعة Hess Group.

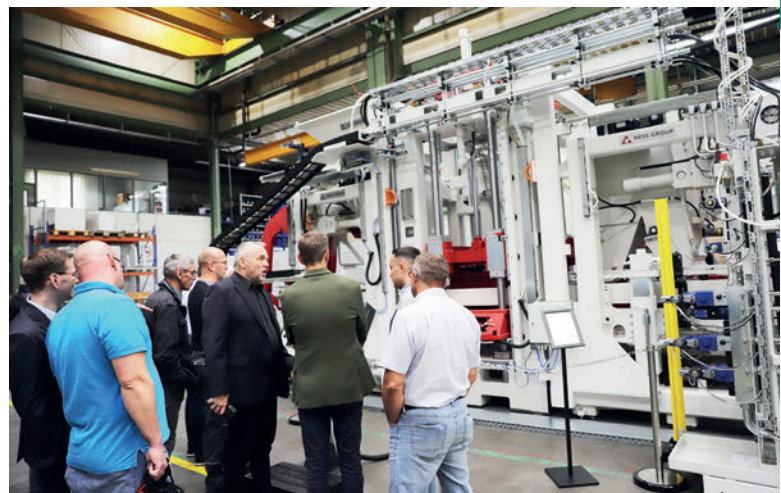
The meeting provided a platform for experts as well as newcomers to the industry and offered the opportunity to deepen existing relationships, make new contacts, examine industry trends and challenges, and jointly develop perspectives for the future of the industry.

The diverse exhibition programme featured machines such as the RH 2000-4, circulation and robotics technology, and the latest digital developments in sales and service, underpinned by live demonstrations. This afforded the trade visitors an exclusive opportunity to exchange ideas and gain insight into Hess' production processes.

The affiliated companies of the Topwerk Group - SR Schindler, Prinzing Pfeiffer and Hess AAC - were also represented at the event. They demonstrated the breadth and expertise of the company's portfolio with their exhibition areas.



Welcoming the guests to the evening event



The diverse exhibition programme included machines such as the RH 2000-4



This special booklet, given to every visitor at the event, offers a journey through 75 years of Hess history.

However, technology was not the only focus of the in-house exhibition. At the heart of the event was human interaction. This was particularly evident during the evening programme, honoring the long-standing relationships between customers and the Wahlbach-based company. The international environment provided space for in-depth discussions and intensive networking. It became clear that the strength of the Hess Group lies not only in its technological innovation but

also in its ability to foster lasting and meaningful relationships in the industry.

With the successful staging of the 2023 in-house exhibition, the Hess Group once again confirmed its position as an industry leader and its commitment to innovation and customer proximity. ■



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Betolar and Fujairah Concrete Products (FCP) announced their collaboration

Launch of low-carbon concrete products in the UAE

إطلاق منتجات الخرسانة منخفضة الكربون في دولة الإمارات

Betolar and UAE-based concrete products manufacturer Fujairah Concrete Products (FCP) announced their collaboration at the international Big 5 Global construction event in Dubai. At the event, the companies launched paving products made of low-carbon concrete. The products are based on the cement-free Geoprime solution developed by Betolar.

أعلنت شركة Betolar وشركة الفجيرة للمنتجات الأسمنتية (FCP) المصنّع للمنتجات الخرسانية ومقرها الإمارات العربية المتحدة عن تعاونهما في حدث البناء الدولي Big 5 Global في دبي. في هذا الحدث، أطلقت الشركات منتجات الرصف المصنوعة من الخرسانة منخفضة الكربون. تعتمد المنتجات على محلول Geoprime (جيوبرايم) الخالي من الأسمنت الذي طوره شركة Betolar.

"The UAE has been working for a long time to bring new sustainable products to market to significantly reduce CO₂ emissions. Cement reduction plays a crucial role in drastically cutting CO₂ emissions from building materials. Our solution helps the industry reach its sustainability goals. In turn, we have the opportunity to offer our solution for the high-volume market together with a large player," says Betolar's Chief Commercial Officer Ville Voipio.

FCP, part of Fujairah Building Industries, is a public shareholding company where the major shareholder is the government of Fujairah. FCP is a leading manufacturer of concrete products in the Fujairah region of the United Arab Emirates. FCP is known for its high-quality concrete products. The company operates as a supplier of concrete products in several large projects. FCP produces more than 25 million blocks and more than 800,000 square meters of paving annually.

Betolar has been engaged in preparatory cooperation with FCP since the beginning of 2023. Together, the companies have designed and tested a geopolymer-based concrete paving product manufactured with the Geoprime solution, which is suitable for the Middle East market. Since the pro-

duction does not use cement but industrial side streams, the use of new products significantly reduces the CO₂ footprint compared to ordinary cement-based paving stones.

The paving products manufactured by FCP with the Geoprime solution meet the standards of the Abu Dhabi Council for Quality and Conformity (ADQCC). Local standards for compressive strength and water absorption parameters have also been adopted. In addition, Geoprime paving products meet the requirements of the standards regulating wear resistance (EN 1338, EN 1339 and EN 1340). As a manufacturer of concrete products, FCP has recognized the importance of environmental impacts and acquired EPD environmental certification.

"Environmental sustainability is a real concern worldwide. FCP has always developed new projects that contribute to the sustainability of the construction industry by collaborating with world-class players to implement customized solutions," says Naser Al Mulla, General Manager of Fujairah Concrete Products. ■

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Early age properties of high strength concrete

خصائص العصر المبكر للخرسانة عالية القوة

■ Derek Mostert and Elsabe Kearsley, Department of Civil Engineering, University of Pretoria, South Africa

The use of modern admixtures, cement extenders and improved cement manufacturing techniques makes it possible to cast concrete with compressive strengths up to 150 MPa, using materials and equipment available in most well equipped concrete casting facilities. The high cement paste contents, combined with the low water/cement ratios and the high admixture contents can result in behaviour that differs significantly from what is normally assumed. This article contains results obtained from tests conducted within hours of casting mixtures with different water/cement (w/c) ratios, while adding HRWRA to retain constant workability. Although the HRWRA does not affect the properties of the concrete after more than 24 hours, the setting time, heat of hydration and strength development during the first 24 hours after casting are delayed. The slight delay in setting time can cause a reduction in the early age shrinkage that takes place after setting, resulting in a reduction in the internal stresses caused by self-desiccation of high strength concrete.

إن استخدام الخلطات الحديثة، وممددات الأسمنت وتقنيات تصنيع الأسمنت المحسنة يجعل من الممكن صب الخرسانة بمستويات مقاومة ضغط تصل إلى 150 ميجا باسكال، وذلك باستخدام المواد والمعدات المتوفرة في معظم منشآت صب الخرسانة المجهزة تجهيزاً جيداً. ويمكن أن تؤدي محتويات العجينة الأسمنتية العالية، بالإضافة إلى نسب الماء/الأسمنت المنخفضة ومحتويات الخليط العالية، إلى سلوك يختلف بشكل كبير عما هو مفترض عادةً. تحتوي هذه المقالة على النتائج التي تم الحصول عليها من الاختبارات التي أجريت خلال ساعات من صب الخلطات بنسب مختلفة من الماء/الأسمنت، مع إضافة HRWRA للاحتفاظ بقابلية تشغيل ثابتة. على الرغم من أن HRWRA لا يؤثر على خصائص الخرسانة بعد أكثر من 24 ساعة، إلا أن وقت الإعداد، وحرارة التميّه وتطور القوة خلال فترة 24 ساعة الأولى بعد الصب يتأخر. ويمكن أن يؤدي التأخير الطفيف في مدة التصلب إلى تقليل الانكماش المبكر الذي يحدث بعد التصلب، ما يؤدي إلى تقليل الضغوط الداخلية الناتجة عن الجفاف الذاتي للخرسانة عالية القوة.

Researchers first developed high strength concrete mixes with compressive strengths exceeding 80 MPa in the 1970's, but since then the definition of "high strength" concrete has changed significantly. The use of modern admixtures, cement extenders and improved cement manufacturing techniques makes it possible to cast concrete with compressive strengths up to 150 MPa, using materials and equipment available in most well equipped concrete casting facilities [1]. The increased strength is obtained by not only increasing the material packing density through the use of controlled particle size distribution and smaller maximum sized aggregate, but also reducing the water/cement ratio, thus reducing the water content, while increasing the cement content and

thus the paste content. The high strength concrete mixtures mostly contain finer aggregates, resulting in increased particle surface areas, requiring more cement paste to glue all the particles together. The water/cement ratios used in the high strength concrete can be reduced to as low as 0.25 due to the efficiency of modern High Range Water Reducing Agents (HRWRA). The high cement paste contents, combined with the low water/cement ratios and the high admixture contents can result in behaviour that differs significantly from what is normally assumed. This article contains results obtained from tests conducted within hours of casting mixtures with different water/cement (w/c) ratios, while adding HRWRA to retain constant workability.

Table 1: Concrete mix composition.

w/c ratio		Mix 0.25	Mix 0.35	Mix 0.45	Mix 0.55
Material	Relative density	0.25	0.35	0.45	0.55
Cement (kg/m ³)	3.15	900	643	500	409
Water (l/m ³)	1	225	225	225	225
Aggregate (kg/m ³)	2.86	1315	1584	1734	1829
HRWRA (%)	1.06	2.00	1.33	0.67	0



■ Elsabe Kearsley holds a PhD from the University of Leeds, UK. She is a registered professional Civil Engineer and currently she is Professor in Civil Engineering at the University of Pretoria. For the last 30 years she has been conducting research aimed at reducing the environmental footprint of the cement and concrete industry. elsabe.kearsley@up.ac.za



■ Derek Mostert is a concrete technologist with a Master's degree from Queens University, Belfast. After working in the construction industry for 25 years, he became a staff member of the University of Pretoria in 2005. Since then he has been involved in cement and concrete research. This paper is based on work that he conducted as part of a recently submitted PhD. mostertderek9@gmail.com

Experimental setup

The mix compositions used to cast specimen with w/c ratios ranging from 0.25 to 0.55 can be seen in Table 1 [2]. A constant water content was maintained for all mixtures. The cement used was a Cem I 52.5N, while the aggregate was crushed dolomite with a maximum particle size of 5 mm. The HRWRA is a modern polycarboxylate ether that for the normal dosage of 0.5% per mass of cement does not affect the strength of concrete after more than 24 hours. To maintain

the workability of the concrete at lower w/c ratios the HRWRA content had to be increased to 2% of the cement mass to retain constant workability for the w/c ratio of 0.25, which is a typical w/c ratio used for high strength concrete with compressive strengths exceeding 100 MPa. After casting, all specimens were covered and placed in a constant temperature room at 25 °C.

The heat of hydration, strength and stiffness development of the mixtures were studied for the first 48 hours after casting. Heat of hydration, early age shrinkage and stiffness was measured on 300mm high 100 mm diameter cylinders, while the compressive strength of the concrete was established by crushing 100 mm cubes.

Results

The heat of hydration was recorded using a thermocouple placed in the centre of a cylindrical specimen and the results can be seen in Figure 1. As expected an increase in cement content (reduction in w/c ratio) caused an increase in heat generated during hydration. The maximum temperature was however not reached at the same time after casting and an increase in HRWRA resulted in an increase in the time between

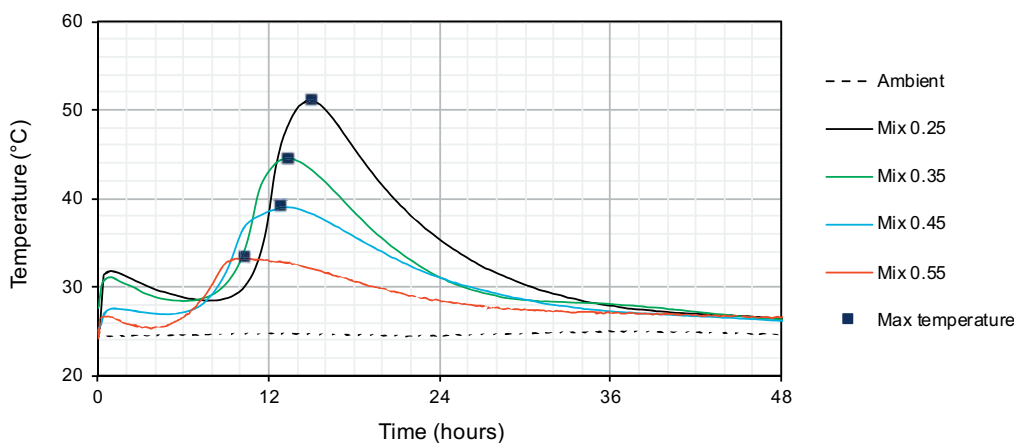


Fig. 1: Effect of w/c ratio on heat of hydration.

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Fig. 2: Effect of w/c ratio on compressive strength development.

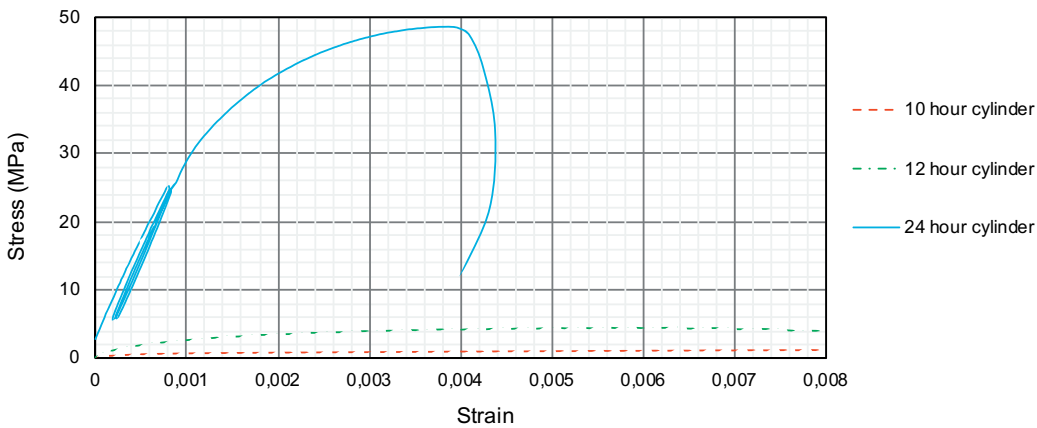
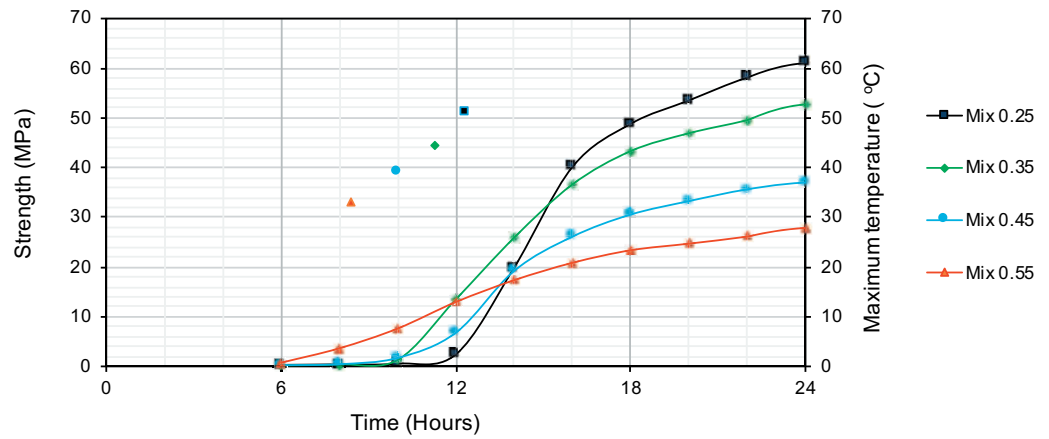


Fig. 3: Development of concrete stiffness.

casting and maximum temperature reached. This indicates that early age hydration could be affected by the HRWRA.

From 6 hours after casting cubes were demoulded and tested in 2 hour time intervals and the results can be seen in Fig. 2. After 24 hours the strength trend is as expected with an increase in w/c ratio resulting in a reduction in strength. Cubes cured at room temperature are however seldom tested within 24 hours of casting and thus the trend observed during the first 24 hours after casting is of interest. None of the mixtures had a compressive strength exceeding 1 MPa within 6 hours of casting and only the mixture with a w/c ratio of 0.55 had a measureable strength after 8 hours. This is the mixture containing no HRWRA. With increased HRWRA contents, the time it took before a measureable strength was recorded increased. This confirms that setting time could be affected by mix composition, especially when very low w/c ratios are used. Kang et al. [3] indicated that the point in time when the rate of change in the heat of hydration temperatures reaches a maximum can be used as final setting time of cement-based materials. The point in time where the maximum slopes of the curves in Figure 1 was calculated and plotted in Figure 2 for each of the mixes with the maximum hydration temperature reached. The calculated setting times correlates well with the times when measureable compressive strengths were first recorded for the different mixes.

The stress-strain behaviour of cylinders was used to determine the stiffness of concrete with the Modulus of Elasticity

defined as the tangential slope of the stress-strain graph up to a load in the region of 40% of the strength of the specimen. An example of the early age stiffness development of the concrete is given in Figure 3 where the stiffness development for the 0.35 w/c ratio mixture can be seen. From these results it can be seen that up to 12 hours after casting the stiffness cannot be measured, but 24 hours after casting the concrete stiffness is nearly 80% of the ultimate stiffness with the failure strain moving towards the value of 0.0035 often assumed in design codes of practice.



Fig. 4: Shrinkage measurement immediately after casting.



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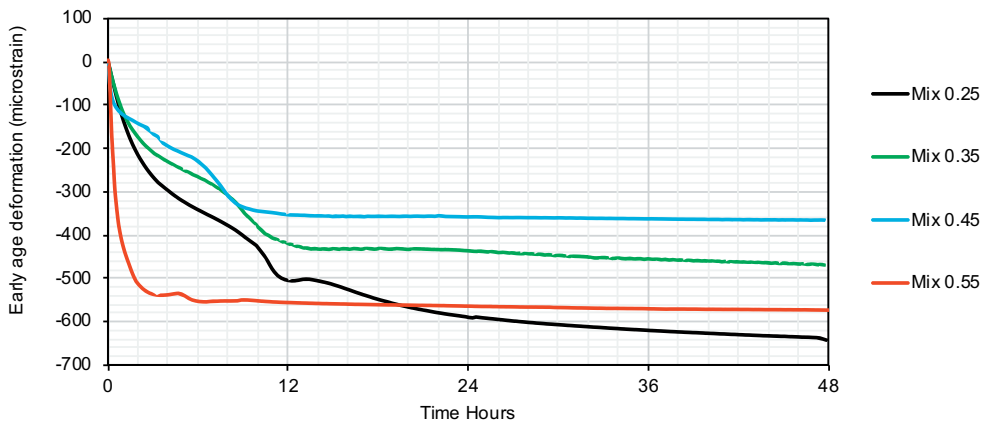
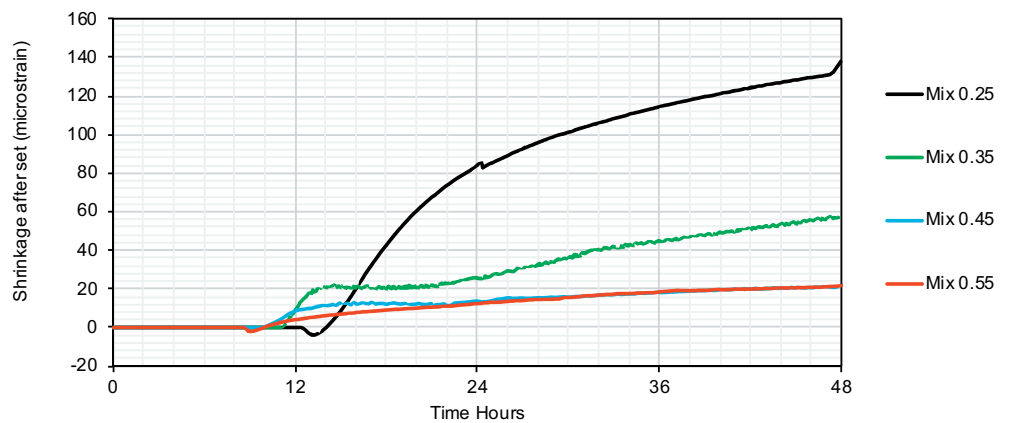


Fig. 5: Effect of w/c ratio on early age deformation.

Fig. 6: Effect of w/c ratio on shrinkage after setting.



Researchers have been concerned about the early age shrinkage of high strength concrete caused by self-desiccation of the cement at w/c ratios below 0.38. Early age volume change was recorded on 300 mm high cylindrical specimen, cast into moulds lined with Teflon and sealed on the surface with an steel plate covered in an oil film as indicated in Figure 4. A Linear Voltage Displacement Transducer (LVDT) was placed in the centre of each specimen and movement was measured from directly after casting. The effect of w/c ratio on the total recorded deformation can be seen in Figure 5.

These results indicate that the lowest w/c ratio mixture deformed the most, but a significant part of the deformation takes place immediately after casting, which could be due to plastic settlement. Volume change before concrete setting cannot cause internal stresses and thus the detrimental part of this graph would be the section after the concrete turned into a solid. The volume change after setting, as defined in Figure 2 can be seen in Figure 6. These results confirm that if water loss is prevented limited shrinkage takes place in concrete mixes with w/c ratios exceeding 0.38. As the w/c ratio is reduced to below 0.38, which is necessary for high strength concrete, there is an increase in early age chemical shrinkage and this can be explained by increased self-desiccation of the concrete. It is however worth noting that the actual strain that develops after setting is limited and even at w/c ratios as low as 0.25 this shrinkage is limited to no more than approxi-

mately 150 microstrain, which is significantly less than drying shrinkage.

Conclusion

Higher cement contents does result in increased heat of hydration and strength development. Concrete with relatively high cement contents and HRWRA takes more than 12 hours to gain stiffness at room temperature. Although the HRWRA does not affect the properties of the concrete after more than 24 hours, the setting time, heat of hydration and strength development during the first 24 hours after casting are delayed. The slight delay in setting time can cause a reduction in the early age shrinkage that takes place after setting, resulting in a reduction in the internal stresses caused by self-desiccation of high strength concrete.

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Innovative block manufacturing systems with multifunctional block-making machines

أنظمة تصنيع البلوك المُبتكرة مع آلات صنع البلوك متعددة الوظائف

Rekers GmbH Maschinen- und Anlagenbau has developed from a small garage workshop at its foundation in 1955 by Karl Rekers into a medium-sized enterprise with around 180 employees based in Lower Saxony, Germany. Machines and systems are manufactured there for the concrete products industry worldwide. Its product portfolio, which has grown over the decades, includes mechanical grabs, concrete transportation and concrete spreading systems, various handling systems for railway sleepers as well as manhole rings and concrete pipes, in addition to block manufacturing systems and control units for mixing and dosing systems. A wide range of special systems, designed specifically for the customer, round off the programme. Rekers is proud of carrying on the entire production in-house. From engineering to manufacturing to the final control unit, everything takes place at the company's main location in Spelle, Germany. Since the handover in 2000 from Karl Rekers, the firm's founder, Annette and Norbert Foppe have been engaged in its management with the same philosophy and objectives - innovations reinforce expertise and safeguard both company and jobs.

لقد تطوّرت شركة Rekers GmbH Maschinen- und Anlagenbau من ورشة جراح صغيرة عند تأسيسها في عام 1955 على يد كارل ريكرز إلى مؤسسة متوسطة الحجم يعمل بها حوالي 180 موظفًا ويقع مقرها في ولاية ساكسونيا السفلى بألمانيا. يتم تصنيع الآلات والأنظمة هناك لصناعة المنتجات الخرسانية في جميع أنحاء العالم. وتشمل محفظة منتجاتها، والتي قد نمت على مر العقود، الخطافات الميكانيكية، وأنظمة نقل الخرسانة وأنظمة نشر الخرسانة، وأنظمة المناولة المختلفة لعوارض السكك الحديدية بالإضافة إلى حلقات فتحات المجاري (غرف التفطيش) والمواسير الخرسانية، بالإضافة إلى أنظمة تصنيع البلوك ووحدات التحكم للخلط وأنظمة التغذية للمواد الصلبة. هناك مجموعة واسعة من الأنظمة الخاصة، المصممة خصيصًا للعميل، تكمل البرنامج. وتفتخر شركة Rekers بمواصلة الإنتاج بالكامل داخل الشركة. إن كل شيء يتم في الموقع الرئيسي للشركة في سبيل، بألمانيا بداية من الهندسة وحتى التصنيع إلى وحدة التحكم النهائية. ومنذ أن تم تسليمها من كارل ريكرز في عام 2000، فقد انخرط مؤسس الشركة، أنيت ونوربرت فوبي، في إدارتها بنفس الفلسفة والأهداف - حيث تعمل الابتكارات على تعزيز الخبرة وحماية الشركة وتوفير الوظائف على حد سواء.

Back in 2012, Dipl.-Eng. Norbert Foppe, the managing director of Rekers GmbH, launched the RS series, a new, future-oriented design for block-making machines. The concept of a

90° rotated block moulding machine was born out of and driven by constantly growing customer demands for a variety of production possibilities.



RS 4 KV Block Machine

The RS Block Machine concept

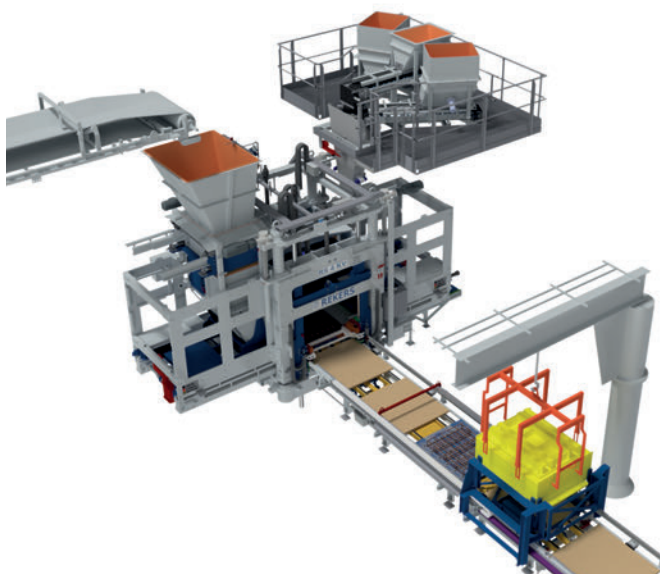
The introduction of the RS series once again testified to Rekers's innovative strength. A number of novel design principles underline the uniqueness of this series, not only with the 90° rotated configuration of the core and facing elements compared to the usual direction of travel of production boards but also several patents.

Block-making machines in the RS series break new ground in their structural design. The frame is bolted together from thick steel plates and moves vertically on solid columns according to the height of the product being produced. Tamper head and mould are guided diagonally on heavy-duty columns whose span width ensures exceptionally uniform vertical guidance. Stable guidance is generated horizontally by mounting the shafts at the points furthest apart on the upper and lower frames – something which in turn benefits product quality. This column arrangement creates a large window directly at the board ejection point. It has the side effect of providing a direct view of the actual process and thereby of allowing the operator to optimise parameters immediately.

The RS series is perfectly suited for producing both common concrete products, such as paving blocks, slabs, masonry blocks, kerbstones, and also concrete brick slips or facing bricks with a minimum product height of 15 mm, as well as concrete products with, e.g., steel reinforcement and many other concrete products. There are hardly any limits to product variety, so that RS series machines are well known as highly flexible, universal block-making machines.

RS 4 KV Block Machine

The pioneering machine series was supplemented with the introduction of the RS 4 type block-making machine in 2019. The inaugural large board machine went into operation at



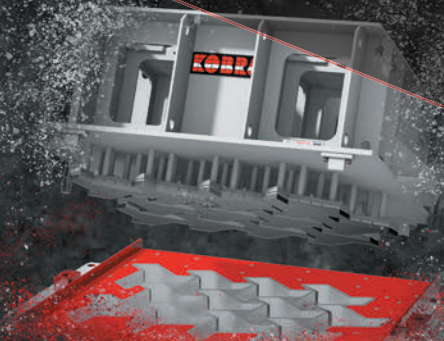
Overview RS 4 KV Block Machine

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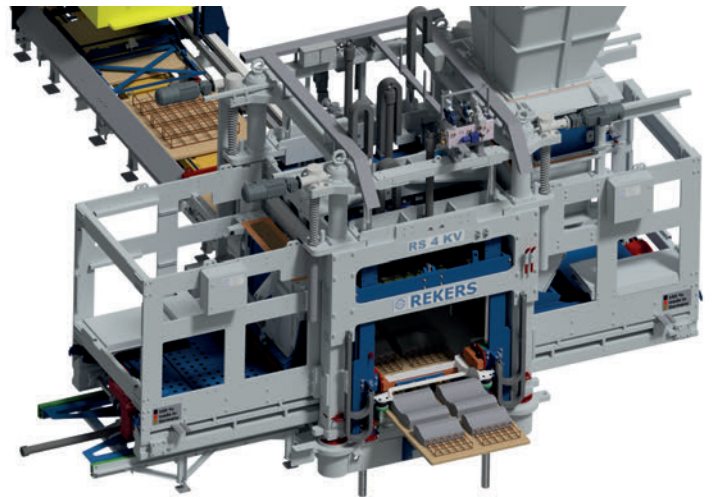
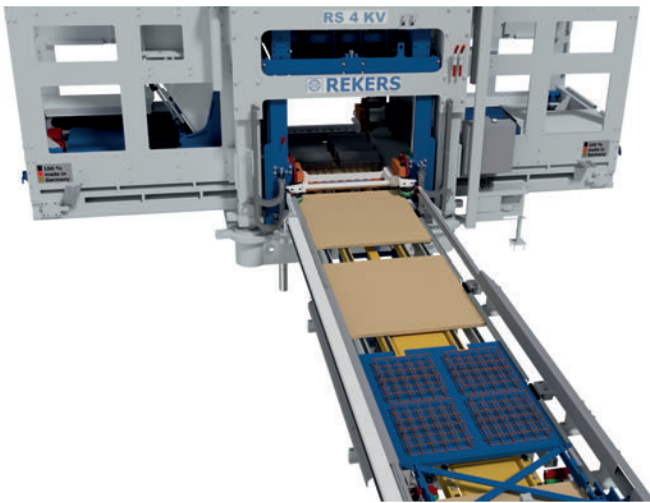
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The large window opening, provided on both sides, allows the RS 4 e.g. to feed in reinforcement laterally onto the vibrating table

90° with cantilevered feedboxes for core and facing concrete, servo-electric feedbox drives and the first-time use of a carbon-toothed belt drive for feedboxes. All common concrete and many more standard products can be rapidly manufactured in high quality on this large board machine. Its possibilities with the documented low product heights of 15 mm up to 500 mm mean that there are hardly any limits to variety in production.

The RS 4 KV is, according to Rekers, in no way inferior to other conventional block-making machines in terms of quality and quantity. At the same time, its servo-electric feedbox drives with recuperation make it the most sustainable, energy-saving block machine in the industry - worldwide!

Final touches - existing moulds from old stocks can be imported

The last obstacle in designing the block machine was to be able to import moulds used in existing production facilities without having to manually assemble adapters. Producers around the world often have a mould pool that has accumulated and become established over the years. The RS machine was fitted out in such a way that moulds with their tamper unit can be transferred to the new machine type, since filling takes place via the mould's long side, i.e., in the same way as conventional machines. The machine is now even more versatile having overcome this obstacle.

Features

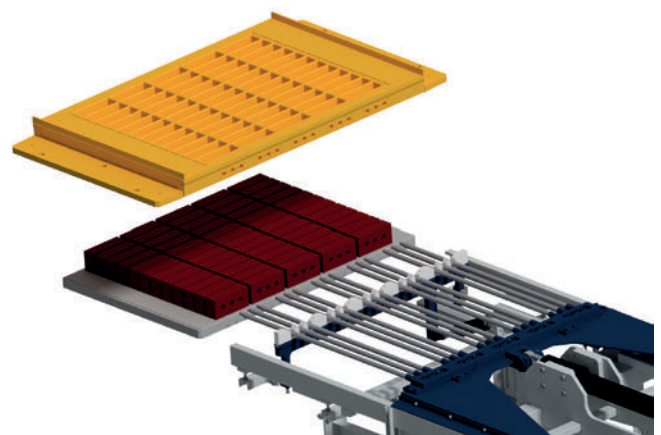
Options, such as four-sided pallet centring on the vibrating table, the machine's fully automatic height adjustment, laser measurement of the hopper and feedbox filling levels or a smoothing roller, are no longer uncommon on the market and are therefore naturally also available with the RS 4. On the other hand, there are options that deviate from standard and open up further production possibilities for the customer.

Reinforcement insertion device

The insertion of polystyrene cores for producing insulating blocks or reinforcing cages for larger pavement slabs or drainage channels can be carried out unproblematically with the RS 4 thanks to the side feed. The large window opening, provided on both the board infeed and board discharge sides, allows the RS 4 to feed in reinforcement laterally onto the vibrating table without having to remove the facing concrete unit. Cost-effectiveness is enhanced in parallel because, thanks to its autonomous electric drive, the reinforcement can be fed in at the same time as a new production pallet immediately after demoulding. In terms of production, this means shorter cycle times and less wear due to avoiding unnecessary movements. The reinforcement insertion device can be loaded manually or, alternatively, automatically with different types of reinforcement.

Mandrel unit in combination with drawplate device

The patented mandrel unit has proven itself on the market and has already for years been a source of great satisfaction, particularly for Rekers's customers from Great Britain, for



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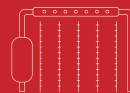
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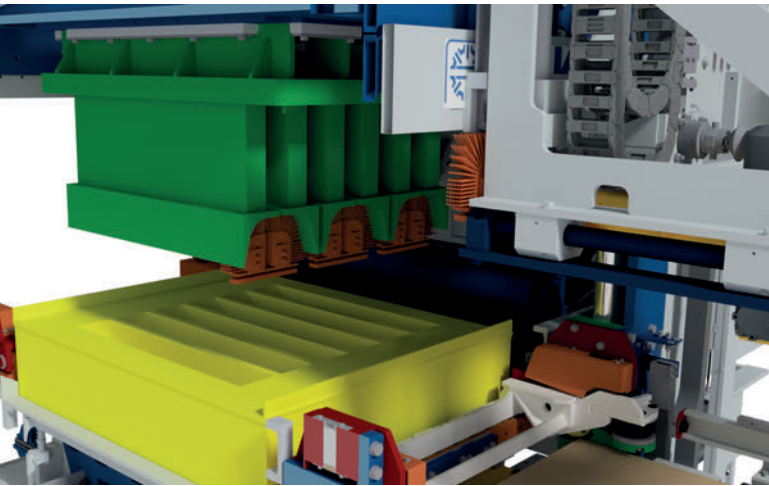


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Tamper brush at right angles to the feedbox direction of travel

cost-effectively mass producing concrete façade blocks. The concrete clinker underside can be given a profile so that the visible side is easier to define. Thanks to the mandrel unit, recesses can be provided in the block centre so that better block layer bonding can be generated during installation. At the same time, weight and material can be saved during manufacturing. The drawplate serves in addition as a separate non-linked unit for profiling on the block underside in production as well as for protecting high-quality production pallets.

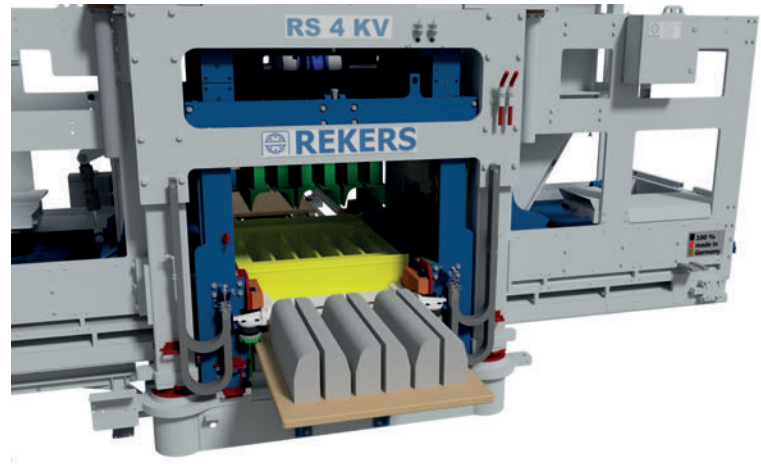
The mandrel unit is located underneath the facing concrete table plate and can be linked with the drawplate. The unit possesses a separate drive so that it can be moved and controlled independently of the production process.

Tamper brush at right angles to the direction of the feedboxes

The tamper brush, i.e., tamper shoes with radii, for cleaning kerbstones is not a new development, but a special feature here in its fully electric, self-adjusting version. This tamper brush is freely adjustable in the vertical direction to suit the product. It is attached to the main frame of the board feed side, so that the machine operator still has a full view of the vibrating table. Only the brush head needs to be changed - if it should become necessary. Brush wear is also stored in the smart control unit, so that adjustments can be made automatically in the system. The tamper head's entire length is brushed off using a special linear guide so that it is clean for the next production process and no residues contaminate the high-quality products.

Colour Blending facing concrete

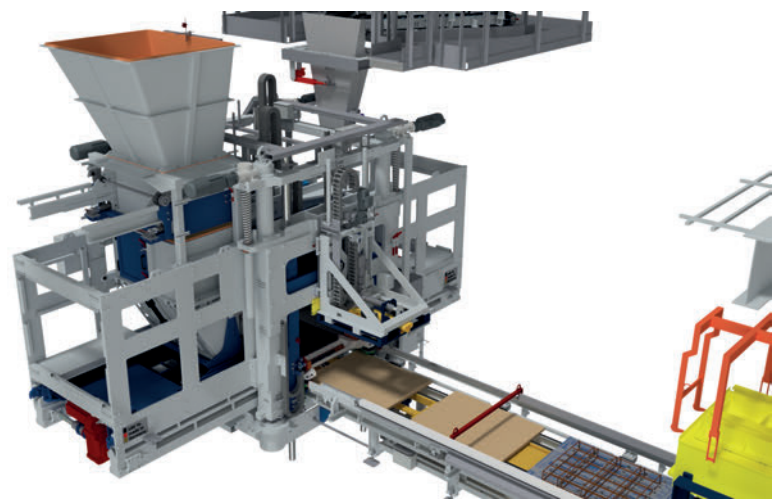
The patented Colour Blending Compact system offers producers the possibility of manufacturing colour-reproducible products, i.e., of allowing a product to be manufactured with the same appearance in a subsequent production run at a later date and to be delivered to an end customer without any detrimental effects. Obviously, it must be pointed out that the recipe and its ingredients should be the same.



In addition to the Compact version, there is the possibility of employing the likewise patented Colour Blending system, in which 3-6 different coloured facing concretes can be used. As an alternative, a less automated drawplate option is also possible, as well as simply filling directly into the bunker.

Colour Blending core concrete

For the colouration of an entire product, as for example with crushed blocks or full-colour paving blocks, the drawplate version offers good operative results in terms of random colour distribution within a product, which means that differing, beautiful, natural colour designs are possible. The hopper is located above the machine and can take up to three batches from the core concrete mixer. These are placed one on top of the other. After the last colour batch has been applied, a drawplate is slowly pulled back at intervals underneath them so that the concrete above breaks in its structure and mixes



RS 4 KV including Colour Blending System for core and facing concrete

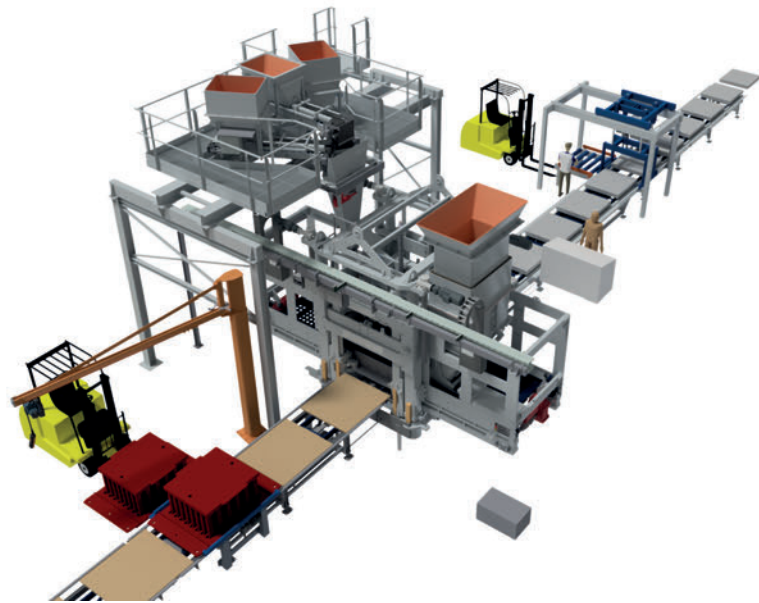
on its way into the bunker below, thus ensuring that the colours are thoroughly intermixed.

Automatic mould changeover

Another new feature is the automatic mould changing system. According to Rekers, mould changeovers with corresponding moulds of identical dimensions can easily be carried out in less than 5 minutes. The new mould being inserted into the machine can be placed in advance on a lowering station above the pallet infeed.

The mould being removed is placed on a production pallet at the start of the mould changing process. The mould and tamper locks are automatically released for this purpose. The old mould is conveyed out of the soundproof booth while the new mould moves into the machine area with the aid of the pallet conveyor.

The new mould with its tamper unit is clamped automatically and the old mould is lifted off the fresh track by a lifting unit. Production can now be resumed. The old mould can be picked up from the lifting unit by means of a forklift without influencing the machine cycle.



Overview of the RS 4 KV automatic mould changeover system

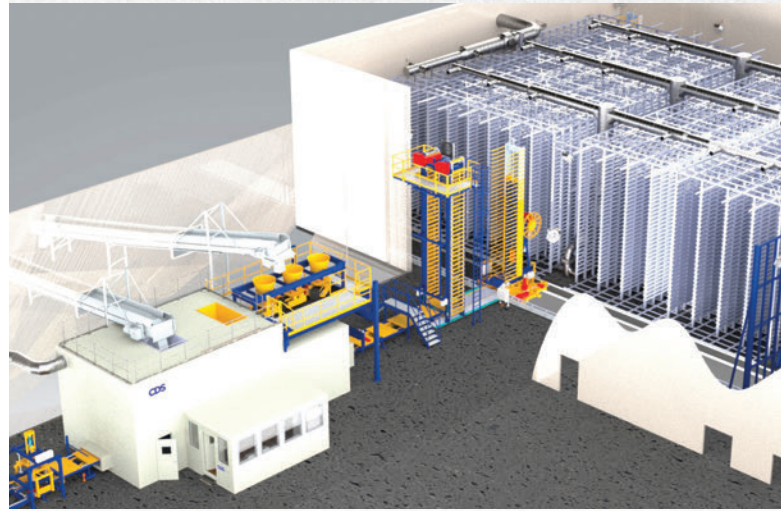
Many other options / future developments

Many customised enlargement options are also available with RS 4. These are mainly used for special products.

Continuous reproducible filling

There are various options for the core concrete filling unit, such as a single or double hopper for filling the feedbox or, alternatively, a double bunker for filling the feedbox. The opening mechanism can be either hydraulic or electric. Integrating a conveyor belt, which is mounted underneath the

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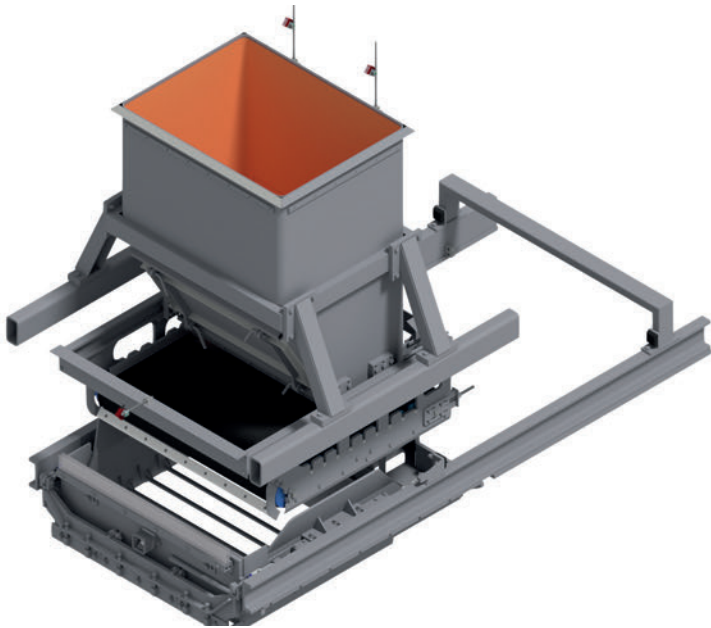


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Core or facing concrete unit with feedbox filling by conveyor belt for uniform, continuous, product-related spreading

core concrete bunker and serves the purpose of repeatable, precise dosing, is a more specialised task. The width of the conveyor belt must be adapted to the mould occupancy rate. The concrete mass on the conveyor belt can be regulated in relation to the product via a slide valve. The conveyor belt is moved electrically so that, based on the product, it can supply the feedbox uniformly, cycle after cycle, with the same amount of concrete at the same points in the feedbox. It is primarily used in manufacturing large-format products such as slabs. The unit can be installed on the facing concrete and/or core concrete side.

High-end facing concrete

On top of this, an innovative solution for accommodating a second feedbox and hopper unit makes it possible to integrate a double facing layer with a high-end facing concrete mix. The second feedbox is designed as a linked unit so that it can be removed when not in use. The high-end layer can be applied as an additional functional step since the feedbox possesses its own drive. The add-on layer can also be applied at random or as a reproducible, unchanging variant. As an option, the application of the add-on layer can be optimised with the aid of an additional smoothing roller. Depending on circumstances, its narrow storage bunker can be supplied in a mobile or stationary version.

Integrating ceramic tiles into the production process

The RS 4 can also offer economic advantages with a special automated process for integrating ceramic tiles including adhesion preparation and a core concrete layer. Ceramic tiles including their adhesion preparation can be fed in from the board feed side in a similar way to the reinforcement cage inserter, so that the machine operator still has an optimum view of the vibrating table.

Differing ceramic tiles can be fed into the machine depending on their dimensions. A cantilever arm mounted above the board feed track is employed for this purpose. Thanks to special technology, this arm picks up the ceramic tiles and inserts them into the mould cavities after the production mould has already been filled with core concrete. Special grabs and a negative mould help to ensure that the very tight tolerances between the mould and the ceramic tile are maintained.

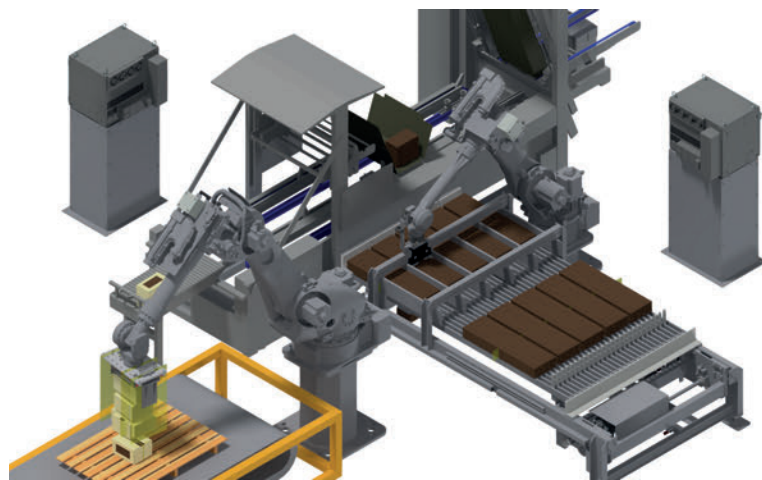
The ceramic tiles including the adhesion preparation and core concrete layer are stored in chambers for curing once the production process is complete. A vacuum unit is recommended for packaging. This picks up the ceramic tiles from the production pallets and stacks them to form the package.

Brick slip production and packaging options

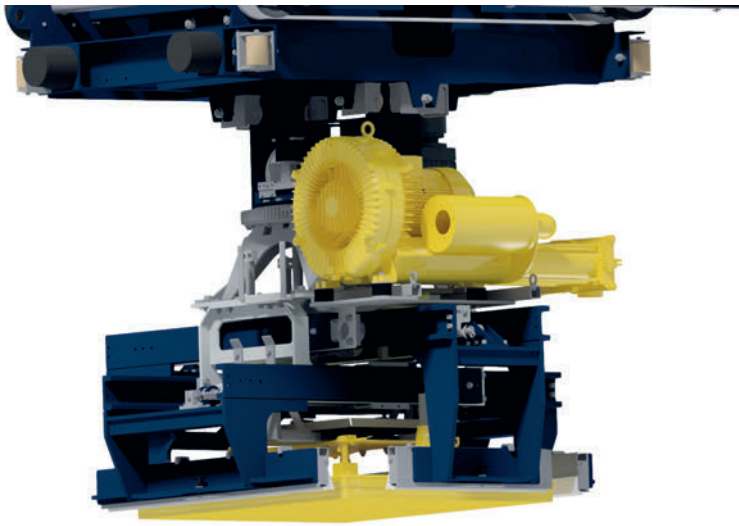
The RS series is also a proven pioneer in concrete brick slip production and, as mentioned at the beginning, offers the possibility of manufacturing products with a minimal height of only 15 mm. In this case, as well, the 90° rotated machine offers the advantage that neither the facing nor the core concrete unit has to be lifted per machine cycle, because the board feed to the vibrating table as well as board ejection towards the curing chamber is effected laterally. It means that all filling units can remain stationary in position.

Brick slip products are both conceivable and feasible in diverse variations, such as with surface structuring or straight surfaces and edging on the outside. Rapid production processes including colour variations generated by the Colour Blending system offer producers a wide range of attractive products.

Handling such thin products would seem to be more of a challenge, because simply pushing them together and then gripping and transferring them is not adequate in this case. The integration of a vacuum plate in the packaging unit is offered as an optional version, for example, so that a brick slip layer can be sucked up by the vacuum plate and transferred. Foil or cardboard can be placed between the individual layers to cover their entire surface.



Brick slip packaging with a robot



Rekers packaging machine with integrated vacuum unit

The automated integration of cardboard packaging is also feasible. In this case, the brick slip formats are automatically inserted and packed in cardboard boxes so that they can be ergonomically assigned at a construction site or installation location. The individual sealed cardboard boxes are then stacked on a shipping pallet.

The options described for this RS series reflect only a part of their given range. Nevertheless, the potential in terms of production variety and production possibilities can certainly be appreciated. It must also be stressed that the machines can be used universally and flexibly for small and large products, and that there are virtually no limits in terms of filling properties and finishing. ■

FURTHER INFORMATION



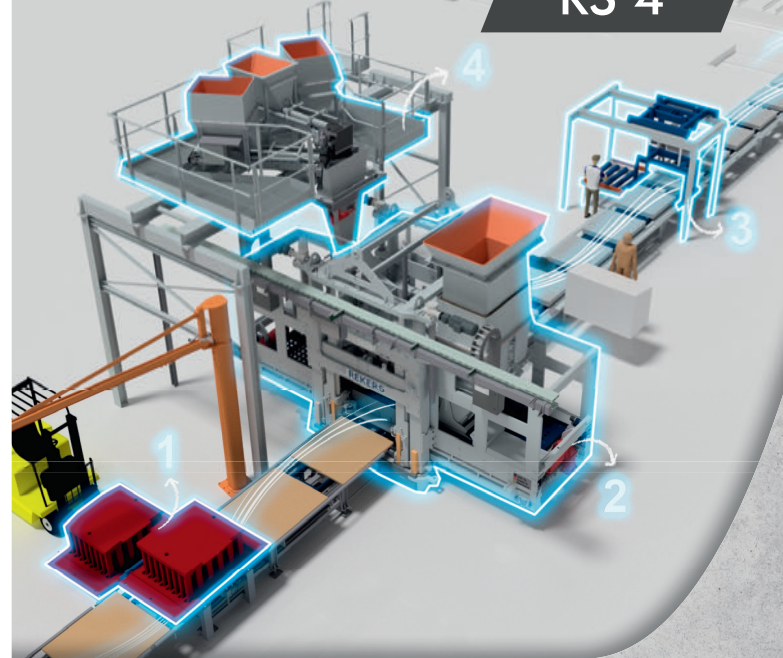
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Wasa AG, 64293 Darmstadt, Germany

All-plastic boards ensure continuity and high performance in unison

الألواح البلاستيكية بالكامل تضمن الاستمرارية والأداء العالي في انسجام تام

■ Alexander Simos, Wasa AG, Germany

Delfing Baustoffwerke GmbH & Co. KG has been successfully manufacturing its products for almost 20 years now on all-plastic boards made by Wasa. The decision at that time to switch to the then revolutionary all-plastic boards has now proven to be the absolute right one, both in terms of cost-effectiveness and production technology.

تقوم شركة Delfing Baustoffwerke GmbH & Co. KG بتصنيع منتجاتها بنجاح منذ ما يقرب من 20 عامًا على ألواح بلاستيكية بالكامل من صنع شركة Wasa. وقد أثبت القرار الذي اتُخذ في ذلك الوقت بالتحوّل إلى الألواح البلاستيكية الثورية أنذاك أنه القرار الصحيح المُطلق، سواء من حيث فعالية التكلفة أو تكنولوجيا الإنتاج.

Since the company's foundation by Willibald Delfing in 1947, family-owned Delfing Baustoffwerke has been passionately involved with concrete blocks. Its first creative concrete block systems for home, garden and public spaces were developed over the course of time, starting with pumice and lightweight concrete wall construction materials.

Today, in its third generation, Delfing is still developing and manufacturing high-quality, innovative products for a wide range of applications - concrete blocks from the classics to the environmentally friendly and sustainable. Their ideas created in concrete can be found in private living spaces and open urban areas.

After successful and promising test trials in 2003, Delfing made the decision at the beginning of 2004 to use all-plastic boards as a production base. 7,400 all-plastic boards measuring 1,400 x 1,100 x 50 mm were ordered from Wasa at that time.

Production boards from recycled plastic

Wasa has been producing plastic boards for the concrete block industry from recycled plastic in Neubrunn, Thuringia, Germany since 1991. The very flat surface of Wasa Uniplast boards is extremely robust and impact-resistant. Thanks to its steady growth in experience and good cooperation with nu-



View of part of the large company premises. The roof surfaces are covered with solar modules for sustainable energy generation



View of the production line at Delfing

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View of the Wasa production halls at Neubrunn

merous customers in the concrete block industry worldwide, Wasa has managed to offer a reliable, long-lasting production board that still enjoys great popularity today - 30 years later.

In the early years of the Wasa Uniplast, Wasa still manufactured its all-plastic production board with galvanized steel profiles, with the board side facing the direction of production. This gave the board rigidity so that it could better withstand the high loads in concrete production facilities. Wasa delivered this type of board to Delfing Betonsteinwerke at that time. The Wasa Uniplast board featured a smooth, seamless, level surface, which also allowed customers to regrind the board surface - if and when necessary. The board's design could be individually adapted according to prevailing requirements. For heavy loads in the concrete block production facilities, the board was additionally reinforced with steel inserts inside and adapted to requirements accordingly.

Through constructive exchange with customers as well as ongoing research and development with the all-plastic board, Wasa was able to present at bauma 2007 the successor model - the new Wasa Uniplast Ultra - to one of the most successful production boards on the market. In its advanced state of development, the Wasa board is still state-of-the-art today. It can do without any reinforcing by means of steel profiles. This is achieved by using recycled industrial plastic reinforced with glass fibres. Thanks to this homogeneous material mix, the board's production properties are excellent

and consistent over its entire lifespan and service life. Vibration transmission with the board has also been significantly increased and improved.

Since 1991, around six million Wasa Uniplast production boards and Wasa Uniplast Ultra fibre-reinforced boards have left the Wasa factory in Thuringia for all directions in the world. Wasa can say with a clear conscience: "This type of board provides our customers with a good, completely reliable production board that is well-proven over the long-term".

Regrinding

Production board regrinding is, of course, also offered by Wasa. The all-plastic boards from Wasa are very well suited for regrinding due to their composition. A worn surface or one with concrete build-up can be restored to almost new condition after many years of use in a concrete block factory. Other build-ups caused by overspraying surface protection products (such as hydrophobic sealers) can also be easily removed in this way without really affecting the production base.

Wasa is also able to travel to a production facility on site with a specially designed truck trailer and grind boards at a customer's premises. This saves customers' transport costs and time - and also benefits the environment by reducing emissions. As a rule, about one week's time is needed to regrind approx. 5,000 boards. Grinding can basically be carried out without major restrictions during ongoing operations.

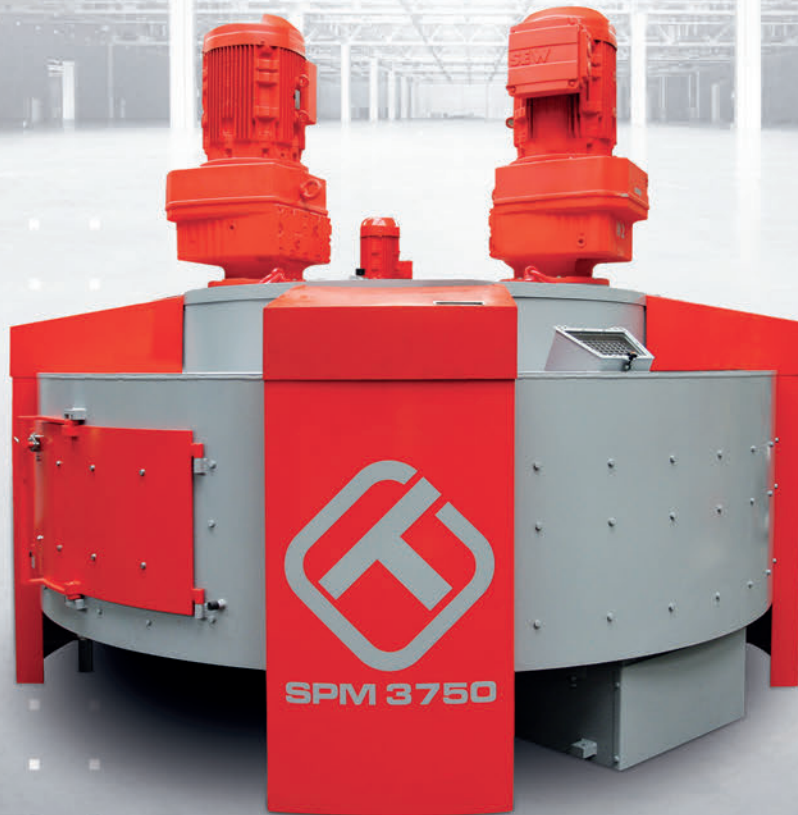
Since the introduction of "Wasa Grinding" - the official product name of the service offered - more than 350,000 boards have been reground. Especially in this day and age, this service offers a very quick and convenient solution for prolonging the life of existing production boards. Grinding is a very economical solution in times of ever tighter budgets because regrinding requires only a fraction of the investment of that for new boards.



Board grinding system installed on a trailer for regrinding on site at concrete production facilities

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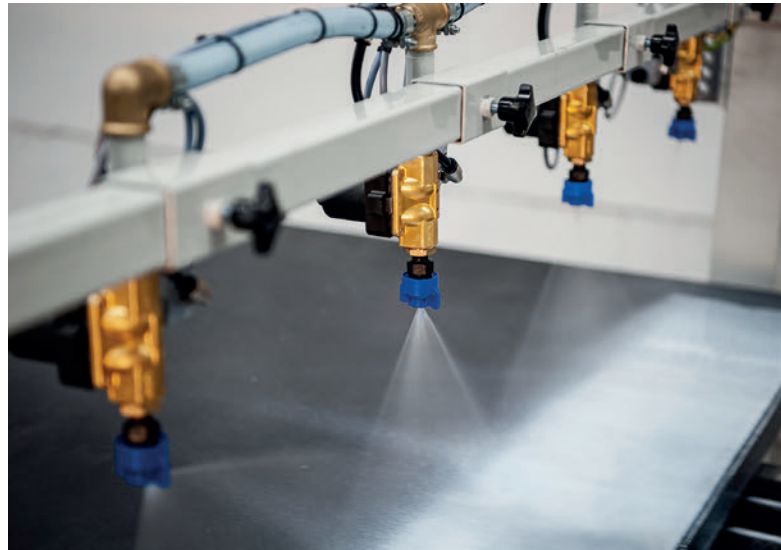


Intensive board cleaning: scraper unit - spiked roller - scraper unit - wiggle-wire cleaning brush

Production still continues at the Delfing concrete block factory with a large part of the boards supplied in former times, without ever having reground the board surface. This naturally speaks volumes about the good production conditions at Delfing, good board handling and about the very resistant surface of this production base from Wasa. Good handling of the production boards and their cleaning are very important issues with regard to operational performance. Wasa recommends using a cleaning brush fitted with wiggle wire for optimally cleaning the all-plastic production board. A scraper unit can also be installed in front of this, with which to scrape coarse concrete residues from a production board. If a build-up resulting from concrete or a hydrophobic coating is visible with the all-plastic board, employing a Wasa spiked roller can possibly solve the problem.

Similarly, using release agents maintains the jointless production boards and prevents possible adhesion of concrete products to them. With "Wasa Protect", Wasa offers its own easily biodegradable, vegetable oil-based release agent emulsion. The release agent is supplied ready-for-use in an IBC container. Wasa Protect can be used without hesitation for any type of board as the product has been adapted to the boards' material properties.

The decision was made about 3 years ago at Delfing Betonwerke to replace old worn-out Wasa Uniplast boards with new



Using release agents maintains the boards and prevents possible adhesion of concrete products

fibre-reinforced Wasa Uniplast Ultra boards. It shows that mixing old and new production boards is also possible without any problems.

Wasa Uniplast Ultra, with its consistent, sustainable production properties, will continue to be first choice for numerous concrete production facilities in the future. Each day, Wasa and its employees are working on continuing this success story. ■

FURTHER INFORMATION



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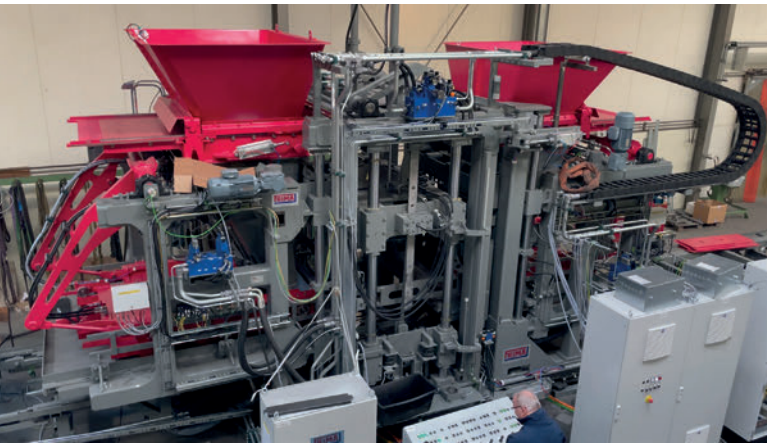
Replacement of the concrete block machine as part of an extensive modernization at Egner in Erasbach

استبدال آلة الكتل الخرسانية كجزء من عملية تحديث واسعة النطاق في شركة Egner في مدينة "إيراسباخ"

Mark Küppers, CPI worldwide, Germany

Egner + Sohn GmbH is a medium-sized and innovative family business with a large selection of concrete paving blocks, block steps and masonry systems. Egner can look back on a long history, as it was entered in the commercial register as early as 1845, when it was still a company solely focussed on construction. For more than 50 years, Egner has also specialized in the production of high-quality concrete products. With four production plants at two locations in Neumarkt and Erasbach, concrete products are manufactured in two shifts, primarily for southern Germany. While the Neumarkt site specialises in the production of an extensive range of concrete paving slabs and blocks, the second site in Erasbach primarily manufactures products for civil engineering and road construction, such as gutters, edge slabs and curb stones. Since 2009, the concrete block line in Erasbach has been gradually and extensively modernized on both the wet and dry sides using machines and systems from Frima GmbH & Co KG from Emden. Based on good past experiences, Frima was then also commissioned with the replacement of the concrete block machine, which was delivered and put into operation this year.

تعد Egner + Sohn GmbH شركة عائلية متوسطة الحجم ومبتكرة تضم مجموعة كبيرة من كتل الرصف الخرسانية، ودُرَج الكتل وأنظمة البناء. تمتلك شركة Egner وراءها تاريخ طويل من الإنجازات، حيث تم تسجيلها في السجل التجاري في وقت مبكر من عام 1845، عندما كانت لا تزال شركة تركز فقط على البناء. وقد تخصصت شركة Egner أيضاً - منذ أكثر من 50 عاماً - في إنتاج منتجات خرسانية عالية الجودة، فمن خلال أربعة مصانع إنتاج في موقعين في "نيوماركت" و"إيراسباخ"، يتم تصنيع المنتجات الخرسانية على مناوبتين، للاستخدام في المقام الأول لجنوب ألمانيا. وبالرغم من أن موقع "نيوماركت" متخصص في إنتاج مجموعة واسعة من ألواح وكتل الرصف الخرسانية، فإن الموقع الثاني في "إيراسباخ" يقوم في المقام الأول بتصنيع منتجات للهندسة المدنية وتشبيد الطرق، مثل المزاريب، وألواح الحواف، وأحجار الرصيف. وقد تم تحديث خط الكتل الخرسانية في "إيراسباخ" تدريجياً منذ عام 2009، وعلى نطاق واسع على الجانبين الرطب والجاف باستخدام آلات وأنظمة من شركة Frima GmbH & Co KG من إمدن. وبناءً على التجارب السابقة الجيدة، تم تكليف شركة Frima أيضاً باستبدال آلة الكتل الخرسانية، والتي تم تسليمها وتشغيلها هذا العام.



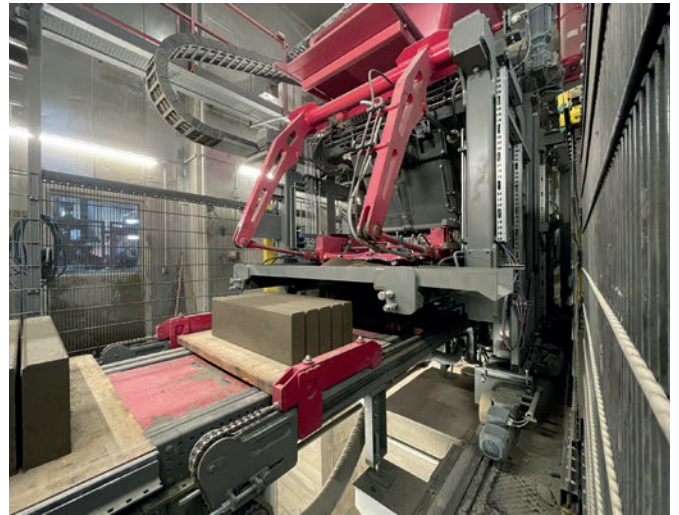
Final trial operation of the HP1000 at Frima in Emden shortly before delivery to Egner.



New conveyor belts for concrete transport



Frima HP1000 in use at Egner's Erasbach plant in Germany.



The site in Erasbach was only taken over at the beginning of the new millennium and has significantly increased the production capacities for concrete products from Egner. Today, a total of 150 employees at both locations ensure smooth processes and high-quality concrete products, which not only impress with their product quality. After all, sustainability and environmentally conscious action have always played an important role at Egner. Across generations, it was and is a matter of conviction for the company to take responsibility for climate-friendly and resource-efficient production.

The use of photovoltaic systems, which are installed on the production halls at the Neumarkt and Erasbach sites greatly reduces the proportion of purchased green electricity. The entire lighting of the production halls and office buildings is equipped with energy-saving technology, which is controlled intelligently and according to demand.

Recycled materials are used in some of Egner's products. Through the purchase of a new crusher with its own screening plant, Egner can even offer concrete blocks made from almost 100% recycled aggregates.

Production-related surpluses and residual quantities are processed and completely returned to the ongoing production process. In this way, raw materials are used sparingly and efficiently. The quality of the products is continuously monitored in the in-house laboratory.

The company's own sand pit, which is directly connected to the Neumarkt plant, supplies Egner with high-quality material, without the need for energy-consuming and long transport distances. All other aggregates and raw materials used, such as crushed aggregate and gravel, are sourced in the regional vicinity from domestic supply partners to keep CO₂ emissions associated with transport on a low level.

In the company's own truck fleet, which handles around 80% of deliveries to building materials suppliers, municipalities and private clients, Egner relies on modern vehicles with low-emission engines of the latest generation. Internal plant logistics, too, are increasingly being converted to alternative systems.

State-of-the-art manufacturing technologies at both sites enable Egner to optimize energy consumption. The waste heat generated during production is used to heat the production halls.



Control panel and visualization.



The control cabinets are located on the upper level.



The existing loading frame was integrated into the new control system.



Rotho's existing curing and hardening rack was also expanded by Rotho as part of the modernization.

Extensive modernization of the concrete block line in several steps

The first time Frima became active in Erasbach was in 2009. On the dry production side, an automatic strip inserter was retrofitted, combined with a pallet feeder for depositing

transport pallets on the platform wagon including pallet stack feeding.

Five years later, Frima delivered and installed a board package vehicle group with a turntable for buffering board packages over three floors as well as a new vehicle group in a



The new board stacker from Frima is located behind the underlay board turning machine.



Board packaging vehicle assembly with turntable for buffering board packages over three floors.

In 2019, Frima supplied servo packaging and the mobile Servo-Doppler.



double-joint design including deck adjustment for the drying chamber to the Egner plant.

Board package vehicle group

The maximum stack height per parcel measures 28 underlay boards. The scope of supply also included the loading and unloading station for the board package vehicle group, the roller conveyor and a board buffer rack with 3 shelves.

Vehicle group in double-butt design

The new vehicle group was delivered with a floor number of 14 / 7 and a maximum load capacity of 15 t to match the existing system.

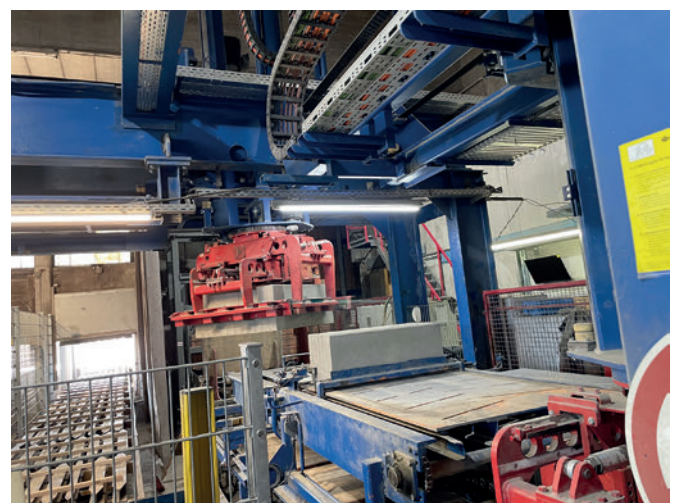
Five years later, Frima supplied a servo packaging system and the mobile servo Doppler with high energy efficiency, including an electric 4-sided clamp for the concrete block

setting system, a development by the company. The block setter allows block layers to be removed on the drying line for subsequent stacking on a block package transport. The concrete block layers can be rotated up to 360° before settling. The trolley runs speed-controlled in a gantry bridge with a toothed belt drive.

The sliding track on the dry production side was converted to an electric drive and new safety technology was installed.

Block Forming Machine Frima HP1000

This year, the existing concrete block machine had to give way to make room for the new Frima HP1000. The HP1000 was designed as a board paver for a wide range of applications, both in terms of its performance range and its functional features. To ensure that a uniformly high product quality is achieved in this production area, the machine is available with several technical features. During development, the



The block layers can be rotated up to 360° before placement. The trolley runs speed-controlled in a gantry bridge with toothed belt drive.



The automatic strip inserter has been in operation since 2009.

focus was on industrial suitability and ease of use. This resulted in a very stable frame structure as well as components that are easy to install and maintain. The effective high-performance hydraulic system ensures a stable and consistent production process.

A further advantage of this flexibility also relates to the control technology. Extensions can be integrated at any time with both centralized and decentralized automation structures. The HP1000 compact block forming machine enables the production of concrete building materials such as paving blocks, curbs, concrete slabs, masonry and hollow blocks or garden elements.

The concrete will continue to be produced using Teka's existing mixing technology, and Frima has supplied and installed new conveyor belts to transport the concrete to the HP1000 silos for the facing and core concrete. An automatically tilting inserter ensures that the core concrete silo of the concrete block machine is evenly filled. The level measurement is carried out by means of a radar probe. The electromotive hopper flaps are equipped with a cleaning function.

The core filling wagon is equipped with a hydraulic shaker grate, and the filling wagon for the facing concrete layer was ordered with special equipment. To produce high-quality paving products in various colours, the machine at Egner is equipped with a colour mix system for core and facing concrete.

The filling device is equipped with a hydraulic plate adjustment. The efficient servo vibrating device with modern technology and monitoring sensors has 4 drives with an automatic imbalance adjustment. The punch cross cleaning works perpendicular to the direction of production and is used to clean the punch plates in the production of curbs and paving stones with large chamfers. The device can be assembled and disassembled manually quickly and easily.

The machine provides automatic height adjustment of the filling device using a column guide, which is driven by electrically operated lifting spindle elements and controlled by rotary encoders.

An interface on the

concrete block machine allows operation with moulds that contain stamp heating. The mould holder has been adapted to the existing moulds, so that these can all be reused without any problems. The quick-change device enables quick mould changes with short downtimes.

A quieter working atmosphere is provided by a noise protection enclosure. At Egner in Erasbach, the concrete products are produced on wooden underlay plates with dimensions of 1,400 x 950 x 60 mm, supplied by mywood.

Frima's automation concept, based on the Siemens S7 Fail-Safe technology, communicates fail-safe via ProfiNet. Safety-relevant signals are transmitted via a bus system to ensure compliance with the necessary safety level. Intelligent components such as frequency controllers can be managed directly via the bus and, if necessary, set to a safe state. Thanks to this solution, the usual cabling effort has been significantly reduced.

Thanks to the state-of-the-art and clear visualization of the latest generation equipment, the entire system can be controlled clearly and comfortably, and the entire safety equipment of the system can be monitored.

Additional system components round off the overall package

In addition to the HP1200 concrete block machine, Frima also supplied and commissioned a hydraulically operated board stacker and a free-lift conveyor with electric drive on the wet production side. The existing mast was integrated into the new control system. ■

FURTHER INFORMATION



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It's the filling that counts

الملاء يمثل العامل الأهم

Concrete products need to meet quality requirements regarding the design, format, surface texture, strength and resistance that will withstand time, to satisfy customer demands. Only consistently high quality concrete products will lead to customer satisfaction. A very important factor influencing the quality of products is the filling of the filling box and the mould. Errors during filling are nearly impossible to be compensated for in the subsequent compaction process.

تحتاج المنتجات الخرسانية إلى تلبية متطلبات الجودة فيما يتعلق بالتصميم، والشكل، ولمس السطح، والقوة والمقاومة التي ستتحمل الزمن، لتلبية متطلبات العملاء. و فقط المنتجات الخرسانية عالية الجودة ستؤدي إلى رضا العملاء. يتمثل أحد العوامل المهمة جدًا التي تؤثر على جودة المنتجات ملء صندوق التعبئة والقالب. ويكاد يكون من المستحيل تعويض الأخطاء أثناء الملء في عملية الضغط اللاحقة.

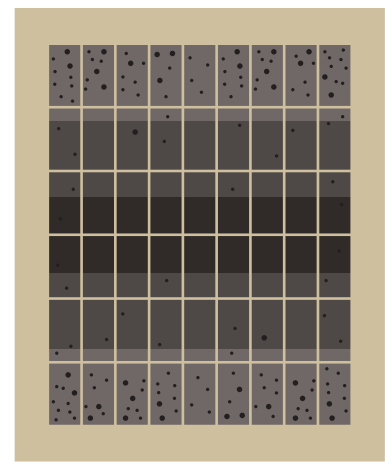
In principle, the entire production process for concrete products is complex. In addition to the optimal filling, many other factors influence the subsequent quality of the final product. Depending on the concrete product, there are a variety of different challenges to be mastered. Assuming suitable raw materials, for example, the concrete quality and homogeneity produced in the concrete mixers is just as essential as the transport of the fresh concrete to the block making machine. Here, among other things, segregation processes must be avoided since segregation leads to different and therefore unfavourable distribution of volume weights and stone structures on the production board. It must also be ensured that the concrete is processed quickly and continuously.

However, these topics, which are also independent in themselves, will not be considered in the following. Instead, the focus is placed primarily on the filling of the filling box and the mould.

Reproducibility as a quality-determining feature during dosing

The following applies in principle: The concrete quantity in the filling box must be adapted to the material requirement in the mould. If the quantity of concrete in the filling box is too low, the mould will not be filled completely. Too much concrete also has a negative effect, as the concrete can no longer move freely or is pre-compacted by too many filling box movements. As a rule of thumb for an optimal quantity of concrete, a look at the oscillating grate helps. This should still be covered with concrete after the mould has been filled and the filling box has moved backwards.

For dosing the correct amount of concrete into the filling box, Masa equips the block making machine either with a silo flap below the concrete silo or a dosing belt (optionally available for models of the XL and XL-R series), depending on the requirements.



Section through the machine silo, top view machine silo, top view mould: Unfavourable distribution of the fresh concrete in the silo of the block making machine or on the production board.

Proven and classical: Silo flap below the concrete silo

In the case of the block making machine equipped with silo flaps, the amount of concrete in the filling box can generally be controlled by means of dosing angles or laser level measurement. However, based on many positive customer testimonials and the many years of experience of its own commissioning engineers and process technicians, Masa sees a clear advantage in the first variant and therefore equips the block making machines in the main mix filling box with dosing angles as a standard.

When using dosing angles, the machine operator can set the amount of material to be dosed product-specifically by selecting the appropriate position, length, and number of dosing angles. This allows for a consistent and repeatable quantity of concrete to be accurately dosed. The positioning of the silo outlet must be taken into account: this should be located centrally above the dosing angles so that the material flow is limited by the angles. The concrete is then distributed in the filling box with a distribution cycle from the oscillating grate. When using dosing angles, it's important to regularly clean this area of the machine to ensure consistent results.

If the filling box is equipped with laser level measurement, the parameters can be saved product specifically, but there are certain limitations when using the silo flap. The material



The number, length and positioning of the dosing angles have a direct effect on the material flow and thus enable exact dosing and repeatability.



The difference between average and exceptional comes down to the details.

“Our milestone speeds up the production of your landscaping products: Masa XL-R.”

Sascha Maunz + Nico Schwang,
Industrial Mechanics, Masa Andernach

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At Masa, we think of nothing but concrete – and how to shape it for the building materials industry. The machines we design and build are used for the production of concrete blocks, pavers or landscaping products, aerated concrete blocks and (reinforced) panels as well as sand-lime bricks. In other words, we are real concrete heads with a passion for reliable, high-performance machines.

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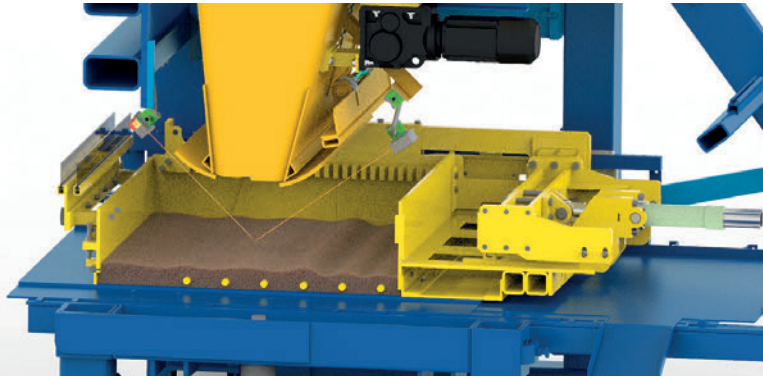
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Scan the QR code for more information about our high-performance concrete block making machine.

Sascha and Nico, two of our smart concrete heads, use their precise work to allow all the servo-hydraulic components of the XL-R to reach their full potential. The fluid interaction of the individual servo-driven components enables overlapping machine sequences resulting in shorter cycle times and repeatable results.

Just ask the concrete heads!



Measurement of the concrete quantity by laser

can flow differently from batch to batch, and the reaction time of the silo flaps need to be taken into consideration. Another influencing factor that can only be calculated to a limited extent is the different flow behaviour of the material from the concrete silo. In addition, the positioning of the laser must be considered. The laser must be positioned in such a way that it can measure the amount of concrete even when the flap is open. However, this means that the measurement is only taken at an angle against the cone of material that is building up. The measurement result is therefore an estimate, and does not reflect the exact filling level inside the filling box.

Furthermore, the time losses that occur when fine dosing is set (short opening and closing of the silo flap) must also be considered. In addition, possible adhesions on the silo walls, which can occur in connection with fine dosing, cause an increased cleaning effort.

Further possibilities of the block making machine with silo flap

With a large board machine (e.g. 1400 x 1300 mm), it is essential for block production, for example, that a correspondingly large quantity of concrete is filled evenly into the filling box.

Here, the control of the Masa block making machine offers the option of either moving the filling box with an open silo flap or opening the silo flap twice with different positioning of the filling box.

Variable and first-class: Dosing belt under the concrete silo as a high-end solution

However, the higher the demand for product quality, the more a high-end solution should be considered in this area as well. Masa is convinced that an ideal premium component is required for the ideal filling of the filling box: the dosing belt. The dosing belt, which is optionally available for the XL and XL-R series, opens a multitude of possibilities. For Masa, from a technical point of view, it represents the machine concept that enables the plant operator to adjust the filling of the filling box most variably and optimally to the respective product requirement: Analogous to equipping the machine with a silo flap, the concrete can be batched whilst the filling box is not



Dosing belts enable variable and optimal filling of the main and face mix filling box

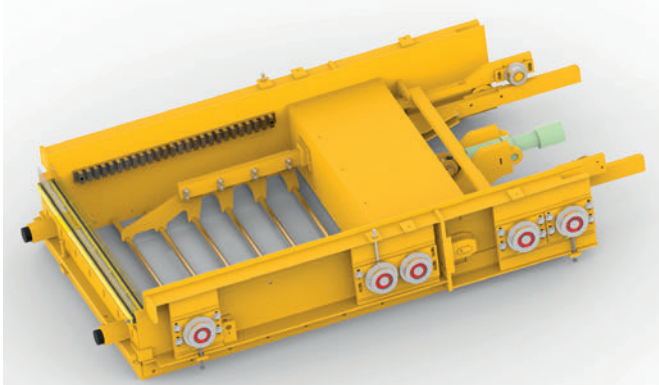
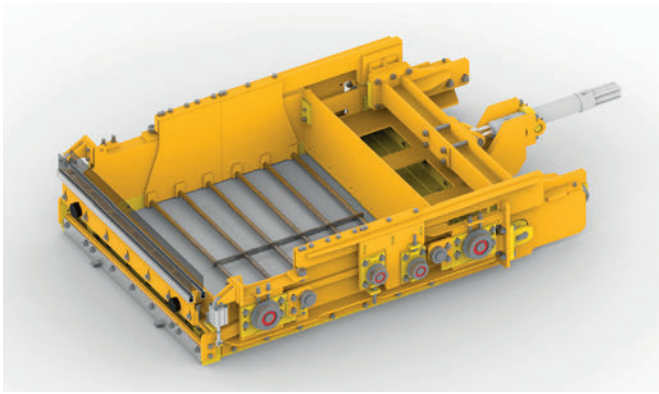
in motion. One of Masa's standardised accessories is the laser level measurement in the filling box, which, in combination with a dosing belt, delivers significantly more accurate and unbiased measurement results, as the laser measurement is taken almost directly from above in this solution.

The dosing belt also shows significantly better values in terms of reaction time relative to the classic silo flap. The shut-off of the dosing belt is faster. The dosing belt is frequency-controlled and can thus be infinitely adjusted in speed. The various adjustment options for the belt speed allow variable fine metering. The dosing process can be carried out with much more repeatability overall, even with short cycle times. As a result, this means that the produced premium concrete products have a very high reproducibility with regard to their texture, a decisive quality feature for the end customers. Similar to the machine variant with silo flap, the filling box can also be moved during filling. The objective is the same: an even distribution of the concrete from front to back in the filling box. But the required, uniform concrete height can be influenced much better and thus set more precisely by the combination of filling box speed, dosing belt speed, and size of the opening at the silo outlet. By adjusting the parameters accordingly, in the case of belt dosing, it is also possible to distribute the concrete with small filling quantities.

Homogeneous filling due to optimised oscillating grate

Probably one of the most important developments in recent years to improve the filling process was the oscillating grate with external guiding.

In the course of consistent and continuous adaptations of the Masa block making machines to the respective current product requirements, the Masa engineers also changed the positioning of the guiding elements. In previous oscillating grate designs, these were located inside the filling box. As is well known, the concrete in the middle of the material silo has a different flow behaviour than at the silo walls. The resulting cone of material is now negligible, as the current type of design ensures a much more uniform distribution of the concrete in the filling box and thus an absolutely repeatable,



Filling box with new and old oscillating grate in comparison

homogeneous filling of the entire mould. Concretely, the optimisation has an effect especially on the more even distribution of the concrete also at the outer filling areas.

For the oscillating grate drive, in addition to the conventional version with linear cylinder and two limit switches, Masa also offers a variant with distance sensing (only for the XL-R model series), in order to be able to adjust the stroke variably, or a variant with hydraulic motor (for the XL and XL-R model series), which enables a faster oscillating movement.

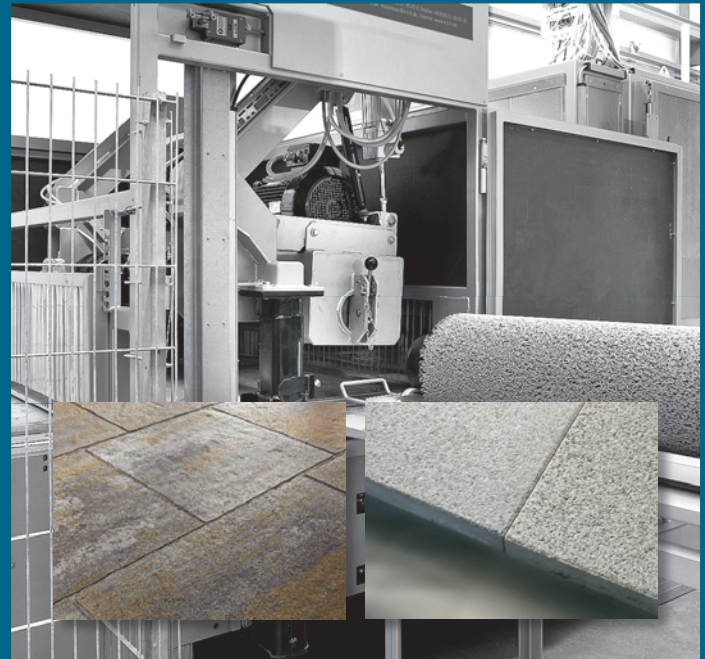
**Universal and yet special:
Other machine-related influencing variables**

The Masa block making machines, especially the XL and XL-R series, are universal machines and can produce the complete range of high-quality concrete building materials such as pavers, kerbstones, concrete slabs, masonry and hollow blocks or elements for gardening and landscaping.

They owe this characteristic not least to some of the machines' equipment features, which are explained below and also influence the quality of the end product.

Vibration

A harmonious and evenly distributed amplitude over the vibration table is important both for an even filling of the mould and for the subsequent compaction of the concrete. This is because uneven vibration causes the mould to be filled with

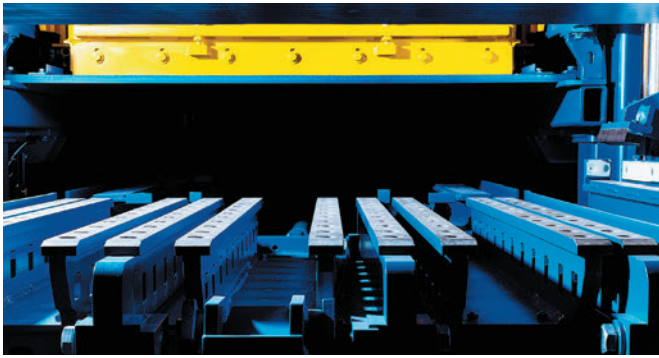


CURLING SYSTEM
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- Cleans, smoothens the product surface and creates a shiny finish
- Accommodates variation of product heights - either way front to back, left to right or even diagonally over the product layer
- Integration to the KBH Dancing Weights System possible – alternatively Stand Alone System
- Modular design allows accommodation of many different layer sizes and different product layer travel speeds – we design to plant specifications

**When installed at the KBH Dancing Weights System
3 modes of operation are possible:**

- Distressing and Curling
- Distressing only – curling brush raised
- Curling only – dancing weights raised



One-piece vibration table with vibrating elements and impact bars

more or less material in certain areas, depending on the amplitude of the generated vibration. In addition, the concrete tends to migrate if the vibration is stronger in one area - similar to a vibrating trough.

Significant factors influencing the amplitude are:

- Mass of the vibration table
- Mass of the mould
- Mass of the concrete
- Spring constant of the vibrating elements (rubber buffers). The spring constant describes the ratio of the force acting on the spring to the resulting deflection of the spring.

A symmetrical and torsionally rigid design of the proven, one-piece vibration table results in an even distribution of mass and an even input of impact energy when the impact bars bounce against the production board.

The quality and condition of the vibrating elements are extremely important. As part of Masa's quality management, this quality is therefore checked at the beginning, which enables a harmonious amplitude to be achieved in the end.

Regular inspection of the vibrating elements is essential in order to detect early deviations from the standard values or damage. With the timely replacement of vibrating elements that no longer comply with the standards, the system operator can avoid the uneven vibration and the associated loss of quality in the products.

The Masa vibration analysis can be optionally installed on the machine for this purpose and thus supports the plant operator in the control.

Last but not least, exact angular synchronisation (servo vibration) or exact mechanical adjustment of the vibrator weights (frequency-controlled vibration) is important to avoid horizontal force components of the vibration. Only vertical vibration forces are desired that ensure an exact up and down swing of the vibration table.

Filling box and mould guidance

If the mould vibrates freely in the mould bearings, disturbing influences such as friction cannot affect the vibration. The

mould guidance should therefore be set with minimum tolerance.

Masa designs mould bearings that also guide the mould in the direction of production, thus avoiding unwanted horizontal movements. Furthermore, this design also allows the compaction head to enter the mould accurately, thus reducing wear on the mould and the compaction head plate.

Masa takes another influencing factor into account in the design of the block making machine: The continuous filling box rails are designed in such a way that the filling box can move in a positively guided "free-floating" manner above the mould without its weight influencing the vibration during the filling process.

Pneumatic pressure-regulated air bellows hold the mould in the mould bearing. The air pressure can be individually adjusted to the mould and can be optimally set separately for the filling and compacting process.

Following the trend: Developments for special concrete products

Overall, there has been a considerable change in the product portfolio in the concrete block industry in recent years. For example, depending on the market, the trend is currently more towards large-format products. Masa has taken these market changes into account with various further developments on the block making machine and especially on the filling box. The additional equipment and options offered for the universal block making machine thus open a range of possibilities for the production of products with special requirements and challenges. This can be demonstrated in more detail with the following four exemplary product groups:

- Thin-walled wall building materials
- Concrete products with large volumes
- Slabs with large dimensions
- Pavers with/without chamfer

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Frankston Concrete Products successfully operating the drycast market in Australia

شركة Frankston Concrete Products تقوم بتشغيل سوق الصب الجاف في أستراليا بنجاح

Frankston Concrete Products located in Melbourne, Australia, has been in operation more than 50 years and is one of Melbourne's top precast concrete suppliers. Its owner, Peter Zigouras, purchased the company in 1971 having almost zero precast industry knowledge but an abundance of business chops that served him well in making Frankston a success. Now his sons, Nick and Ben, have taken the reins and some cues from their father on making bold business decisions that are yielding excellent results.

تعمل شركة Frankston Concrete Products، التي تقع في ملبورن بأستراليا، منذ أكثر من 50 عامًا، وهي واحدة من أفضل موردي الخرسانة مسبقة الصب في ملبورن. لقد اشترى مالكها، بيتر زيغوراس، الشركة في عام 1971 ولم تكن لديه أي معرفة تقريبًا بصناعة الخرسانة مسبقة الصب ولكن ثمة وفرة من أختام الشركة التي ساعدته جيدًا في تحقيق نجاح شركة Frankston. وقد تولى الآن أبنائه، نيك وبن، زمام الأمور وأخذوا بعض الإشارات من والدهم بشأن اتخاذ قرارات تجارية جريئة تحقق نتائج ممتازة.

If you see a chance. Take it.

In many ways this is a story about the rewards of risk taking. It illustrates how a chance business opportunity, a chance meeting with a sales rep, and the chance two sons took to build more business collided to make Frankston Concrete Products the success it is today.

It all starts in the early 1970s in Melbourne where a young Peter Zigouras was working as an accountant but dreamed of being an entrepreneur. His chance came when Frankston, a small wetcast producer specializing in gardening products,

was for sale. "He had no knowledge of precast concrete," said Ben Zigouras, Peter's son. "He just knew he wanted to run a business." With financing from his mother, Stavroula, and his wife, Kay, Peter purchased the company completely blind to what it entailed. At the time, the business centered around cheaper, high-volume, low-margin wetcast products. It helped that Peter was a very "creative" accountant with a sharp business mind who quickly recognized the need for the business to expand into more commercial and industrial pursuits. One of which was wholesaling plastic pipe, commonly used in Australian stormwater systems, and the other was products used in tradewaste (liquid waste generated by



a)



b)

(a) the new Frankston Concrete Products factory in Melbourne, Australia. (b) the old Frankston yard they occupied for nearly 50 years.



Frankston tradewaste interceptor.



Left to right, Ben, Peter and Nick Zigouras, owners of Frankston Concrete Products.

commercial and industrial businesses) applications. In fact, in conjunction with local water authorities, Peter invented tradewaste apparatuses such as grease and petroleum oil interceptor traps that eventually became certified and then required in all new local tradewaste applications. His work in developing these products proved to be a huge boost to his business as Frankston had a very strong foothold on the market once these interceptor products were mandated.

At the same time, plastic pipe was becoming a major focus of his business too, but he wisely never abandoned Frankston's wetcast roots. This served the company well as it faced stiff competition in the 1980s from large international plastic pipe suppliers. By keeping a toe in wetcast, Frankston was able to exit plastic and shift full throttle into wetcast production of concrete stormwater pits and tanks for residential, commercial and industrial customers.

A chance meeting that left a big impression

In the late 1990s, Peter's sons, Nick and Ben, became more involved in business. Ben was already somewhat engaged as he found himself installing the pits and tanks Frankston manufactured as part of a plumbing apprenticeship he was

pursuing. And Nick, who had moved back from Sydney, was operating his environmental science business out of the Frankston office.



The BFS Souveraan is known for its high quality, high throughput pipe production.



Above: Main gear box with extremely powerful electrical motors for the counter-rotating compressing tool.

HawkeyePedershaab and BFS Box Culvert Production

One Modular Mold Set. All Box Culvert Sizes.



System Benefits:

The molds can be used in different plant configurations - either in a machine or egg-lay solution with many advantages over traditional wetcast production:

- **Make all box sizes with higher productivity and less labor.**
- **Pegged and machined mold components facilitate precise assembly.**
- **Strong design withstands vibration and stripping forces and dead-weight stresses without flexing or sagging.**

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Souveraen's robotic arm automatically inserts anchors to produce Frankston's unique pipe with lifting lugs. These products are extremely popular with Frankston's customers as installation time can be cut in half when using them. The anchor-feeding robot called BFS Transfix (patent pending) operates irrespective of shape of the pipe.

Before long, the brothers took on more responsibility and found some very successful ways to diversify Frankston's concrete interests. With the company experiencing considerable growth and in the competent hands of his sons, Peter was able to step back a bit from the day-to-day operations.

That set the stage in for a cold call Ben received from Volker Nusser, a sales rep who worked for BFS Betonfertigteilesysteme GmbH, a concrete pipe and manhole machine manufacturer based in Blaubeuren, Germany, which since 2018 has been part of the Afinitas family of brands. Ben remembered how Volker brought them several brochures on drycast production machines like the Jumbo, Mammut, Souveraen and Atlantic. "Here was this big Bavarian guy telling us that we should start making drycast stuff ... and we had never heard of it!" laughed Ben.

But the idea Volker planted with them firmly took hold. In 2013, the Zigouras family acquired a 4 hectare (almost 10-acre) empty lot that would eventually become the site of their new factory. After visiting drycast plants in Australia and Europe to understand the equipment and skills required to run them, the brothers determined drycast manufacturing was definitely in their wheelhouse. In fact, compared to the much slower spun pipe technology used in Australia, they felt they would be crazy not to do it.

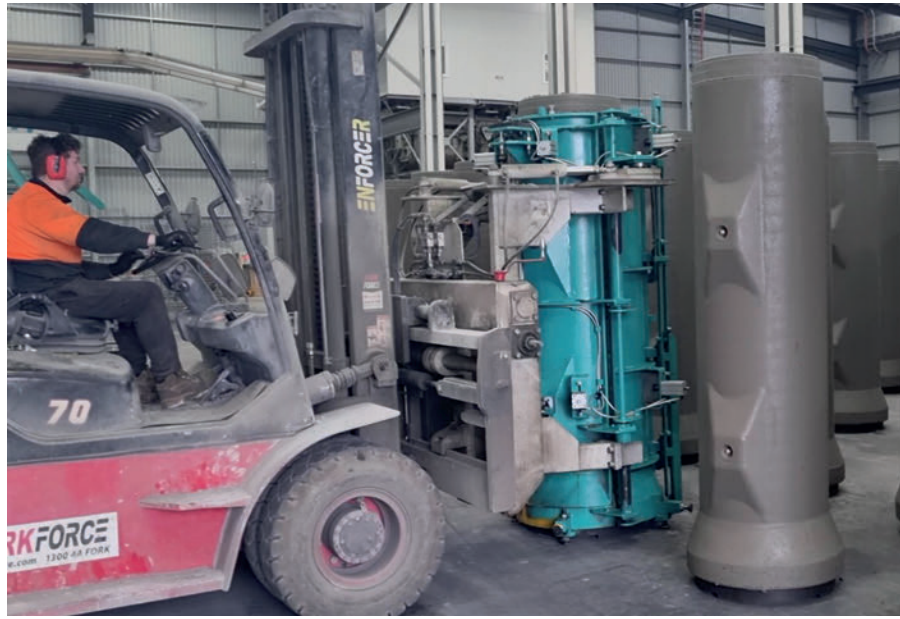
Taking a chance on drycast

With the financial backing of their father, the brothers took the leap and decided to bring their longtime contact Volker Nusser and the BFS team with them on this new journey into drycast production. It was a giant step - a new plant to build, new equipment to purchase and a completely new production process to learn.

"In choosing BFS, price was important, quality was important, and we had been to the plant in Perth, Australia, to see the Souveraen and Atlantic operate. The Perth team was really big on the service they received from BFS after the sale," said Ben. "Plus, Volker's completely random drop in from a decade earlier meant something too."



Pressing tool with roller levels.



Souveraen’s computer-controlled production and camera system.

Three-piece mold design with forklift truck demolding device.

Nick and Ben decided to build their 15,000 square meter plant around the BFS Souveraen 1625 packerhead concrete pipe machine, where they are now running pipe that is 300 DN up to 600 DN and the BFS Atlantic 1515 Roto model machine where they are running four different sizes of stormwater pits from 450mm x 450mm to 900mm x 900mm.

staff only one shift, their typical production numbers are much lower per day. But the labor savings of the automated machinery will be transformative (and already is) according to Ben as they bring more wetcast products online, particularly on their other machine: the BFS Atlantic.

The BFS Souveraen is known for its very high product quality due to the design of its packerhead. Most packerheads have a row of rollers and a row of trowels that pack the concrete against the form. The Souveraen has multiple rows of both. That allows concrete to be packed with as much force but with less torque required from the machine, providing more even distribution of the force against the concrete.

Souveraen’s computer-controlled system calculates the concrete amount using the process controller and supplies it via the “S-feed” concrete supply system in a precisely defined amount and speed to the compaction process, resulting in consistent pipe quality. The machine’s built-in weighing system ensures minimal waste as the concrete is released when the machine controller identifies the need.

In addition, BFS’s unique three-piece mold design increases efficiency with rapid loading and unloading of the mold thanks to its quick-closure mechanism. The double-hinged molds are opened and closed by the forklift driver by a hydraulic mechanism and can be carefully transported to the curing area where they are demolded.

The Frankston team is pleased with the quality and output they are receiving from the Souveraen, where the machine has the capability to produce up to 300 pipes per day of any size using only two operators. According to Ben, the limiting factor is their ability to hire staff. Because they can currently



Frankston’s BFS Atlantic 1515 system is designed to produce tanks, pits, manholes, tapers, pipes and similar concrete products with a height up to 1500mm and a max inner diameter of 1500mm and square products up to 900mm x 900mm.



The Atlantic 1515 with pallet handling on the right side. The pallet magazine is adjustable to accommodate a range of pallets.

The Atlantic is a versatile machine that can produce diverse concrete elements: large, small, round, angular. At the heart of the Atlantic is a powerful three-head central vibrator with hydraulic clamping and program-controlled compaction force setting. This ensures well-regulated, forceful and fast concrete compaction. The Frankston Atlantic machine is specially equipped with the BFS Roto mold-turning device to increase the efficiency of making stormwater pits with bases. Roto allows the product to be poured upside-down and, once made, the pit is rotated on to the pallet to minimize the amount of handling needed. This functionality can be disabled for products without a base. The Frankston Atlantic also automates the process for 4-sided knock-outs on the pit walls saving the team time and reducing rework.

"Our record for 450mm x 450mm stormwater pits is 120 in one day," said Ben. "To put that in perspective, with wetcast production it would have taken us 3 weeks to do it and the cost is about two-thirds less. The Atlantic has been a real game changer with how much you can do."

Ben said eventually they will stop making stormwater pits in wetcast and manufacture their entire range of products out of the Atlantic. "This will help our labor situation immeasurably. You would be talking about running that whole operation with a max of 3 people as opposed to 15," said Ben.

What are the chances of a Pandemic?

As luck would have it, the new Frankston plant opened its doors in January 2020, a few weeks before the world was turned on its head by the COVID-19 pandemic. The Souveraen and Atlantic were in the process of being commissioned when Australia was closing its borders and the BFS technicians working on the project had to leave.

"They were very apologetic, but what could they do, they had to get out," said Ben. "But we were like 'what do we do?'" Fortunately, thanks to virtual technology they were able to very successfully complete the commissioning via online methods and Whats App. "Klaus Müller, and the BFS technical team were getting up at all hours to help us finish and this really validated my decision to go with them."

"It has been a lot of fun working with the Frankston team from the very beginning," said Klaus Müller, Managing Director of BFS Manufacturing for Afinitas. "Now we are happy that they are producing such great products. The success of our customers is our reward."



Automated wall knockout process has greatly increased efficiency.



Ben Zigouras checking on operations in the plant.

And, as Ben admits, they took on a lot at once, but having an experienced supplier like Afinitas/BFS really helped them in terms of designing the plant layout, selecting the equipment suited to their production needs, and mastering the equipment and production processes. "They even helped us think through things like how the stockyard should be layed out," said Ben.

Upon a recent visit, Torben Mørch, Vice-President of Sales for Afinitas, who now covers the Australian market remarked how impressed he was with the plant construction and its operations. "The plant is kept clean, and the machinery is well-maintained, the production team works like clockwork and you can see they are proud of what they do. And the products look great, so it is really a pleasure to visit this plant."

No chance of stopping

Ben describes how when his approximately 30 team members are in place and the machines are running, the Frankston plant is "just humming." And already receiving an ROI on their equipment investments makes him very optimistic about the opportunities that await them. While in the near term their focus is on perfecting the products they have, about 99%, of which are for the stormwater industry, they have their eyes on expanding their reach and product offerings.

"When I think back on that first contact with Frankston, plunked right out of a Melbourne phone book, and what this small company developed into, it is amazing" said Afinitas Sales Manager Volker Nusser. "But I always knew they were serious about their work and would be successful."

In reflecting on their success, Ben credits his father's willingness in the early 1970s to take on a business he knew nothing about and then doubled down on it in 2013 by backing his sons in their expansion into drycast. "He taught us, you got to put your cards on the table and give it a go," said Ben. There's a good chance this is not the last you'll hear of Frankston.

FURTHER INFORMATION



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The evolution of a concrete spreader

تطور فارشة الخرسانة

Speedy represents the perfect combination of cutting-edge technology and efficiency. In an era dominated by the Industrial Revolution 4.0, this machine stands out for its ability to raise the standards of the precast concrete industry.

تمثل آلة Speedy (سبيدي) مزيجًا مثاليًا من التكنولوجيا المتطورة والكفاءة. في عصر تهيمن عليه الثورة الصناعية 4.0، تتميز هذه الآلة بقدرتها على رفع معايير صناعة الخرسانة مسبقة الصب.

Speedy is a driver/operator based machine, designed by Bianchi Casseforme over 30 years ago, which is constantly be improved, dedicated to the transport and distribution of concrete, within a precast facility.

Speedy represents a rational and economical solution for the precise distribution of concrete into precast plants, with a remarkable casting cycle time decrease with no additional requirement for external infrastructures or manpower. This allows to optimize times, minimize costs and above all to make the entire distribution process smoother and safer.

Manoeuvrability and versatility

These are the main features of Speedy, which can be easily used in multiple situations, always guaranteeing excellent casting accuracy. A single operator can transport up to 4 cubic meters of concrete from concrete mixing plant. The distribution into formworks is guaranteed by a distribution arm, that can rotate 360° on a fifth wheel driven by a reduc-

tion gear. The group distribution arm/hopper can be inclined, which allows casting up to a height of about 3.500 mm.

Safety

Over the years, Bianchi Casseforme has constantly perfected every single detail of this machine, introducing a number of improvements especially in terms of safety necessary to guarantee its optimal operation for both the driver as well as those that work around the machine, each machine produced can be tailor made to suit a client's requirements having a long series of options extras. The Speedy gives the operator the possibility to work with maximum precision and maximum comfort. Each Speedy can be equipped with a system of cameras and monitors that ensure precise and instantaneous detection. The images are reproduced on the monitor in the cab, allowing the operator a 360-degree view around the vehicle, a system that eliminates blind spots and protects people.



Right hand view



Pouring at a height of 3m on left hand side



Pouring on the right hand side

Technology

Equipped with the latest technologies, this machine fits perfectly into the context of Industry 4.0, where connectivity and automation are fundamental. For total monitoring of all phases of daily production, even remotely, of the drivers cab, alarms and working data of the machine, it is possible to add an MDR module that allows data management directly from your office server. The interconnection of the machine to the company server allows its monitoring in real time. Its functions include geolocation, sending data about alarms on the machine and live displaying work phases with the possibility of intervening when faults occur.

Sustainability

The electric model, which will be available soon, is certainly a winning choice, especially to comply with increasingly stringent emission regulations, especially in the cases where, as often happens in Italy and Europe, where the machine needs to work in completely closed environments. It will



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Rear view with reversing radar and camera

therefore have no limitations in its use; indeed, this should be a winning formula.

In summary, Speedy represents a step forward in the evolution of the precast concrete industry, embracing the most advanced technologies, ensuring operational efficiency, and introducing a touch of innovation and style with our new colors.

FURTHER INFORMATION



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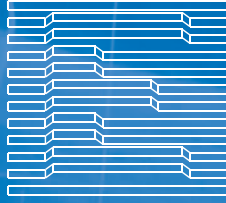


Large display for production information



Monitor for 360° view and reversing radar

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Moldtech S.L., 41500 Alcalá de Guadaíra (Sevilla), Spain

Complete plant for prestressed beams for HS2 high speed railway project in UK

مصنع كامل للعوارض سابقة الإجهاد لمشروع السكك الحديدية عالية السرعة HS2 في المملكة المتحدة

Moldtech has recently commissioned a complete plant to produce prestressed beams for bridges and viaducts for the ambitious HS2 project. Tierra Armada, leading engineering firm part of Freyssinet group, was awarded an important contract for the first phase of the project connecting London with West Midlands.

لقد قامت شركة Moldtech مؤخرًا بتكليف مصنع كامل لإنتاج عوارض سابقة الإجهاد للجسور والكباري لمشروع HS2 الطموح. وقد فازت شركة Tierra Armada، وهي شركة هندسية رائدة تابعة لمجموعة Freyssinet، بعقد مهم للمرحلة الأولى من المشروع الذي يربط لندن بغرب ميدلاندز.

The new high-speed line will run 225 kilometers from London to Birmingham in 45 minutes, connecting with the existing West Coast Mainline with services to places like Manchester Liverpool or Glasgow. Additionally, 4 new stations and 2 depots will be built.

Design of the equipment posed a great challenge, given the need to produce very different and complicated beam geometries in each bench, with very varied patterns of prestressing strands, which represented a significant challenge in the design of the anchors and calculations of the reactions.

Moldtech has supplied three complete self-reacting prestressing benches with capacities of 800 tonnes, 1400 tonnes and 1800 tonnes, and lengths of 82m, 91m and 66m, all with hydraulic opening/closing casting bed system and a wide set of moulds for very varied types and sections of beams (type I, T, inverted T and other special sections).

Likewise, it has been very important to keep a close collaboration with Tierra Armada to define with great accuracy the final width of each of these lines, to maximize the opening range of the moulds to allow for maximum space for workers, considering the varied base widths on each line and the total width available under the gantry crane.



Self-reacting prestressing bench, 1400 tonnes



A system with a wide set of moulds for very varied types and sections of beams

These lines allow easily exchanging moulds and bottom base-plates according to the different beam geometries and can achieve great efficiency in both preparation and demoulding tasks, thanks to the hydraulic system that allows the evenly and smooth opening of the total length of the line avoiding use of the crane, considerably reducing the time and labor required.

All moulds have been built with modular adjustment for sections of variable height and are equipped with a vibration system with pneumatic vibrators for better concrete compaction. Additionally, the moulds feature complete working platforms with access ladders in accordance with local health and safety regulations.

The scope also included other accessories and ancillary equipment, such as hydraulic machinery for prestressing, concrete buckets, lifting equipment, etc.



Moldtech is highly specialized in supplying complete mobile plants for infrastructure projects that can be easily installed close to the construction site and quickly dismantled and transported to another location upon completion of the project. These self-reacting benches can be easily installed on a minimum thickness concrete slab, without requiring a costly investment in civil works foundations. All equipment can be disassembled into shorter modules and transported in trucks.

Although in this case the client of Moldtech plans to operate this plant for a few years, this type of equipment is a very interesting investment for large infrastructure contractors with projects in different countries or distant locations.



The union of forces and experience has allowed meeting demanding execution deadlines, turning unused ground into an efficient and productive prefabrication plant in a record time, which is producing high quality prestressed beams and playing a very important role in the construction of the largest infrastructure project in Europe. ■

FURTHER INFORMATION

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Beams with different types of sections



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New innovations to supplement precast technologies

Decarbonizing the construction industry with structural design optimization and low-carbon concrete

إزالة الكربون من صناعة البناء والتشييد من خلال تحسين التصميم الهيكلي والخرسانة منخفضة الكربون

- Henry Unterreiner, Hyperion Robotics, Espoo, Finland
Jaakko Yrjölä, Peikko Group, Lahti, Finland

Construction industry needs new solutions to solve the issues related to CO₂ emissions. The solutions include the use of smarter structural design and the use of low-carbon materials, which could be facilitated by the use of 3D printing technology. Based on the recent studies and experiments, this technology, particularly in foundation structures, have been proven to be beneficial and at the same time technically feasible. This technology can be seen as a supplement for traditional precast technologies.

تحتاج صناعة البناء والتشييد إلى حلول جديدة لحل المشكلات المتعلقة بانبعاثات ثاني أكسيد الكربون. تشمل الحلول استخدام تصميم هيكلي أكثر ذكاءً واستخدام مواد منخفضة الكربون، وهو ما يمكن تسهيله من خلال استخدام تقنية الطباعة ثلاثية الأبعاد. واستنادًا إلى الدراسات والتجارب الحديثة، فقد ثبت أن هذه التقنية، وخاصة في هياكل الأساس، مفيدة وفي نفس الوقت ذات جدوى من الناحية الفنية. يمكن النظر إلى هذه التقنية على أنها مكملة للتقنيات التقليدية مسبقًا.

Construction is the second largest sector in the world, with \$10 trillion spent on construction-related goods and services every year. At the same time, its impact on the environment is profound: the sector accounted for over 34 percent of energy demand and around 37 per cent of energy and process-re-

lated CO₂ emissions in 2021 [1]. Moreover, concrete, the staple material in construction, is the second most consumed material on earth. Its main constituent, cement, is responsible for 8% [2] of global CO₂ emissions.

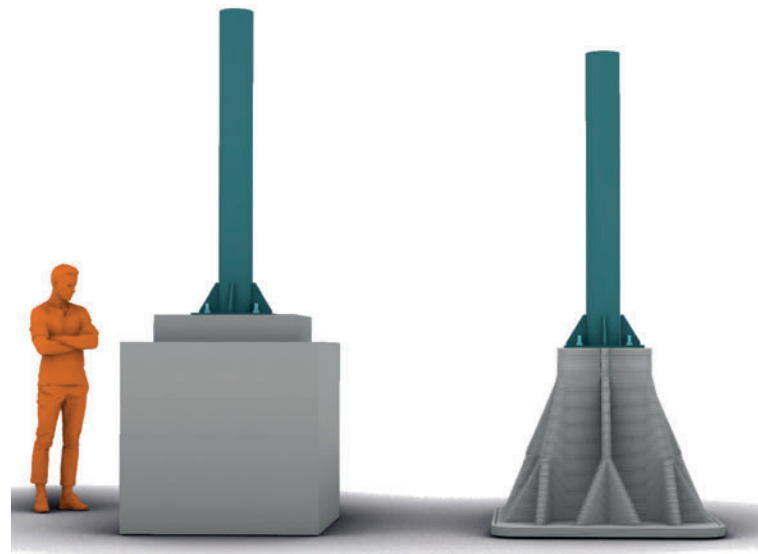


Figure 1: Efficient shapes, which would be extremely difficult to produce with traditional methods (casting in formwork), can now be created automatically.



■ Henry Unterreiner is a structural engineer and co-founder at Hyperion Robotics, a company specialized in 3D printing reinforced concrete for infrastructure and industrial grade applications. After working at Arup for 7 years designing international high profile architectural projects around the world, he is now leading the design, optimization and delivery of projects at Hyperion.
henry@hyperionrobotics.com



■ Jaakko Yrjölä is a leader of Research and Development team at Peikko Group, responsible for several development projects, including product design, technical documentation, software tools and sustainability. He has previously led and supported the team of Deltabeam designers in Peikko Finland. Jaakko has more than 10 years of experience at Peikko and is a Ph.D. candidate studying the mechanical behavior of bolted joints.
Jaakko.Yrjola@peikko.com

To advance the decarbonization, the industry needs to minimize material volumes through optimized design and construction processes, and swapping traditional materials for low carbon, bio-based or recycled alternatives [3]

The company Hyperion has been exploring for the last 3 years the application of 3D printing concrete technology to reduce the carbon footprint, automate the manufacturing process and speed up the installation on site [4]. The 3D reinforced concrete printing technology developed by Hyperion enables the creation of a wide range of concrete structures which can be up to 75% lighter compared to traditional structures.

By utilizing the precision of robotic arms and controlling the setting speed of concrete, concrete elements can be manufactured in a faster and more efficient way with less material. Efficient shapes, which would be extremely difficult to make using traditional methods (casting in formwork) can now be created automatically.

Optimized design and construction processes

Foundations are a good example of how 3D-printing concrete technology can make a difference. Pad foundations, although invisible to the eye, are being used everywhere across the world. When looking at the spectrum of existing foundations, one can notice that they are typically large monolithic blocks of concrete, often relying on concrete as deadweight [5]. This also means a large amount of concrete with high labor and time requirements. Conventional foundation cube could be made e.g. of 4 tons of concrete which generates 400 kg of embodied carbon. It could also take 28 days after being cast on site before being ready to be loaded with equipment.

Built on that observation, Hyperion's foundation is optimized, utilizing the excavated soil to stabilize itself against an overturning moment. Compared to a traditional monolithic block of concrete, the 3DPRC (3D-printed reinforced concrete) foundation is saving up to 75% whilst providing the same structural capacity against loads.

مادختساب هئان ب ب مق



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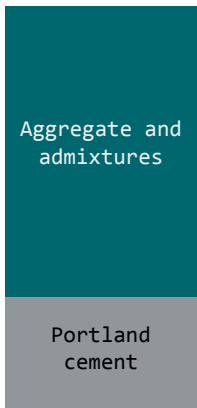
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CO2 content: **120kg per ton**

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Compressive strength: **40-80 MPa**

Recycled content: **Up to 97%**

CO2 content: **15kg per ton**

Figure 2: Low-carbon cement alternatives to meet different needs from more traditional cement-based mix, to mixes with low cement content or even zero cement.

Produce low carbon concrete

Hyperion develops low-carbon cement alternatives to meet different needs from more traditional cement-based mix, to mixes with low cement content or even zero cement. These are made of wastes from coal plants, steel production, mining industries, and demolition sites. The printing mortars are made of up to 95% recycled materials, which make them one of the lowest CO₂ 3D-printable materials in the market. The cementitious mix has 55 MPa compressive strength and 6 MPa tensile strength, which is significantly stronger than conventional concrete often used in building sites (C25/30).

Conducting structural testing on foundations

During the collaboration with electricity company Iberdrola, Hyperion and Peikko tested a 3D printed foundation buried underground in a real soil context. The results were successful resulting in a 3 times higher capacity compared to the calculated design resistance (ULS). Another testing consisted of applying a horizontal force to a steel mast mounted on the foundations. This testing was performed on three small foundations and five medium foundations, which were installed on a testing rig in Hyperion's facility in Espoo.



Figure 3: Testing performed in a real soil context at Peikko's facility in Lahti, Finland and load tests at Hyperion's facility in Espoo, Finland.



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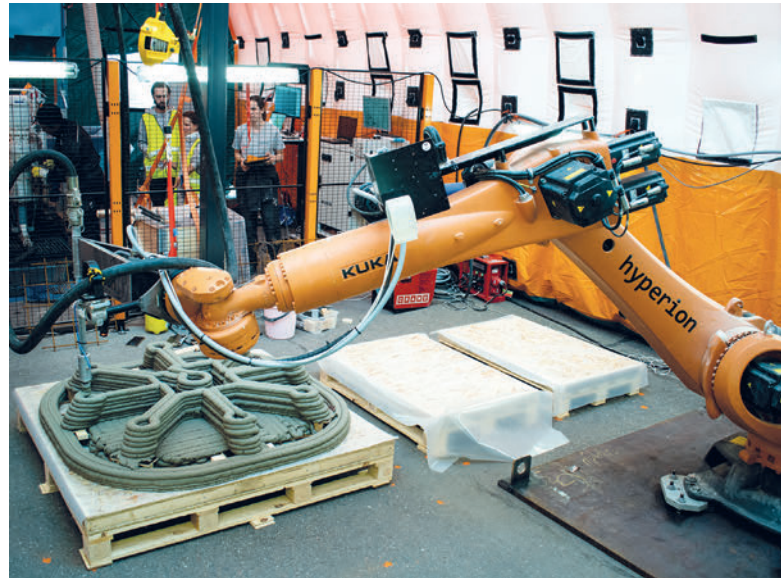


Figure 4: The micro-factory was sheltered under a 250m² inflatable tent, where 20 foundations of various sizes were printed.

The small foundations were tested until their failure and demonstrated a ductile behavior with the reinforcement elongating and deforming as their maximum resistance was reached. The medium foundations were tested until the testing rig was at maximum capacity with the steel pole starting to fail in bending. The test results showed that all the foundations resisted at least 3 times their design overturning resistance based on the calculation from the stability.

Scale up low carbon construction in a micro-factory

To demonstrate the scalability of its technology, Hyperion deployed its first micro-factory in collaboration with Peikko Group. Over a period of two weeks, Hyperion installed its inflatable shelter of 250m², divided into 2 equal parts of 125m²: A first hall to host the 3D printing activities, a second to bring the printed pieces and cure them in a controlled environment with high humidity and controlled temperature [6].

The components of the whole micro-factory fitted at the back of one truck and was operational 2 days after being deployed. The only infrastructure needed was available asphalted land and access to water and electricity. Within three days, 20 foundations of various sizes (small, medium and large) were 3D-printed.

Importance of connection bolts

One of the key parts of concrete foundations are steel connectors, which are needed for connecting the other structures of the load-bearing frame, such as columns, masts, or walls. Therefore, the 3DPRC foundation also requires steel bolts, as connectors for the steel mast.

As part of collaboration, Peikko provided its bolts for all specimens, such as Voltbolt® anchor bolts. Anchor bolts are installed inside the pockets of the 3DPRC during the printing phase and the pockets are filled with cement-based grout after printing. As a result, the bolted connection can transfer both axial and transverse loads from the steel mast to the 3DPRC foundation.

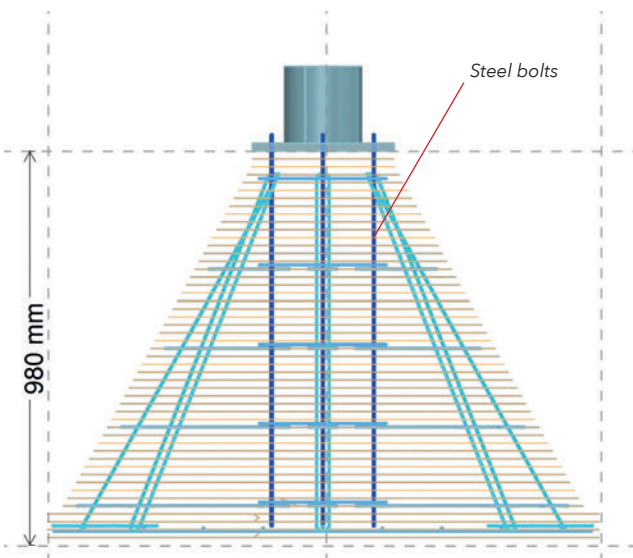


Figure 5: Peikko's Voltbolt® Anchor bolts installed inside the 3DPRC foundation

New innovation supplementing precast

As predicted by Oxford Economics [7], the global construction work done is forecasted to grow by US\$4.2 trillion over the next 15 years, to US\$13.9 trillion. There is an increased demand for new construction while its impact on the carbon emissions will be irreversible once a new asset is built. Therefore, it is crucial for companies throughout the industry value chain to prioritize embodied emissions as they build - optimizing design and construction process and switching to low-carbon concrete alternatives.

The optimized design done by 3D printing technology, using low-carbon concrete is not a utopia of tomorrow, but it is a proven technology and has practical applications already today. The proven technology can be used by traditional precasters, to e.g. extend their product portfolio in the areas

where optimized design requirements cannot be met by normal precast methodology. ■

FURTHER INFORMATION

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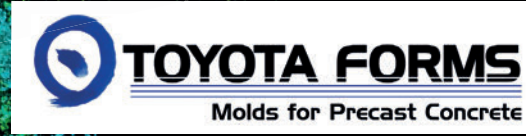
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Leading mesh welding technology at Abu Dhabi Precast LLC.

تقنية اللحام الشبكي الرائدة في شركة أبوظبي بريكاست ذ.م.م.

Abu Dhabi Precast (ADP) established in 2001 is one of the leading precast and pre-stressed concrete companies in manufacturing, delivery, and erection of Precast Products in U.A.E. Since its establishment, ADP has grown from a single factory to multiple facilities in the Mussafah location that are solely owned and operated by ASCORP Holdings.

تعتبر شركة أبوظبي بريكاست (ADP) التي تأسست في عام 2001، إحدى شركات الخرسانة مسبقة الصب وسابقة الإجهاد الرائدة في مجال تصنيع المنتجات مسبقة الصب وتسليمها وتركيبها في دولة الإمارات العربية المتحدة. وقد نمت شركة أبوظبي بريكاست منذ تأسيسها، من مصنع واحد إلى منشآت متعددة في موقع المُصنَّع تملكها وتديرها شركة ASCORP Holdings وحدها.

ADP, with approximately 1.330 high skilled employees, has the capacity to produce 1.200m³ a day of a variety of pre-fabricated products. ADP's various products adhere to the strictest international standards and have consequently been approved and utilized in both the public and private sector.

ADP possesses several state-of-the-art machinery and facilities in all of its factories. In the production facility which is located in Abu Dhabi Industrial City-Al Mussafah Industrial area, occupies a total land area of 227.000 m² with covered production area of 32.000m². It is equipped with three modern and fully computerized batching plants.

The latest plan of ADP was to invest into a fully automatic mesh welding line for the production of both standard construction mesh as well as engineering mesh, mesh with openings and mesh with bent line and cross wires. After an extensive market research for the most advanced solution, a machine of Eurobend's AMM Series chosen.



View of Abu Dhabi Precast yard

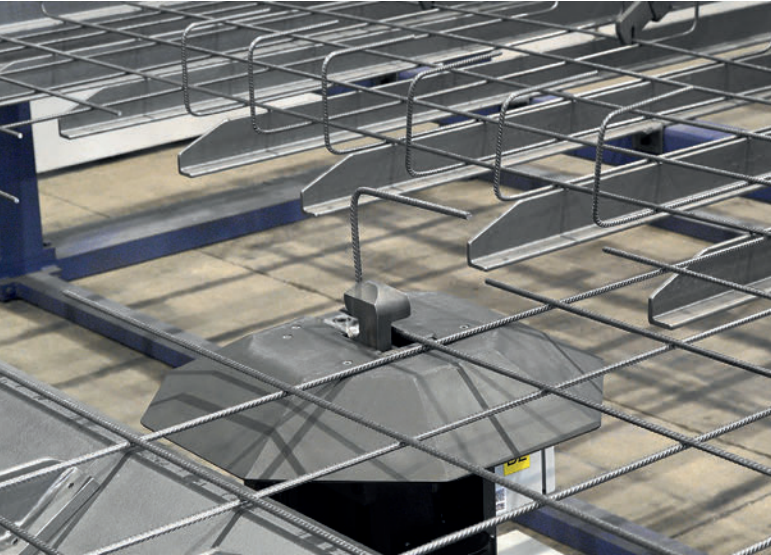
Flexible mesh welding lines with integrated bending modules and unique mesh bending stations - the AMM series

Eurobend GmbH installed a flexible, state of the art mesh welding line model PL XY Twin AMM BU BM with integrated bending modules for the production of special mesh, engi-



View of the installed a PL XY AMM BU BM machine





Universal bending module

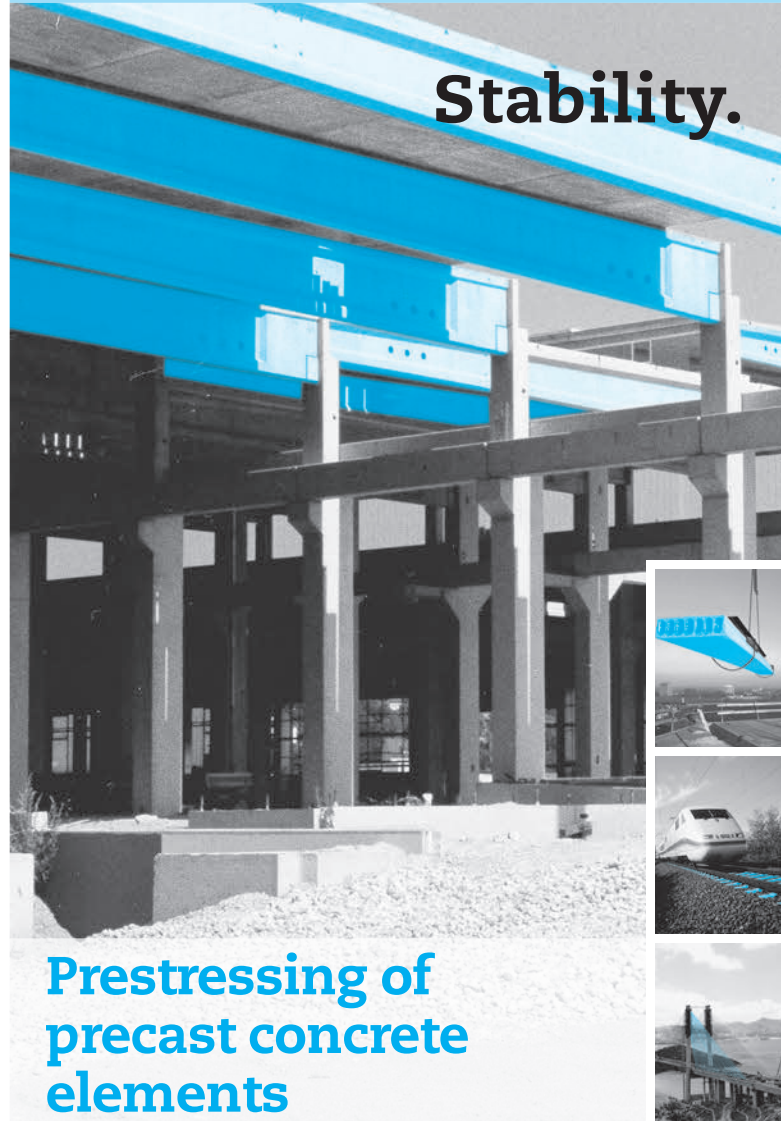
neering mesh, mesh with openings, mesh with bent line and cross wires.

The Eurobend AMM machine works from coil and offers the highest flexibility at a very high level of automation without any changeover times. A number of innovations and unique design features make the AMM the leading model on the market:

- Any type of mesh can be produced automatically, immediately and without changeover and idle times.
- The line and cross wires are fed into the welding portal immediately by two separate Flexiline rotor straightening and cutting machines, featuring the patented Eurobend maintenance-free 5G rotors each with eight hyperbolic rollers and with extremely fast diameter changing system. The diameter changeover takes place in less than 3 seconds without any mechanical moving parts.



Synchronous working universal bending modules



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Bent mesh with openings



Detail of bends



Production of L-shaped mesh

- Direct feeding of the cross wires into the welding portal: The complicated, maintenance intensive and susceptible common cross wire feeding systems, where the cross wires have to be produced first and then the longitudinal wires, as it is the case in the lines with one straightening machine, are no longer necessary.
- Thanks to the innovative concept, the AMM machine is the most compact on the market and has a minimal floor space demand.

The AMM is equipped with a unique, state of the art precision bending system consisting of two integrated, in-line universal bending modules for bending individually selected line and cross wires, even within openings. The sophisticated design, the servo-driven operation together with the advanced and modern software makes them technically superior in this industry sector. They are characterized by highest precision and speed. Two bends are performed in 2.5 seconds with consistently precise bending geometry. No idle times during production: During the bending process of one mesh the next one is already in production.

The AMM has the capability to connect to master computer for the "Just-In-Time" production, synchronized with circulating pallet systems. ■

FURTHER INFORMATION



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Ratec GmbH, 68766 Hockenheim, Germany

Magnet box in focus

الصندوق المغناطيسي في بؤرة التركيز

Magnet-based formwork solutions offer quick and easy handling during shuttering and deshuttering, which has a positive effect on production speed. The magnets hold the formwork securely in place. Adhesive or welded joints become unnecessary, which means that work can be carried out in a way that is gentler on the material. More than 20 years ago, Ratec launched the Standard Pro Magnet Box, or SPB for short (in the USA: KPB Klacker Power Box), and with it introduced the switchable magnets into the precast plant. Today, the SPB is used for formwork fastening in numerous precast concrete plants worldwide.

توفر حلول صب الخرسانة القائمة على المغناطيس معالجة سريعة وسهلة أثناء إنشاء الهياكل المؤقتة (القولبة) وتفكيك القولبة، ما له تأثير إيجابي على سرعة الإنتاج. يقوم المغناطيس بتثبيت القوالب في مكانها بشكل آمن. وتصبح الوصلات اللاصقة أو الملحومة غير ضرورية، ما يعني أنه يمكن تنفيذ العمل بطريقة أكثر لطفاً على المادة. منذ أكثر من 20 عامًا، أطلقت شركة Ratec الصندوق المغناطيسي الاحترافي القياسي، أو اختصارًا SPB (في الولايات المتحدة الأمريكية: KPB Klacker Power Box)، ومعه أدخلت المغناطيسات القابلة للتحويل إلى المصنع مسبق الصب. اليوم، يتم استخدام SPB لتثبيت القوالب في العديد من مصانع الخرسانة مُسبقة الصب في جميع أنحاء العالم.

Reliable adhesive force

According to the manufacturer, the design with magnetic suspension, spring mechanism for activation and powerful built-in magnet ensures that no air gap can occur between the magnet and the pallet when activated, which would impair the adhesive force. The reliably strong magnetic force holds the formwork securely in place and prevents it from being moved unintentionally. At the same time, the magnetic suspension inside the box ensures that the integrated magnet floats when not activated, allowing the SPB to be moved easily and positioned precisely.

Patented built-in magnet as a basis

Standard magnets from the Pro-Magnet series are used in all RATEC magnet boxes and formwork systems. The company's

own in-house magnet production in Germany allows it to tailor the magnets to the exacting requirements of its customers and thus realise numerous special solutions. In addition to the tried and-tested standard variants of the built-in magnets with adhesive forces of 450, 900, 1,350, 1,800 or 2,100 kg, Ratec can also implement other designs and magnet strengths as required, or adapt the installation components structurally without losing adhesive force, for example for particularly narrow shutters.

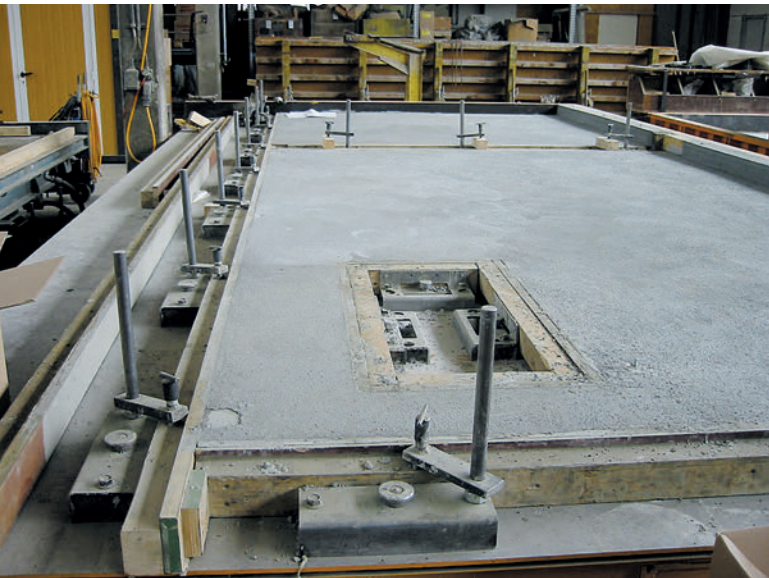
High performance neodymium magnets are used for the Pro-Magnet series. Stainless steel bandages and various coating steps and processes make the magnetic core extremely corrosion-resistant. Ratec's extensive know-how in the field of magnet design and application enables it to perfectly meet every customer-specific requirement with precision.



SPB as basis for fastening the MST formwork beam



Fastening of stair formwork by means of SPB



SPB with hold-down adapter

Low workload

The Pro-Magnet is activated by a foot click or rubber mallet, thus fixing the magnet box firmly to the steel formwork surface. Even if a tool is required to release the magnets, time and effort is saved because the integrated adhesive force is reliable and thus the number of magnets required can be minimised over the formwork length.



SPB with 2- and 3-sided combination bracket for fixing a recess

Flexibility

The standardised hole spacing of the screw connections for attachments and adapters on the magnet box ensures that the magnet boxes can be used flexibly in the long term. Among other things, the SPB is also the basis for the formwork systems Easy Form, MST (Modular Formwork Beam) and PSV (Pro System Vario), which, in addition to the magnet box, provide a modular system of standardised components that offers a flexible formwork solution for most applications.

Wide range of accessories

Another useful addition is a set of attachment brackets, which are available in different heights. With 2- or 3-sided combination angles, recesses in particular can be formed very well. Another category consists of adapters for holding down the formwork skin, either with a fixed height or as a variant with a hold-down bar to which a profile hold-down can be securely clamped in a height-adjustable manner.

Special solutions for radius formwork, for stairs or for welding on a steel formwork skin are also part of the company's extensive repertoire.

The SPB magnet box can also be used with repetitive element geometries to avoid re-adjustment. The HT stop adapter as an accessory for the SPB 900 (900 kg adhesive force) consists of a foldable stop bracket that is folded approx. 80 mm away from the formwork when stripping the formwork. When





SPB with HT stop adapter

shuttering again, the same geometry can be produced with the adapter folded forward again without having to re-adjust.

Continuity for maximum customer benefit

The basic design of the SPB has remained the same over the years and, with its clearly defined hole spacing, the users can rely on it.

The SPB can be used to form a wide range of elements, from planar solid elements with or without recesses, for both longitudinal and transverse shuttering, to stairs, columns and trusses (in combination with Easy Form and vertical supports), to volumetric elements such as cellar shafts (with Easy Form and vertical supports). In battery and module production, the SPB is also used to fasten Ratec's shrink window solution. Since its introduction, the SPB has proven itself in almost all areas of application. This makes it one of the most versatile solutions for forming precast concrete elements and a solid basis for formwork tasks. ■

FURTHER INFORMATION

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حلول مخصصة لتحديث مرافق الإنتاج وتحسينها

The renowned company mbk Maschinenbau in Kisslegg is increasingly establishing itself as a preferred partner for customer-specific solutions in the modernisation and optimisation of production systems. Through dedicated collaboration with customers and continuous expansion of the product portfolio, mbk is able to precisely identify and realise individual requirements.

تعمل شركة mbk Maschinenbau الشهيرة في مدينة كيسليج على ترسيخ نفسها على نحو متزايد بصفقتها شريكًا مفضلًا للحلول الخاصة بالعملاء في تحديث أنظمة الإنتاج وتحسينها. فمن خلال التعاون المخصص مع العملاء والتوسع المستمر في مجموعة المنتجات، تستطيع MBK تحديد المتطلبات الفردية وتحقيقها بدقة.

The modernisation and optimisation of existing production facilities is one of the focal points of the corporate strategy. Supported by the company's practice-focused development and design departments, this area is increasingly taking centre stage. Customers benefit from the many years of experience and the customer- and solution-orientated approach that is one of the company's guiding principles.

A very good example of mbk's innovative strength is the newly developed product family of the mbk DRA wire straightening and cutting machine. The DRA family offers solutions for different requirements in various versions:

DRA C features

Rotor straightener with one rotor, fixed measuring stop and upright cutters. A cost-effective solution, particularly suited

to jobs where the investment cost is paramount, without sacrificing quality.

DRA E-Features

Rotor straightener with a rotor, length measurement by a measuring wheel and optional stationary or flying cutter. This variant is particularly suitable for tasks where a high-quality solution with simultaneous flexibility is required.

DRA M features

Rotor straightener with up to six rotors, either stationary or flying cutters. This option offers very high performance and quality with great flexibility. This is an extremely worthwhile option, especially for customers who want to overcome capacity and quality bottlenecks in existing circulation systems.



Wire straightening and cutting machine DRA-C



Wire straightening and cutting machine DRA-E



Wire straightening and cutting machine DRA-20-M for wires up to 20 mm



DRA-M wire straightening and cutting machine with integrated double bender

Another special feature of the DRA M series is the possibility of equipping it with a double bender, which considerably expands the range of applications and flexibility. This facilitates use in new investments and retrofits in precast plants and reinforcement bending companies. Other automation solutions include possibilities for placing the wires on a circulation pallet or picking units.

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Benefits of shear keyed surfaces in precast building – Application in hollow core slabs for floors / roofs

فوائد الأسطح ذات خوابير القص في المباني مُسبقة الصب – التطبيق في الألواح الأساسية المجوّفة للأرضيات/الأسقف

■ Enric Solsona, Prensoland S. A.

At the interface between two precast concrete surfaces working in shear, there are three factors contributing to the shear resistance: The cohesion of the concrete / The forces normal to the interface surfaces/The dowel action by steel bars protruding one of the concretes and inserted in the other one. Depending on the finish of the concrete surface, different coefficients are assigned by the international codes in the calculation of the shear resistance.

عند الواجهة بين سطحين خرسانيين مُسبقي الصب يعملان في القص، هناك ثلاثة عوامل تساهم في مقاومة القص: تماسك الخرسانة/القوى الطبيعية على السطوح البينية/عمل الوتد بواسطة قضبان فولاذية بارزة من إحدى الخرسانات ومدخلة في الأخرى. واعتمادًا على تشطيب السطح الخرساني، يتم تحديد معاملات مختلفة حسب الاكواد الدولية في حساب مقاومة القص.

The American Concrete Institute Code ACI318, Nov.19, states the following:

Chapter 16.2.1.1 – Transfer of forces by mean of grouted joints, shear keys, bearing, anchors, mechanical connectors, steel reinforcement, reinforced topping, or a combination of these, shall be permitted.

From the table 16.4.4.2 – Nominal horizontal shear strength, of the same code, we can estimate that the concrete placed against hardened concrete intentionally roughened to a full amplitude of approximately 1/4 inch, mobilizes about 4 times more shear than the concrete placed against hardened concrete not intentionally roughened.

In Europe, the Eurocode 2, in turn defines the geometries of the hardened concrete surfaces as very smooth, smooth (slipformed or extruded), rough and indented.

The European approach is as follows:

The shear design value must be less or equal to the shear resistance.

The shear resistance must be less or equal to the friction mobilized by the shear key after cracking.

Both are summarized on the following equation:

$$V_{ED} = <V_{Rdi} = c f_{ctd} + \mu \sigma_n + \rho f_{yd} (\mu \sin \alpha + \cos \alpha) \leq 0,5 v f_{cd} \quad (1)$$

Where:

C, μ are coefficients assigned depending on the surface finishing:

Surface finish	'c'	'μ'
very smooth	0,025 to 0,10	0,5
smooth (slipformer or extruded)	0,2	0,6
rough	0,4	0,7
indented	0,5	0,9

σ_n : force normal to the interface surface.

f_{ctd}: design tensile strength

f_{cd}: design compressive strength (for acc = 1)

The third term of v_{Rdi} in equation (1) is not considered because there is no armature protruding from the slabs and inserted on the grout pored at the longitudinal joint.

But the same European code EC2 in point 10.9.3 (12) reads that in diaphragm action of hollow core slabs with grouted joints, the average longitudinal shear VRDI must be limited to 0,15 MPa for smooth or rough surfaces.

In other words, based on the European code EN1992-1-1 (Eurocode 2), all the existing smooth side hollow core slabs or with their installation in progress on the date this article is published, have a longitudinal shear limited to 0,15 N/mm² when they are meant to work in diaphragm action, which is the great majority of the cases.



Fig. 1: Shear key on the side of a 200 mm. thick pre-stressed concrete hollow core slabs.

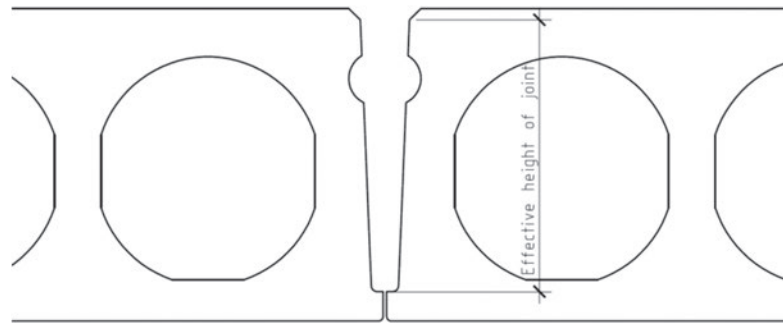


Fig. 2: Out of the total thickness, the shear key is applied to a zone on the sides.

Then the question is:

'Would the pre-stressed concrete hollow core slabs be indented, what is the order of magnitude of the shear brought by this shear key on the hollow core slabs used in floors/roofs?'

We are interested in the value by itself and comparing it to this of the extruded and the slipformed hollow core slabs.

Numerical example

Step A: shear resistance generated by the indenting covering 50 % of the effective height, 200 mm., on the 250 mm. hollow core slab side, when there is a force of 0,25 N/mm² normal to the joint.

The 50 % of the side surface smooth, generates:

$$v_{Rdi} = 0,2 * f_{ctd} + 0,6 * 0,25 \text{ N/mm}^2 = 0,2 * 1,2 + 0,6 * 0,25 = 0,39 \text{ N/mm}^2$$

The 50 % of the side indented surface, generates:

$$v_{Rdi} = 0,5 * 1,2 + 0,9 * 0,25 = 0,825 \text{ N/mm}^2$$

$$\text{Total } v_{Rdi} = 1,21 \text{ N/mm}^2$$

On a length of 1,0 meter: $V = 0,825 * (1000 * 200/2) + 0,39 * (1000 * 200/2) = 121,5 \text{ kN/m}$

If smooth, the code limits to 0,15 N/mm², therefore: $V = 0,15 * (1000 * 200) = 30,0 \text{ kN/m}$

The additional shear force brought by the indenting is: $121,5 - 30,0 = 91,5 \text{ kN/m}$.

Step B: friction generated by the 40 mm. concrete compression layer on the top of the slabs:

$V_c = b_w * d * f_v = 1.200 \text{ mm} * 0,04 * 0,63 = 30,24 \text{ kN/m}$ (value 0,63N/mm² following Walraven: 'Shear under which no shear reinforcement is necessary in elements unreinforced in shear, general limit, for concrete C40 and thicknesses up to 200 mm.) Therefore, we verify that the additional shear resistance of 91,5 kN/m is bigger to that of the compression layer 30,24 kN/m.

Step C: If we fit #10 teeth of length 50 mm each and height 100 mm in a slab length of 1,0 meter, according to the example shown, the resistance of each indenting submitted to compression will be the following:

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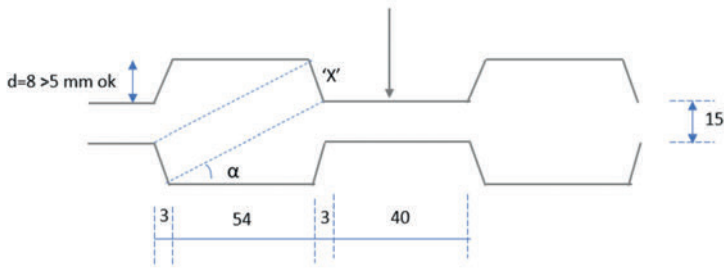


Fig. 3: Eurocode 2 compliant geometry of a shear key as example

Applying IPHA Precast Concrete Structures, II edition, prof. Kim S. Elliott:

$$\text{tg } \alpha = 23 / 57 \rightarrow \alpha = 22^\circ$$

$$X = 8 / \cos(\alpha) = 8,63 \text{ mm.}$$

The root shear area is: $\#10 * (3 + 54 + 3) * (h = 100) = 60.000 \text{ mm}^2$

The friction at the indented zone is $0,825 \text{ N/mm}^2$, then:

$$V = 0,825 \text{ N/mm}^2 * 60.000 \text{ mm}^2 = 49,50 \text{ kN}$$

$$\text{On each indenting there will be: } 49,50 \text{ kN} / (10 \text{ teeth} * \cos \alpha) = 4,95 / 0,927 = 5,33 \text{ kN}$$

The resistance of the teeth taking the weaker concrete (poured at the joint C25/30) including the correction factor is: $f_c = 5,33 \text{ kN} * 1000/100 * X' = 6,17 \text{ N/mm}^2$
 $f_{ck} / \gamma_c = 25 / 1,5 = 16,66 \text{ N/mm}^2 > 6,17 \text{ N/mm}^2$ stress on each tooth. OK.

Tensile forces across the joint must be avoided, meaning $\sigma \geq 0$.

This can be ensured by placing bars of convenient section, A_s , at the end of the slabs or even better would the hollow core slabs be cast using a plastic concrete, by producing them with a track of exposed wires at both ends.

Conclusion

In precast concrete construction, the shear key is contemplated by most of the international building codes as a mechanism for the transmission of additional shear. In affected zones they become an inelastic lateral mechanism for the absorption of energy during a seismic episode.

In non-seismic zones the shear brought by the side indenting equals or even exceeds this from the compression layer on the top of the hollow core slabs of a floor.

The same side indenting is also refraining the transmission of vibration at the longitudinal joints for what in most of the cases the use of cross bars or bands of mesh on the top of these joints as it happens to the filigree slabs is no longer required. ■

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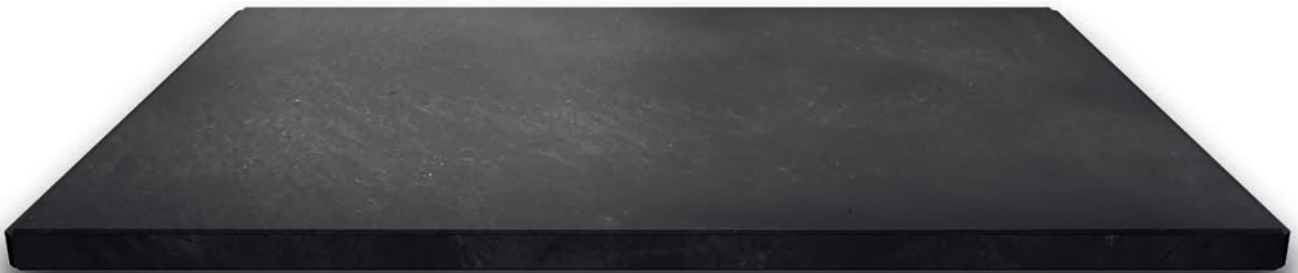
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