CEMENT & BUILDING MATERIALS REVIEW

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ARAB UNION FOR CEMENT AND BUILDING MATERIALS

Cement and Building Materials Review

Arab Album | International News | New Products | Technical Articles | Diary Dates

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Egyptian Gulf Bank to lend Beni Suef Cement LE200 m

Egyptian Gulf Bank (EGBE) has agreed to provide a LE200 million loan for Misr Beni Suef Cement (MBSC).

The loan will be divided into two equal disbursement worth LE100 million each, the first will fund the coal production line investment costs, and the other will cover the working capital.

Beni Suef Cement announced in October the signing of contract to build a coal mill in 12 months for 200 million.

Source: Shorouk Newspaper & Arab Finance Editor

Suez Cement completes coal trials at Katameya plant

Suez Cement has completed the trial period of using coal to run its Katameya factory and it is now the main source of fuel at the Egypt-based factory.

The Italcementi group company is currently operating at 80 per cent of it 1.5Mta capacity compared to 50 per cent during times of natural gas supply shortages.

The company said that energy mix at the Katameya factory consists of coal (85 per cent), industrial waste (10 per cent) and ordinary energy (five per cent).

The cost of converting the Katameya factory to coal was US$10m, in addition to the US$8m to raise the environmental standards of the factory.

The company's cement plant in Suez should have started using coal in January, expecting that, following the switch, capacity utilization at the Suez works will be increased from 60 to 80 per cent.

Suez Cement will also start the planned 120MW windfarm after completing the technical study. Upon completion, the windfarm will supply 3040- per cent of Suez Cement's energy needs by the end of 2015.

Arab Union for Cement and Building Materials
(AUCBM)

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www.aucbm.org

Members

Ciment de SIBLINE sal

SIBLINE is one of the 3 clinker and cement producers in the Republic of Lebanon. SIBLINE currently produces 3,400 tons of clinker per day. Thus, resulting with an annual production of cement exceeding 1.35 Million tons.

In addition, SO.IME Liban sal, a subsidiary company of SIBLINE**,** produces readymix concrete at an annual capacity of 200,000m^3.

Since 1975, SIBLINE has been a key player in the Lebanese cement industry.

In 2012, SIBLINE completed an upgrade project on its clinker production line 1 which consisted of preheater cyclone modifications and improvements including the installation of the Gooseneck. This enhancement allows for more than 40% utilization of alternative fuel. This project also included the installation of a complete new clinker cooler with a production capacity of 1000 metric tons per day.

In 2014, major changes occurred within SIBLINE which enable the company to be at the forefront of the construction industry growth and future developments projections for the MENA region. Indeed, thanks to the addition of two new business lines the Lightweight Construction Solutions and the Construction Chemicals, SIBLINE has expanded in order to better serve the needs of the construction sector by offering a diversified range of construction material and products. Furthermore, SIBLINE is surely migrating towards a sustainable production with an increased commitment to be environmentally friendly.

As part of this upgrade and for a better compliance with the environmental requirements, SIBLINE replaced the Electrostatic Filter of Kiln Line 1 with a bag house filter for final dedusting.

Last but not least, SIBLINE still aims at attracting highly talented young individuals and has undergone a brand refresh to protect its brand equity and keep it up-to-date.

Members

Arkan opens Dh1.3 billion cement factory in Al Ain

Arkan Building Material Company opened Dh1.3 billion cement factory outside Al Ain

The greenfield plant has capacity to produce four million metric tonnes of clinker and 5.7 million metric tonnes of cement per annum.

The cement plant will source its raw material from its own queries in Al Ain and Oman.

The cement plant will meet the local requirements as 90% of its output will be consumed domestically and only 10% will be exported to GCC countries.

The UAE's cement industries manufacturer 35 million metric tonnes annually against the domestic demand of 10 million metric tonnes.

The factory would ensure leadership in production of cement as it will boost output capacity to four million tonnes of clinker per year from 900,000, while annual cement production will go up 5.6 million tonnes from 4.5 million tonnes.

http://www.khaleejtimes.com

Sinai Cement coal conversion

Sinai Cement plans to invest US$ 41.9 to convert its cement plants for the use of coal instead of natural gas.

Source: www.globalcement.com

Southern Cement's third line is 70% completed

Southern Province Cement Co has completed 70% of the third line of its Tahama plant. The project is supposed to be complete on by March 2015

Source: www.globalcement.com

'The Acknowledged Pacesetter'

The first cement producer both in the Kingdom of Saudi Arabia and the region as a whole, Arabian Cement Company (ACC) was first incorporated in 1955, steadily expanding over the years to produce up to 12,000 clinker tons per day as of 2014.

A leading Public Listed group based in Jeddah, ACC operates within the cement and ready-mix markets, both inside and outside of Saudi Arabia, and is ranked as one of the largest 100 companies in the Kingdom, with its main activities revolving around the Rabigh plant, the Qatrana plant in Jordan, a ready-mix concrete and construction supplies company in Jordan, and a cement products company.

No matter what the business unit, ACC is committed to producing high quality cement and associated products in accordance with the very highest international standards, thus allowing it to meet the required specifications of the marketplace at a competitive price. Achieving long-term, sustainable success by exceeding customers' expectations is the company's primary goal, whilst continuously improving the effectiveness of its quality management systems by investing in the very latest technology and constantly upgrading its manufacturing facilities.

With a strong emphasis on innovation, training and

development, ACC ensures that it has meticulous quality control systems in place in order to ensure product compliance, as well as acting upon a clear commitment to environmentally friendly production.

ACC is renowned for its ability to attract and retain high calibre personnel, and then offering them ongoing training for continual professional improvement. Moreover, the company's top management team is committed to personal involvement in all major projects, with their expertise delivering value that makes a real difference.

ACC is fully committed to helping its clients reach their goals, professionally and cost-effectively. And in doing so it ensures the highest standards in health and safety. Part of its philosophy is that business can be carried out efficiently, with the very finest workmanship, without compromising the health and safety of its workforce.

Ranked sixth in the industry, with a 7% market share nationwide, ACC is looking forward confidently to ongoing growth and expansion, with the company aiming to be in the top three within the next five years.

The company will approach this task in several ways. Currently, for instance, ACC is proceeding with the construction of line number seven, which will add 10,000 additional tons of clinker production per day.

What is more, ACC has the advantage of being very well located in the western region, including being right next to King Abdullah port facilities adjacent to its production area. The company has a competitive edge due to its geographical position. As a result, ACC will carry on its efforts to raise the production capacity of its production lines to new highs, whilst maintaining the safety, quality and reliability of its equipment.

ACC in uniquely qualified in what is a specialist field and possesses resources that allow it to provide a comprehensive array of products and services, whilst applying the latest innovations in industry practices and cost control methods to ensure that clients are continually delighted with the service they are given. The difference, the people, the experience and the methods that ACC provides results in on time, on budget, quality controlled projects.

Great teamwork and reliable technology minimise plant disruption

Introduction

When plant equipment fails, replacement technology is not the only answer. Teamwork plays a vital role in ensuring operations get quickly back to normal.

Story

Something was amiss at the Tahama Cement Plant in Saudi Arabia. The gearbox installed on one of its mills had not been meeting performance requirements, and when the gearbox failed, a quick solution was needed to get the mill back into operation.

Meanwhile on another of Tahama's mills, an FLSmidth MAAG gearbox had consistently been performing to expectations. So when the decision had to be made for a replacement gearbox, the choice fell on FLSmidth MAAG.

The Tahama Cement Plant is owned by Southern Province Cement Company (SPCC), one of Saudi Arabia's leading cement producers. SPCC operates three cement plants with a total cement production capacity of over 5.3 million tpa. The Tahama plant produces more than 1.85 million tons of clinker a year. Peter Brockmann, Field Service Engineer at FLSmidth MAAG, arrived at the Tahama plant soon after the gearbox failure. The old gearbox had already been removed and Peter and his colleagues could quickly get to work. The project consisted overall of two parts. First, the foundation needed to be prepared. Then the gearbox could be installed, aligned and tested.

Peter Brockmann explains the challenge of preparing the foundation: "The foundation of the previous gearbox was quite complex and not compatible with the FLSmidth MAAG CPU. So the first part of the project involved completely overhauling and renewing the foundation."

SPCC was aware of this challenge, and it was one of the main reasons FLSmidth MAAG had been chosen. Yet SPCC wanted assurances that the new gearbox would meet its performance requirements, as any potential malfunctions and resulting downtime would be costly. This is where FLSmidth MAAG's professionalism and expert knowledge of the particular demands of a cement mill came to the fore. The installation engineers brought a professional attitude and they knew it was important to work as a team with the site's staff, especially as time was of the essence.

Peter Brockmann says, "Our client wanted to know that we could make everything work despite the challenges of the project. It was important that the foundation was prepared properly so that the gearbox would have optimal conditions. We were confident we could deliver to SPCC's expectations as we brought many years' practical experience to the challenge and had completed many similar projects before. The key, especially when you have to work at speed, is teamwork, which involves communicating and everyone taking responsibility for specific tasks."

During the finalization of the foundation work, the principal task of replacing started with the positioning and rough aligning of the gear unit to the mill. This includes the precise control of the mill input flange and mounting of the coupling connecting the mill to the gearbox. This task is followed by fixing the gearbox to the foundation.

With the aligned gearbox fixed and grounded, the oil system and piping can be installed. A functional test of the oil system is necessary before the flushing of the equipment starts. After all these tasks, the functional test of the protection interlocks and the final alignment of the motor and gear unit are the last steps to be performed before the final spin test and hot commissioning of the mill can start.

Today, the mill is once again fully operational thanks to the FLSmidth MAAG CPU and the quick response and professionalism of the SPCC and FLSmidth MAAG teams.

Author: Peter Brockmann, Field Service Engineer at FLSmidth MAAG

Pictures:

New CPU ready to be installed

mill waiting for new CPU

Market leading

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Customer satisfaction drives repeat Siwertell road-mobile unloader deliveries

Following an order signed in early November 2013, Siwertell, part of Cargotec, delivered a road-mobile unloader to Muhammet Gümüstas AS in Istanbul, Turkey, in December 2014. This is Siwertell's third road-mobile unloader delivery to the operator since 2012.

"Satisfied customers placing repeat orders are testament to the quality and efficiency of our state-of- the-art unloading solutions," says Jörgen Ojeda, Director, Mobile Unloaders, Siwertell. "As an existing customer, Muhammet Gümüstas is well aware of the advantages of using our mechanical unloading equipment, and has chosen Siwertell as a preferred supplier of unloading systems.

"Our customers are happy to prioritise quality, reliability and excellent service over the short-term attractions of making a slightly cheaper initial investment. Repeat customers also prove the value of our wider strategy of building and maintaining long-term relations with our customers as an effective pathway to success for all parties." The trailer-based, diesel-powered, Siwertell 10 000 S road mobile unloader will be used to discharge cement at 300t/h. The unit was built at Siwertell's manufacturing premises in Bjuv, Sweden. It is equipped with a double bellows system to allow continuous operation, and a dust filter to minimise dust creation.

"The mobile Siwertell unloader was originally designed for handling cement, so it is naturally perfect for the job. With its enclosed conveying line, this system is also environmentally-friendly as it ensures dust-free and high-capacity unloading operations," adds Mr Ojeda.

Following our very successful Symposium in 2014, we are glad to invite you to the

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For registration, please visit www.lechtenberg-partner.de/html/e_3.html

The programme will feature a range of senior industry decision makers and technical experts covering the key aspects of alternative fuels technologies used in the cement, lime and power generation industry.

On Wednesday, the 14th of October

a wide range of **case studies** in alternative fuels processing, storage, dosing and feeding will be presented by leading equipment providers, such as **ATEC, Praxair, FCT International, Di Matteo, FLSmidth Pfister, Lindner Recyclingtech, MHC Engineering, Metso, Schenck Process** among others.

On Thursday, the 15th of October

we will have the honor to welcome the following keynote speakers among others:

Market Developments

Ahmad al Rousan, Secretary General Arab Union for Cement & Building Materials, the Inter-Arab International Organization, affiliated to the General Secretariat of the Arab League and the Council of Arab Economic Unity

Bruno Carre, Italcementi Middle East VP, CEO, Suez Cement Co, Egypt

Funding Alternative Fuels Projects

Michel Folliet, Chief Industry Specialist – Global Manufacturing, International Finance Corporation, part of World Bank, USA

Dr. Ing. Wolfgang Pfaff-Simoneit, Technical Expert of KfW development bank, Germany

Case Studies in the use of Alternative Fuels

Dr. Ziad Habib, Director, Corporate Process Development and Process Innovation, Lhoist Group, Belgium

Stephan Wehning, Plant Manager, Heidelberg Cement Ennigerloh, Germany (tbc)

Anthony Nicolopoulos, Alternative Fuels Development Director, Titan Cement Co, Greece

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New Siwertell mobile unloader serves Kuwaiti construction industry

CARGOTEC CORPORATION, PRESS RELEASE, 8 DECEMBER 2014, AT 10 A.M. (EET)

Siwertell, part of Cargotec, has announced the successful delivery, commissioning and recent entry into operations of a new mobile Siwertell unloader for Kuwait-based Acico Construction Co. It was ordered in June to help meet the region's growing cement demands and is now operational in Kuwait's second largest port, Shuaiba, located south of Kuwait City.

The trailer-based, diesel-powered Siwertell 5 000 S road mobile unloader is fitted with dust filters and a double bellows system for uninterrupted operations. It was built in Sweden and is now unloading cement at a rated capacity of 300t/h.

The Siwertell road-mobile unloader was originally developed for handling cement, although it can comfortably handle a wide variety of dry bulk materials, explains Jörgen Ojeda, Director, Mobile Unloaders, Siwertell. "Siwertell is considered to be one the leading manufacturers of mobile unloading systems, offering the highest standards of reliability and sustainability, along with the lowest environmental impact possible for cement operations.

"Previously, Acico has enjoyed very positive experiences operating Siwertell mobile unloaders belonging to third parties. This was an important factor in helping the company to conclude that it would like to own and operate its own unit," he adds.

"Siwertell's reputation for delivering reliable systems often makes it the preferred choice. They understand that, in the long run, a low priced system could prove to be more expensive as a result of longer downtime, high maintenance costs and a substantial need for spare parts to keep the system up and running."

ACICO Construction, part of ACICO Industries Company, was founded in 1990 and has experienced sustained and steady growth, says the company. In 2012, it won the Arabian Business Magazine award for 'Green Building Company of the Year', highlighting the company's aim for good environmental credentials.

For further information, please contact:
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Siwertell is part of Cargotec. Cargotec's sales totalled EUR 3.2 billion in 2013 and it employs approximately 11,000 people. Cargotec's class B shares are quoted on NASDAQ OMX Helsinki Ltd. under symbol CGCBV.
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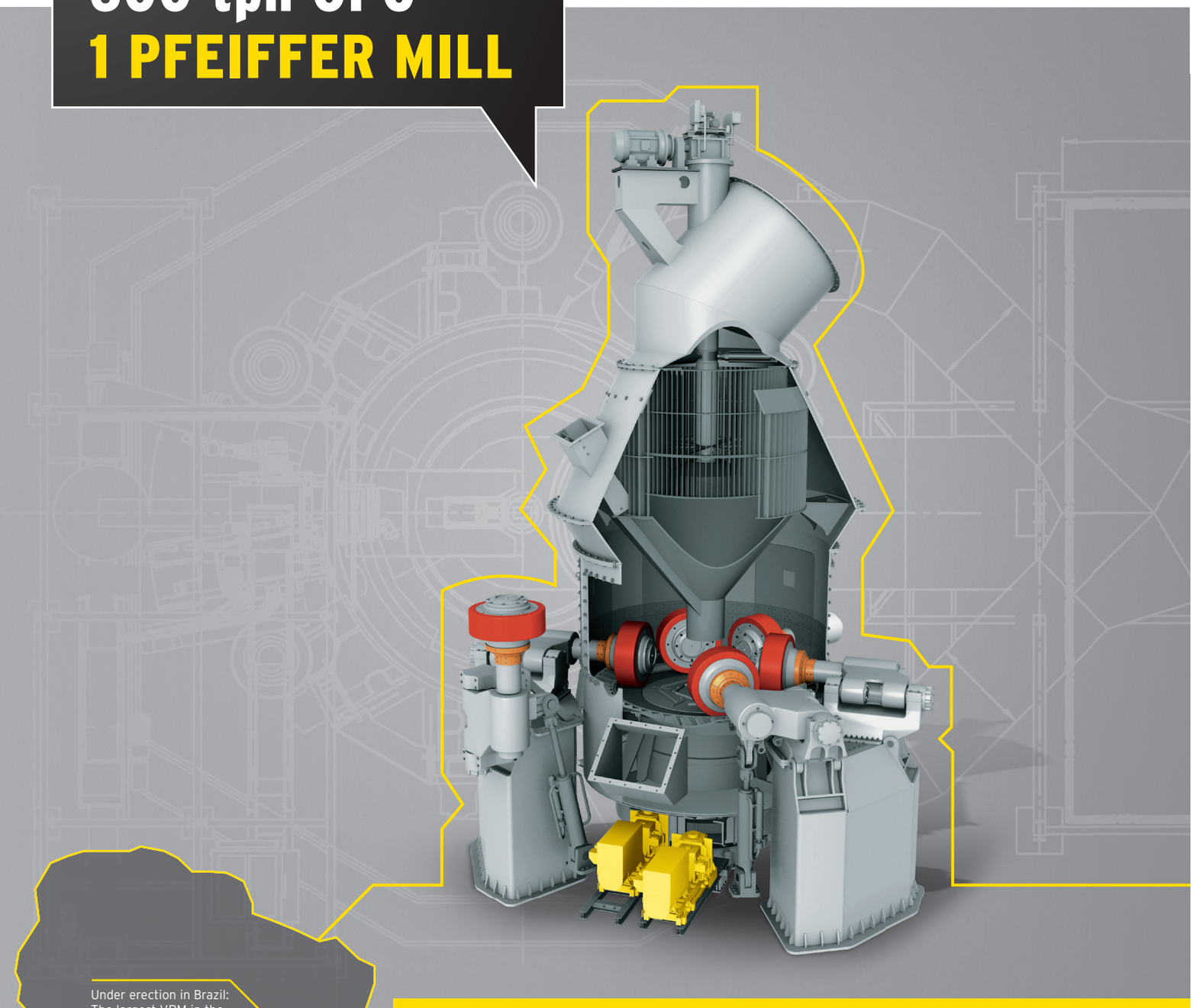

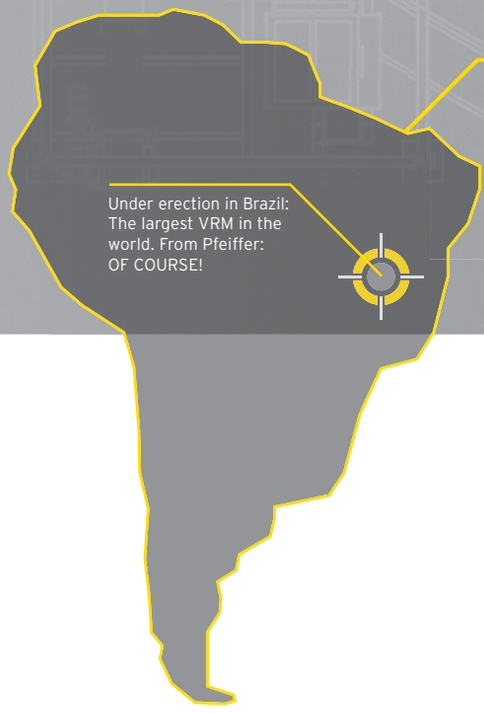

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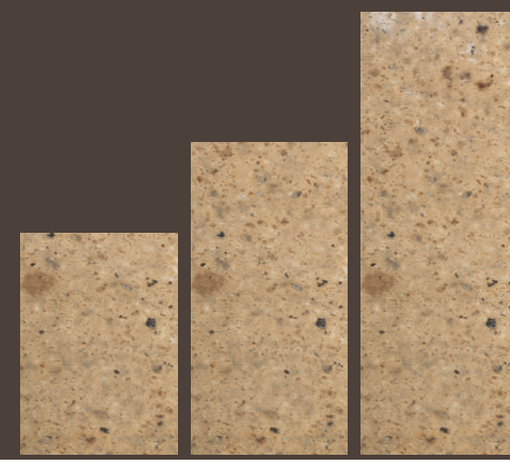
New expert group at Höganäs Bjuf strengthens the company's cement offering



Höganäs Bjuf is a world-leading producer of high-quality refractory solutions for a wide range of applications. The most important market segment is cement production where Höganäs Bjuf supplies smart refractory products for the entire production process – from the cyclone tower to the cooler. With more than 450 customers in over 60 countries Höganäs Bjuf is the true cement specialist.

In order to further strengthen the offering for the cement industry, Höganäs Bjuf has formed the Technical Group Cement (TGC), an expert group that will be responsible for technical development and support on a worldwide basis.

The group is led by Milan Maciga, Group Technical Manager and Area Sales Manager, Eastern Europe. Milan Maciga has more than 30 years of experience within the cement industry. He has superior knowledge of refractory solutions and installations, the cement production process and manufacturing technology, alternative fuels, kiln pyro processing and process chemistry operation. Supporting him is Alexia E. Yiakoumi, Eng. Ph.D. and Technical Marketing Manager Cement. She is an expert in materials selection and development and refractory design. The group consists of technical managers, engineers, designers, supervisors and sales representatives with a high level of technical expertise and extensive insight to market needs.

The main tasks of TGC will be improving existing design solutions and installation procedures, monitor material performance on site and create references,

develop manuals and marketing materials, provide training and educational seminars, perform market research on latest developments in refractories, participate in conferences and exhibitions, and write articles for technical press. TGC stays in close cooperation with the Research and Development centre in Bjuv to review material performance and share knowledge on existing solutions and new products designed according to the customers' needs.

"Höganäs Bjuf has a strong commitment to research and development", says Milan Maciga. "TGC provides a means to further improve our offering for the cement industry and increase the level of service for our customers."

For more information about TGC, contact Milan Maciga at +00420 602 681 686 or : milan.maciga@hoganasbjuf.se.

Höganäs Bjuf began producing refractory bricks in 1825. Today the company has an extensive knowledge and experience in refractories, offering industrial customers a complete range of refractory products and turnkey solutions. Höganäs Bjuf is a multinational organization, and member of Borgestad ASA, which is listed on the Oslo Stock Exchange in Norway. The company is headquartered in Bjuv, Sweden, with subsidiaries in France, Germany, Russia, the Middle East, Malaysia and the Philippines, and agents and representatives around the world.

Porcelanosa reinforces its leadership with Sacmi

Complete plant renewal, which focuses on quality, productivity and energy savings, now under way

The Porcelanosa Group, a global player on the ceramic manufacturing scene and Spain's leading ceramic enterprise, has begun a radical renewal of its production plants as part of a continuous improvement policy centred on quality enhancement and optimisation of the production process. Needless to say, Porcelanosa has chosen its esteemed partner Sacmi to supply several latest-generation machines equipped with the most advanced market-available technology.

The starting point for this production plant renewal, expected to be completed within a year, is the new grinding line. The 'hub' of the line will be the new continuous-grinding MMC120 mill supplied by Sacmi; this will replace the 8 discontinuous grinding mills currently in use, thus providing major energy savings while simultaneously optimising the production process in terms of both costs and the quality of the ground powders.

Further on, the following months will see progressive replacement of the six existing presses with an equal number of Made-in-Sacmi PH5000L units with higher pressing forces (up to 49,000 kN) more suitable for larger tiles. Together with installation of the new presses, the drying department will also be upgraded; this will be done both by adapting some existing machines to keep pace with the increased output rates of the presses and by installing new driers to replace others entirely.

Lastly, the installation of a brand new single-layer FMP285 roller kiln with an overall length of 109.2 metres, equipped with all the latest gas and electricity consumption reduction devices, will allow Porcelanosa – already ISO 18001-certified on account of its commitment to cutting environmentally harmful emissions – to achieve further energy savings while simultaneously reducing CO_2 emissions. The new kiln has also been specially designed to ensure optimal control of every single stage of firing, even with very large tiles, and to boost finished product quality.

With this ambitious investment plan, then, the Porcelanosa Group has set itself a dual goal: on the one hand, the aim is to enhance quality and productivity by making the best possible use of Sacmi-supplied excellence and so reinforce its leadership on both Spanish and international markets. On the other, there is the goal of continuing its policy of corporate responsibility by reducing potentially harmful emissions into the environment and completing a project that is likely to offer good employment prospects for the entire "Plana" area.

Egypt signs MOU with Italcementi to build $200m wind farm

Facility will generate 120 Mw of energy, with production beginning in late 2015

Italian cement maker Italcementi signed an MOU with the Egyptian government to build a wind farm on the Red Sea, part of the country's effort to mitigate its power shortages through renewable energy.

The company will build a facility to generate 120 megawatts of electricity with an investment of $200 million, Omar Mehanna, chairman of Italcementi's subsidiary in Egypt Suez Cement, said in a phone interview. Construction is expected to begin in the second quarter of 2015, and production by the end of that year, he said.

Egypt has been suffering from an acute energy crunch for almost four years, with frequent power cuts fuelling discontent against former president Mohamed Morsi and leading to his eventual ouster in 2013.

To mitigate the crisis, the government in September approved feed-in tariffs for renewable energy production, enabling solar energy producers to sell electricity to the government.

The government will provide an 11 square-km piece of land in El-Zaafarana coastal town, 200 km east of Cairo, to Italcementi through a usufruct agreement.

A later stage of the project will see Italcementi building a facility to produce 200 megawatts with an investment of $330 million, Mehanna said.
The agreement was signed during President Abdel-Fattah El-Sisi's visit to Italy where he met with Italian officials, the pope and business representatives.

http://english.ahram.org.eg/News/116432.aspx

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A new digital frontier for Al Maha Ceramics

The SITI B&T group has signed a new agreement with Al Maha Ceramics, a tile manufacturer located in Oman, to install two **digital machines of the Evolve range** produced by the Group's partner, Projecta Engineering.

The line comprises an **Evocore8** and an **EvocoreSix**. They are digital inkjet decorating machines that implement the "drop on demand" technology and are developed to print ceramic tiles. Their top features are **compactness** and **user friendliness** and can accommodate from 6 to 8 colour modules.

The **Evolve digital decorating machines** definitely represent the **most complete and versatile range** on the marketplace at present, with impressive colour space capacities, to **enhance new material designs and new digital effects on ceramic tiles.**

Al Maha Ceramics is in fact renowned in the Middle East for its distinct design style extending from stone to metal and from modern geometric models to decorative pieces rich in colour and charm. Al Maha chose the cutting-edge technologies offered by the machines of Projecta Engineering in order to support its production needs of versatility and the extent of its product range.

The SITI-B&T Group is a manufacturer of complete plants for the worldwide tile manufacturing industry and has a widespread network on all marketplaces. It offers supreme technological solutions and innovative services and focuses in particular on energy efficiency and reduction in production costs.

It guarantees its customers a complete and tailored service that includes technical assistance for the installation, maintenance and refurbishing phases of production lines.

The SITI-B&T Groups works through the divisions "Tile" (complete tile manufacturing systems), Projecta Engineering and Digital Design (digital decorating machines and digital graphic projects); "B&T White" (complete sanitaryware systems) and B&T Automation (end-of-line automation systems), in collaboration with the renowned sister company SIR (cutting-edge robotic systems).

In 2013, it registered a consolidated turnover of 173 million with a growth of 14.5% and a share of over 80% in exports.

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Formulation of bentonite cement grout for sealing walls

Formulation of bentonite cement grout for sealing walls

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Abstract : *Marine and land environment is deeply affected by NPK company phosphogypsum storage in Sfax city. A part of Taparura project aims to confine this pile of partially or totally heavy metal pollution by creating a sealing wall made up of bentonite waterproof cement. This study is about a methodology formulation of cement bentonite grout to build the screen. The physical properties of fresh and hardened material as well as its mechanical properties were determined. First, a synthesis bibliography introduces the bentonite and cement properties material composition as well as the methods of formulation and standardized tests. Second, an experimental study was carried out to formulate the cement bentonite material. This study has permitted the determination of B/WB, B/C and WT/C ratios of the BC grout and the strength properties of the projected grout. Moreover, the properties of grout in fresh state of bentonite-cement are in a good correlation with the desired conditions for the screen execution. The vertical permeability obtained is so low which limits greatly the flows through the screen. The Young modulus of cement bentonite material is near the soil modulus which conducts to the same strains in both soil and screen thereby reducing micro cracks in screen.*

Keywords : Permeability, grout, sealing wall, viscosity, decantation or settling, durability, mechanical properties…

1. Introduction

The environment is increasingly affected by industrial waste and residues. The industrial sub-products are generally stored on depots and are loaded with pollutants even harmful agent sometimes. The NPK company phosphogypsum pollutants are composed of heavy metals such as zinc, lead, mercury, acids, sulfates and chlorides, nitrates and radiant gas.

Watertight walls are generally used to contain industrial waste by limiting the loaded water flow and therefore, the migration of pollutants. The screen can be used as an obstacle or watertight screen in layers of permeable soils. In fact the screen must be flexible and capable of undergoing deformation without cracking. The screen technique execution consists on evacuation a trench and then to fill it with a grout of bentonite cement. The grout first acts as a support of the trench walls and establish then a watertight wall. The main features of a watertight wall are:

- a sufficient mechanical strength with similar deformability of the surrounding soil,
- a low permeability of 109- m/s that is compatible with the environmental conditions,
- a resistance against chemical attacks to provide a better durability.

According to international standards such as the French legislation (13 July 1992 law), Canadian federal regulation and the American Environmental Protection Agency, Chapuis et al, (1990, 2002), Kouloughli et al (2007) the low permeability of a sand bentonite grout.
This paper presents, first, a bibliographic synthesis dealing with:

- types of bentonites and the physical properties of bentonite grout,
- suitable cement properties for environment consideration (adapted to sulfate and acid marine environment issued from the phosphogypsum deposits),
- methods of preparation of cement bentonite grouts,
- Appropriate tests and available standards for grout characterization.

Second, an experimental study is carried out to propose an optimum formulation of the grout composed by the bentonite (**B**), cement (**C**) and water ($\mathbf{W_T}$). The influence of ratios **B/C** and $\mathbf{W_T/C}$ is analyzed on physical properties of the fresh grout, the mechanical properties of hardened grout such as resistance to compression and tensile as well as the Young modulus in compression and the permeability of hardened grout. The main objective of this study is to find out a formulation methodology of a cement bentonite grout to build sealing walls. The approach consists of dosage variation of the grout components in order to obtain the desired mechanical and physical properties of the wall.

2.Bibliography synthesis

Watertight screens can be used either for the insulation of the storage sites of environment hazardous waste such as phosphogyps or olive water and in permeable soils of dams foundation to prevent water flow. Several types of watertight screen can be designed, Massiera et al, (1999)

- excavated soil mixed with betonite screen **SB**, Liausu et al, (2006)
- soil mixed with betonite screen **SabB** , Kouloughli et al (2007)
- excavated soil mixed with bentonite and cement screen **SBC**, Christopher (2002)
- grout of bentonite cement screen **BC** Portland Cement Association, Opdyke et al (2005), Evans J. C. et al (2006)
- concrete with bentonite screen **BB,** (Zemamla (2008)).

The screens with cement are self-hardened due to cement hydration. The perfect sealing is obtained by introducing a sheet of polyethylene in the trench filled by the grout (in case of **BC** screens), the sheet longevity is important and is about 100 years. The wall casting is basically composed of cement, bentonite and aggregates of sand 04/, grit 48/, eventually an adjuvant and in some cases excavated soil containing fine silt siliceous.

2.1.Bentonite

Bentonite belongs to the family of smectite Chapuis (1990, 2002) . According to Gleason et al (1997) particles of bentonite are composed by assemblies of parallel leaves. The basic molecule of bentonite is $\mathbf{4SiO_2\ Al_2O_3\ H_2O}$ where $\mathbf{SiO_2}$ is silica silicate, $\mathbf{Al_2O_3}$ is alumina and $\mathbf{H_2O}$ is water.
Properties of bentonite suspension help to develop viscosity and to produce thixotropic gel. Due to their clogging and agglomerating properties those suspensions contribute for cake formation by filtration. According to Centre for Civil Engineering Research and regulations, main properties of bentonite to be used in a sealing wall:

- Unit mass of solid particles $\mathbf{p_s}$ > 2.6 g/cm3,
- Gradation with refusal of 125 µm less than 5 %,
- Blue methylene value $\mathbf{V_{BS}}$ > 22,
- Plasticity index Ip higher than 200,
- Shrinkage index $\mathbf{I_R}$ must be high,
- **PH** suspension from 8.5 to 9.5,
- Water absorption is more than 500% in 24 hours,
- Calcium carbon content $\mathbf{CaCO_3}$ is less than 5 %.

The water content of bentonite $\mathbf{w_i}$ should not exceed 13 % at its initial state.

2.2. Cement type

The choice of cement essentially depends on the environmental conditions where the wall will be installed. In fact, for an aggressive marine environment (sulfated water), the cement used in screen must resist to sulfates and percolations sewage from phosphogypsum storage (phosphoric acid attacks: **PH** is approximately equals to 3). According to NF P 18 - 011 standard the criteria in choosing cement are:

- three levels of protection 1, 2 and 3,
- four classes related to aggressiveness especially to acid attacks $\mathbf{A_1}$, $\mathbf{A_2}$, $\mathbf{A_3}$ and $\mathbf{A_4}$,
- the aggressive agents in the soil or in solution such as ions of sulfates $\mathbf{SO_4^{--}}$, ions of magnesium $\mathbf{Mg^{++}}$, chlorides $\mathbf{Cl^-}$; ammonia $\mathbf{NH_4^+}$ and the $\mathbf{CO_2}$ gas,
- the **PH** of the environment.

The standard requires a level three for protection and $\mathbf{A_4}$ as aggressiveness to choose the screen cement. The $\mathbf{C_3A}$ content should be less than 5 % to resist against sulfated sea water. As for acid attacks the slag content must be greater than 60 %, a minimum content of 80 % is required by the Centre for Civil Engineering Research and regulations to ensure a good impermeability and acceptable resistance of **BC** material. The **CEM III/C** 32.5 is cement with granulated blast furnace slag (S) with slag content between 81 % and 95 %. This cement revealed suitable for the conditions of Taparura project due to the following reasons:

- It develops resistance to acid attacks,
- It develops a better resistance than **CEM I** and **CEM II**,
- Its high specific surface offers an impermeability of screen material lower than $\mathbf{108^{-m}/s}$ **BC**.

3. Experimental study of bentonite cement (BC)

The experimental study is to determine the proportions of the various components of bentonite-cement grout in order to obtain a waterproof and flexible screen able to follow ground deformation to avoid micro cracks creation.

Two stages are needed to formulate betonite-cement material BC. In the first stage consists on the determination of the mechanical and physical properties of identified products. The preparation of such mixture needs the following steps:

a. preparation of bentonite grout from bentonite and water. It consists on physical properties determination of bentonite grout and their variation with water dosage,
b. preparation of bentonite-cement grout **BC** which consists on mechanical and physical properties determination in function of used dosages.

The second stage is to propose recommendations about possible dosages as well as the main parameters of formulation of bentonite cement grout for sealed walls.

3.1. Bentonite Identification

Tunisian bentonite SOFAP for oil drilling was characterised by tests performed at the "Higher Institute of Technological Studies at Sfax (Tunisia)" (Karchoud et al, (2007)). The obtained results are:

- Unit weight of solid particles ρ_s **= 2.64 g/cm³,**
- methylene blue value V_{BS} **= 26,**
- plasticity index I_p **= 184,**
- Shrinkage index I_R **= 284,**
- Carbonate content $CaCO_3$ **= 5 %,**
- Initial water content W_i **= 10 %.**

The tested bentonite is classified as a sodium bentonite due to its low CaCO3 content. Moreover it has a very significant plasticity index and a very high withdrawal index. Further, its high blue methylene value is an indicator of strong swelling potential.

3.2.Cement identification

CEM I HRS 42.5 is currently available on the Tunisian market; the class is verified in accordance with the current standard in Tunisia. The consistency test shows that the water cement ratio W_c/C is approximately 0.26; the Blaine specific surface **SSB** is about 5000 **cm²/g**; absolute density is 3.1 **g/cm³** and its apparent density is **1g/cm³**.

3.3. Preparation of bentonite grout

According to standards: Guide specifications cement bentonite slurry trench, (Portland Cement Association (PCA), USA), Cement-bentonite screen (1997) by the Centre for Civil Engineering Research and regulations, and recommended procedures (Erik Mikkelsen P. (2002)), It first consists in measurements of physical properties such as the **Marshall** Cone viscosity, the density, the decantation, the filtrate cake, the time stability of the grout and the sand content in case the grout is used to retain diaphragm walls.

a.Marshall viscosity

This test provides the measurement of flow time to recover fixed volume of grout and, therefore, informs about the influence of water dosage on the grout viscosity (Figure 1).

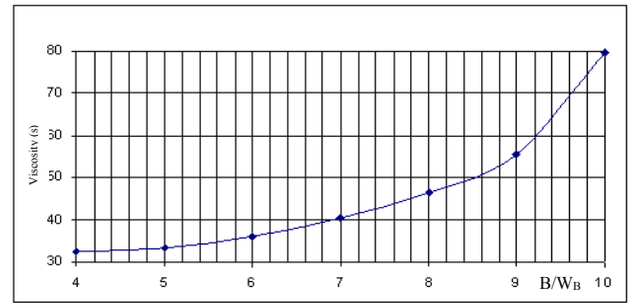


Figure1. Variation of grout viscosity in function of bentonite–water ratio B/W_B

Saturation dosage is the needed water quantity to maintain the grout stability (physical parameters such as density, viscosity and decantation remain unchanged). In this case the saturation dosage corresponds to the minimum of the slopes of the curve (Figure 1) reached for a ratio B/W_B = 5 % as recommended by references: Centre for Civil Engineering Research and regulations and Guide specifications cement bentonite slurry trench.

b.Density

It is measured with the pycnometer method, or with the mud balance which be used in worksite. Figure 2 shows the variation of SOFAP bentonite grout density as a function of the water weight to bentonite ratio B/W_B. It is noticed that for dosages of 5 % to 6 % the density is slightly greater than water density and the walls retention is guaranteed. Density is also a fundamental parameter for the retention wall, According to references: Centre for Civil Engineering Research and regulations and Guide specifications cement bentonite slurry trench, the density value should not exceed 1.15

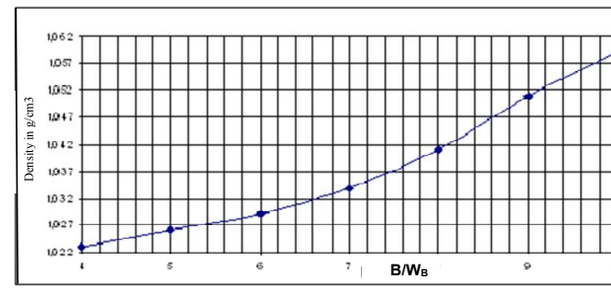


Figure 2. Variation of bentonite grout density in function bentonite-water ratio B/W_B (%)

c.Test of decantation

It is performed within a glass tube of 100 cm3 volume (Table1). The bentonite decantation should be less than 2.5 % in 2 hours and less than 3 % in 4 hours.

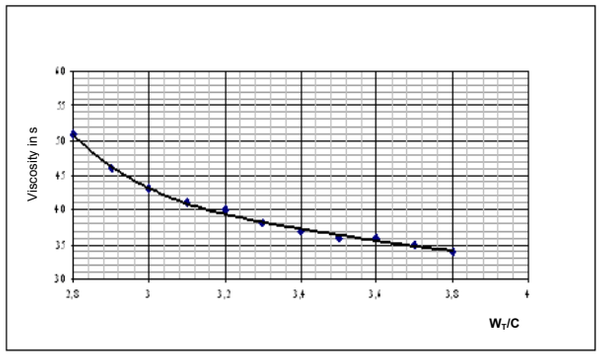
Tableau 1. Decantation versus time					
Temps (h)	1	2	3	4	24
Decantation (%)	1	1	1.5	2	3

3.4.Preparation of bentonite cement grout

Grout is prepared at water cement dosage **Wc/C** = 0.35 and gradually poured in the grout mother. Shaking is necessary during the grout preparation by means of an energetic mixer (the blue methylene test mixer is used with a speed of 700 rpm).

3.4.1. Influence of ratios W_T/C and B/C and cement dosage on grout properties

The influence of bentonite-cement ratio **B/C** on the physical properties of the grout **BC** has been analysed. In performed tests the cement dosage has been varied from 200 to 300 kg/m3 while the bentonite dosage has been varied from 30 to 50 kg/m3 of grout. In turn, the variation of **B/C** ratio from 10 % to 15 % was considered as suggested by Massiera et al (1999&1993) and by the Centre for Civil Engineering Research and regulations. Acceptable physical properties of grout are currently obtained when the dosage of water **WT/C** varies between 2.8 to 4.0 as shown in figure 3. However it is desirable to use a water reducer plasticizer to decrease



WT/C ratio.

Figure 3. Variation of viscosity in function of **WT/C** for a HRS 1 cement and bentonite-cement ratio **B/C=10%**

Table 2 shows the ratios "total water-cement" with viscosity fixed at 40 s for **B/C** ratios ranging from 6 % to 20 %.

3.4.2. Measurement of decantation and density measurements

After Opdyke et al (2005) the decantation is measured for grouts tested at viscosity of 40 s. Figure 4 shows that the decantation remains limited and acceptable for B/C ratios higher than 10 %.

Tableau 2. Variation of W_T/C versus B/C ratio								
ratio **B/C** (%)	6	8	10	12	14	16	18	20
$w_t I_c$	2	2.4	2.7	3.2	3.7	4.2	4.9	5.1

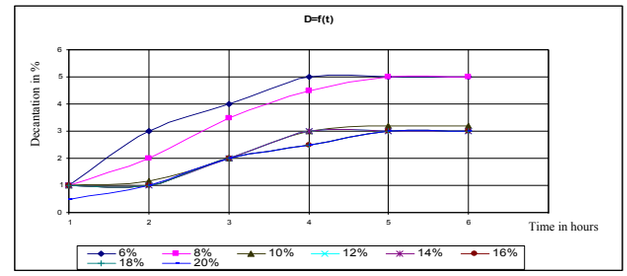


Figure 4. Decantation in function of Bentonite-Ciment ratio **B/C** for at viscosity of 40 s

After Evans et al (2006) the, density is measured for B/C ratios ranging from 6 % to 20 % and for a mean viscosity of 40 s of the grout as shown by figure 5. The density recommended by the Centre for Civil Engineering Research and regulations is about 1.2 to 1.3 corresponding to a B/C ratio of about 11.

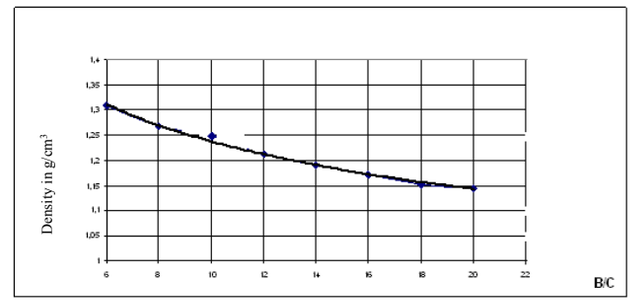


Figure 5. Density in function of B/C for a viscosity of 40 s

3.5.Cement and bentonite dosage evaluation for 1 m3 of BC fresh grout at 40 s fixed viscosity

To determine the dosages of bentonite and Cement for a quantity of 1 m3 of fresh grout, the method of one optimum cubic meter is used to determine the

$$1m^3 = V_c + V_b + V_w + V_{air} = \frac{m_C}{\rho_C} + \frac{m_B}{\rho_B} + \frac{m_w}{\rho_w} + V_{air}$$

Tableau 3. Dosages determination in function of cement								
B/C	6	8	10	12	14	16	18	20
W_T/C	2	2.4	2.7	3.2	3.7	4.2	4.9	5.1
B (kg/m³)	24.7	27.6	31.6	32.5	33.2	33.8	32.9	35.2
C (kg/m³)	412	345	316	271	237	211	183	176

percentages of constituents such that:

The bentonite and cement dosages were determined by equation (1) as mentioned by results given in Table 3.

Figure 6 shows the variation of ratio **(W_T/C)** and the cement dosage versus ratio **(B/C)** for a viscosity fixed at about 40 s. The dosage of water increases with bentonite-cement ratio **(B/C)** because bentonite absorbs a great quantity of water. The second curve shown in figure 6 represents the variation of cement dosage versus the **B/C** ratio. The cement quantity decreases with the **B/C** parameter. Further, Figure 6 shows that for a fixed cement dosage, suitable **B/C** and **W_T/C** ratios (for a viscosity of 40 s) are recommended for the execution of sealing wall. This figure is of paramount importance, in fact for a practical dosage of cement, the dosage of bentonite can be determined and the water quantity is calculated for a grout which has a viscosity of 40 s.

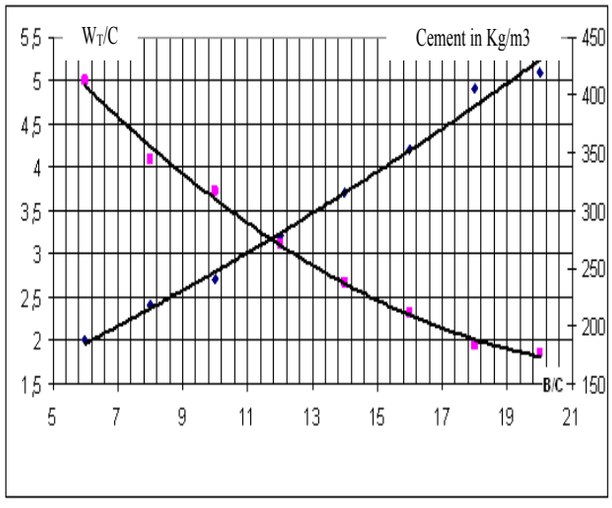


Figure 6. Cement dosage evaluation for a viscosity of 40 s

3.6. Strength properties

In determining the strength properties of **BC** material, four practical dosages of cement were adopted to prepare four grouts C1, C2, C3 and C4 for one cubic meter of grout. The **B/C** and **WT/C** ratios have been determined from figure 6 and results shown in Table 4.

Tableau 4. Determination of **B/C** and **W_T/C** ratios for practical cement dosages

Tableau 4. Determination of B/C and W_T/C ratios for practical cement dosages				
Ref : C (kg/ m3)	B/C (%)	B (kg)	W_T/C	(kg)
(C1): 350	8.25	30	2.4	842
(C2): 300	10.5	31.5	2.86	858.45
(C3): 250	12.8	33	3.5	874.49
(C4): 200	16.75	33.5	4.45	890.92

Table 5 summarizes the unconfined compression σc and tensile σt stresses as functions of cement dosages. Using a cement dosage of 300 kg/m3, in accordance with recommendations by the Centre for Civil Engineering Research and regulations, expected strength properties are obtained.

Tableau 5. Compression and traction resistance in function of cement dosages				
Ages	7 days		28 days	
Resistances (MPa)	σ_{c7}	σ_{t7}	σ_{c28}	σ_{t28}
(C1): 350	0,89	0,285	1,72	0,528
(C2): 300	0,73	0,261	1,03	0,341
(C3): 250	0,46	0,169	0,66	0,259
(C4): 200	0,43	0,137	0,54	0,159

Tableau 5. Compression and traction resistance in function of cement dosages

4.Mechanical and permeability properties of BC

Consolidated Undrained triaxial tests with measurement of excess pore pressure (CU+u) were performed in

Tableau 6. Permeability at triaxial test	
Axial Deformation with deviator maximal	**1.2 %**
Maximal Deviator	**940.4 kPa**
Permeability before consolidation	**k=8.16 10^{-9} m/s**
Permeability after consolidation with 150 kPa	**k=4.84 10^{-9} m/s**
Young Modulus	**E = 140 MPa**

laboratory. From the results of table 6 we find that the vertical coefficient of permeability decreases after consolidation. Indeed the void ratio decreases for a pre-stress of 150 KPa.

Figure 7 shows that the ultimate stress deviator approximates 0.940 MPa and the Young Modulus equals 190 MPa which is determined for elastic axial deformations in the range of 0.3 to 0.5 (%). Further, the residual strength of deviator stress equals 0.8 MPa at strain level of 9 %. This result illustrates that the tested grout has a ductile behavior.

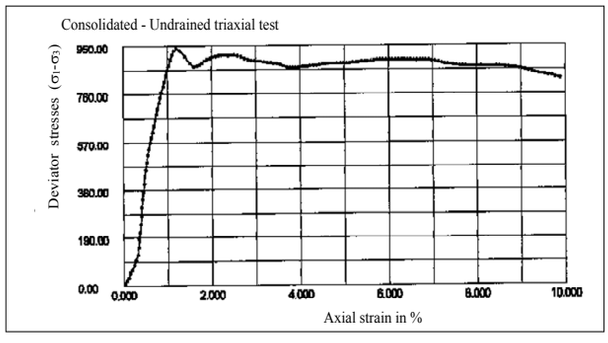


Figure 7 : Triaxial test CU+u consolidation at 150 kPa

5. Conclusions

An experimental study was carried in view of a methodology of formulation of bentonite-cement **(BC)** grout for sealing wall technique. The proposed methodology consisted, first, in the determination of **B/W_B**, **B/C** and **W_T/C** ratios of the **BC** grout and the strength properties of the projected grout. The synthesis of the experimental results shows that:

- For the tested bentonite grout for the wall stability or the **BC** grout preparation, the **B/W_B** ratio should be in the order of 5 % to achieve the suitable stable physical properties: density, viscosity and decantation to prepare a bentonite-cement grout.
- The mechanical and physical properties of the **BC** bentonite-cement grout depend on **B/W_B**, **B/C** and **W_T/C** ratios. The respective recommended ratios are about 10 % to 12 % for **B/C** ratio and about 2.8 to 3.2 for **W_T/C** ratio.

The experimental results obtained for a fresh bentonite-cement grout are in a good correlation with the desired conditions for easy execution of the screen.

In a second stage the mechanical and physical properties of a grout cured during 28 days were determined:

- The unconfined compression and tensile strength for cement dosages ranging from 250 to 300 kg/m3 are σc28 days = 0.5 MPa to 1 MPa et σt28days= 0.1 MPa to 0.3 MPa respectively.
- The Young modulus is of about 140 MPa.
- The coefficient of vertical permeability approximates 8 109- m/s.

In fact the resistance of the wall which depends on its height needs for the cured grout compression and tensile stresses respectively higher than 0.5 MPa and 0.1 MPa. Furthermore the wall deformations must follow those of the neighboring soil to avoid the micro cracks source of problems of the wall sealing.

Finally the results obtained for the cured grout are consistent with prescriptions recommended by the Centre for Civil Engineering Research and regulations. The diagrams obtained by the present experimental study give the opportunity to determine the dosages of a grout bentonite cement constituents for prescribed compression strength.

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Design and Properties for light and self placing concrete:

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Abstract.
The mechanical properties of lightweight concrete placing self strongly depend on the properties and proportions of aggregates present in the formulation. In particular, by their high porosity, the lightweight aggregates are much more deformable than the cement matrix and its influence on the strength of concrete is complex. The work presented here aims to experimentally the method of its formulation and properties of self lightweight concrete placing .

1Introduction

Auto Placing Lightweight Concrete (APLC) is a new concrete both lightweight and very fluid whose implementation is free from vibration. This concrete has several advantages as environmental, technological and economic level. This type of lightweight concrete and placing can be self composed with all types of cement. It may interest the construction Sector Bridge and pavement. However, the properties of fresh and hardened state of the new concrete is needed to study, it is the same for the sizing and design of structures. The objective of this work is to identify this new type of concrete which combines a mixture properties fresh and hardened state.

2Experimental study

2.1 Composition

Two types of light aggregates were used in this study: expanded clay quasi spherical 4650 8/ and polystyrene beads of regular shape (36150/) aggregates. Particle size analyzes showed that the most represented diameters are between 4and 6 mm to 4650 8/, and between 2 and 4mm for 3150 6/. From Table 1, we see that the polystyrene beads 3150 6/ have the lowest mass

Types of lightweight aggregates	Density	Real
4 /8 650	600	920
3 /6 150	140	154

Table 1. Densities of the two types of light aggregates

The matrix used to compose the concrete is APLC mortar Portland cement CEM I 42.5 and sand 05/ mm whose composition was determined according to criteria of non-segregation from one meter. This is call 1 m3 of concrete self-compacting lightweight costs. The quantities of cement, water, additives, air are known, also the ratio G / S, we must complete the formula with sand so as to obtain a cubic meter of concrete self-compacting lightweight which gives the following relationship:

with V_c, V_e , V_{ad} , V_a, V_s and V_G respectively the volumes of cement, water, additives, air sand and aggregates This mortar has a compressive strength 40.4 MPa and identified with a Young's modulus of 28590 MPa.
To determine the influence of lightweight aggregates on the mechanical behavior of lightweight concretes, 16x32cm cylindrical specimens were: made up with an identical matrix and a different percentage of aggregates .
The volume fraction of sand ranges from 0.10 to 0.50 and the corresponding notation are C_0.10, C_0.20, C_0.30, C_0.40 et C_0.50 (for C_0 mortar matrix). The Spread is measured by the average of three diameters as shown in Figure 1

Table 2. Composition of concrete 0/ 4 650

	Co,10	Co,20	Co,30	Co,40	Co,50
cement (Kg/m^3)	425	400	375	350	300
Lightweight aggregate (Kg/ m^3)	83	166	250	333	416
Water (Kg/ m3)	157	168	180	191	225
Dry Density (Kg/m^3)	1925	1850	1730	1610	1506
Spread (cm)	52	48	42	38	31

Figure 1 Measurement of spreading concrete APLC

2.2 Uniaxial compression tests

Compression tests were performed on axial these specimens to determine the Young's modulis and compressive strength of concrete according to the two types of aggregates. The dry density of lightweight concrete was also measured. A study of segregation cured sample showed no surfacing aggregates. The rigidity of the lightweight aggregate being 3.5 to 4 times less than that of the mortar matrix, the modulus of the lightweight concrete Ec decreases with increasing volume fraction of the aggregates The modulus and strength of the aggregates are usually related to their density. The Young's modulus of the concrete thus generally increases with the density of the lightweight aggregate and the gain in strength is particularly important that the volume fraction of aggregate.

2.3 Test box L,

Concrete cohesion, mobility in confined spaces and its ability to cross a heavily reinforced area can be measured with the test box L Figure 2. This test verifies that the development of concrete will not be opposed by blockages aggregate ahead reinforcement.

The number and diameter of the reinforcement can be adapted to reflect the reinforcement present in the real structure. After concrete flow (H2) of the height difference in the vertical parts (H1) and horizontal is measured. The test result is expressed by the ratio H2/H1 filling. A value of this ratio greater than 0.8 indicates a good flow of APLC.

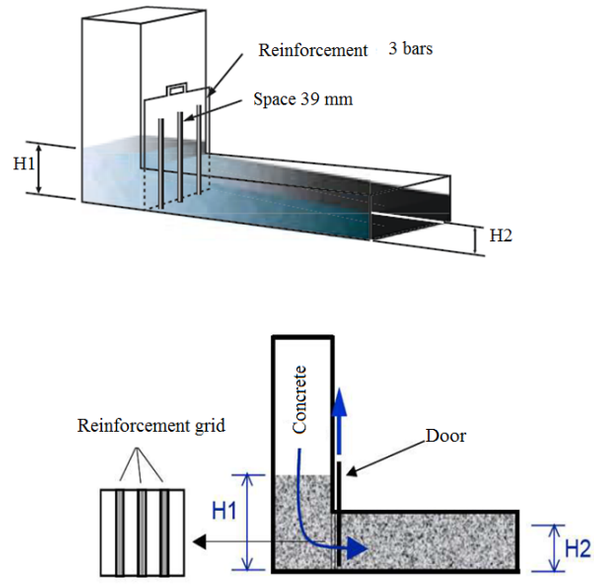

Figure 2. Test box L

We found a ratio H2/H1 = 0.85. This shows good mobility confined to the self-placing lightweight concrete and its ability to cross a heavily armed area. We can also say that the establishment of concrete will not be opposed by blockages aggregates.

2.4 Finding the saturation dose of adjuvant

For each adjuvant used, it is necessary for economic reasons and implementation to determine the dose of saturation of the product which has no more secondary effect additional. The principle is to measure the flow time of the mortar through a cone. March and this for a W / C and a constant A / C variable ratio. Figure 3

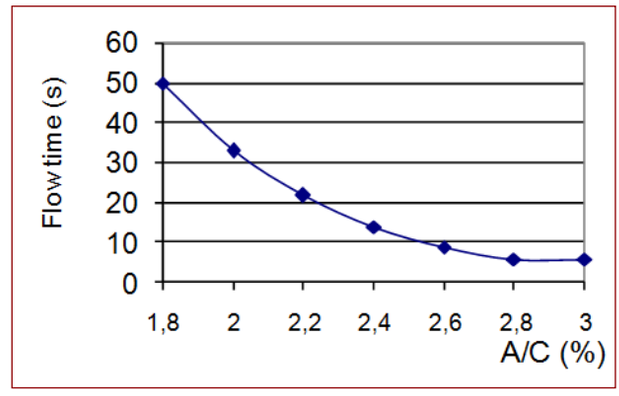

Figure 3 Variation of flow time cone March

We note that from a dose of 2.8% adjuvant compared to the mass of cement, adjuvant ViscoCrete 5400 has no additional thinning effect; the time has stabilized at 6 seconds. So we can conclude that the saturation dose is 2.8%. Fluidity or workability of mortar made with the saturation dose is followed in time every 10 minutes and 60 minutes. After standing the mixture for 10 min, mixing operation again for 15 seconds and the flow time was measured again. Figure 4

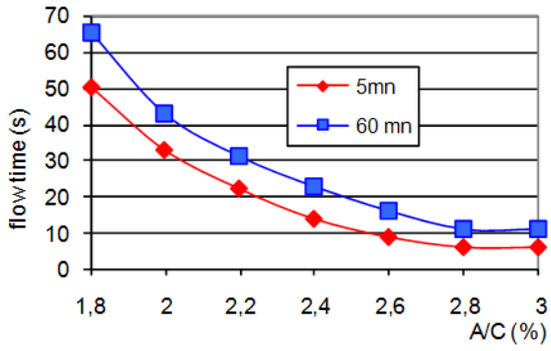

Figure 4 Maintaining maneuverability time

It is noted that the curves of 5 min and 60 min are near that is to say there is not a large vertical displacement which indicates a maintenance workability of the one hand and on the other hand the saturation does not change (2.8%). Based on previous studies on adjuvant we can say that the behavior of the adjuvant ViscoCrete 5400 type 1is compatible with studied cement.

2.5 Instantaneous modulus of APLC

We remind the prescribed formula for traditional concrete Ebij=11000 $\sqrt[3]{(f_{cj})}$. With Ebij and fci respectively instantaneous modulus and strength of the concrete. It is observed that the prescribed formula considers only the resistance, so that BAP would, according to the code, the same module that traditional concrete, provided that the resistances are equal. The modulus of the matrix of the concrete is between 6000 and 25000 MPa, whereas that of the aggregates is between 60 000 and 100000MPa. In what follows we will compare the module given by the ultrasonic unit Figure 5 and that given by BAEL code.

Figure 5 : the ultrasonic unit

fcj (Mpa)	Ebij APLC (BAEL) (MPa)	Ebij TC (ultrason) (MPa)	Ebij APLC (ultrason) (MPa)
25	22164	32950	24000

The comparison shows that the Young's modulus of a lightweight self-compacting concrete is lower than that of Traditional Concrete about 30%. The approach considers only BAEL resistance. Indeed, the density of a self-placing concrete light reaches a low density with closed porosity through the use of a water-repellent mass. The modulus of a calculated by the traditional approach BAEL concrete significantly the same with that measured by ultrasound. This ensures the accuracy of the ultrasound device has an uncertainty of 2.5%.

2.6 Shrinkage of APLC

Concrete shrinkage consists primarily of thermal shrinkage, endogenous and drying. The following table compares the removal of a small self-placing APLC compared to traditional concrete TC. Figure 6

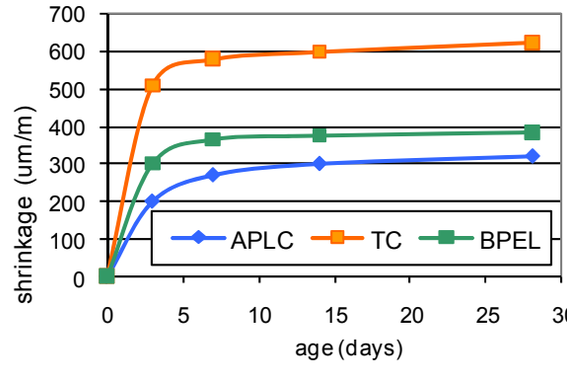

Figure 6 : shrinkage of Auto Placing Lightweight Concrete

In what distinguishes lightweight concrete self placing other concrete we can see a marked decrease in the final shrinkage at the age of 28 days about 51% compared to traditional concrete (320625/). This can be explained by the reduction in the quantity of water (E/C=0.42) . The curve of shrinkage of APLC is also located below that provided by the BPEL with an average difference of 24%.

3. Conclusion and interpretations

The following conclusions are drawn from this study: Light self-placing concrete is easy to manipulate, it take place without any vibration, it does not consume

Age (days)	shrinkage BPEL (µm/m)	Real shrinkage CT (µm/m)	Real shrinkage APLC (µm/m)
3	300	510	200
7	365	580	270
14	375	600	300
28	384	625	320

aggregates large caliber in addition it has a low density. The comparison shows that the Young's modulus of a lightweight self-compacting concrete is lower than that of traditional concrete about 30%. The modulus of a calculated by the traditional approach BAEL concrete significantly the same with that measured by ultrasound. This ensures the accuracy of the ultrasound device has an uncertainty of 2.5%.

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CUSTOMIZED CEMENT ADDITIVES TO DELIVER MAXIMUM ECONOMIC BENEFIT IN MANUFACTURE AND PERFORMANCE

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SUMMARY

High performance cement additives are chemical compounds used in the production of cement to increase the output and efficiency of the grinding process and to improve the performance, quality and handling of the finished cement. The overall objective is to enhance the manufacturing economics by providing increased productivity and profitability.

In today's ever increasing cost-focused environment cement producers need to ensure that the maximum savings potential is realised when considering the application of cement additives so that the cost of the additive generates the maximum return on investment.

Cement additives have long been used to provide benefits as grinding aids and quality improvers. The use of alternative fuels and raw materials as well as the economics concerning CO_2 reduction can provide additional opportunities to exploit chemical additives.

This article considers a systematic approach for the application of cement additives, with the outcome being a customised solution, capable of delivering the maximum value. This involves careful consideration of mill outputs, energy consumption, cement performance, cement composition, clinker factor, CO_2, market needs and the ability to enable other technologies, such as alternative fuels and raw materials.

1.0 INTRODUCTION

High performance cement additives are chemical compounds used in the production of cement to increase the output and efficiency of the grinding process and to improve the performance, quality and handling of the finished cement. The overall objective is to enhance the manufacturing economics by providing increased productivity and profitability. They are usually introduced within the grinding system but can also be added post-grinding and even in blending operations.

In general the use of cement additives can be considered within three broad application categories, namely *"grinding aids", "quality improvers" and "functional additives".*

"Grinding Aids" have been used for many years to improve the efficiency of the grinding process, to increase tonnes/hour and reduce specific energy consumption. More recently, new generations of cement additives have found increasingly widespread use as a means of also improving the quality of finished cement. Often known as *"Quality Improvers"*, such additives are particularly useful in cements containing additions, such as granulated slag, fly ash, natural pozzolan and limestone. These additives influence cement performance characteristics and have the capability to provide significant economic advantage to the cement producer. *"Functional Additives"* include those for specific purpose, such as in the production of Masonry cement or to achieve chromium reduction.

The utilization of cement additives by cement manufacturers has been steadily growing, with a significantly faster growth rate in the last 10 -20 years. This has been due to advances in both the technology of cement additives and changes in the economic environment. Industry and regulatory initiatives (Cr VI reduction, CO_2 and NOx emissions) have also driven increased use of value-added cement additives. Regional differences in utilization exist, principally as a result of differences in energy cost, cement component raw material availability and costs, market demands and regulatory requirements.

The introduction of emissions trading for carbon dioxide has also caused a further increase in chemical additive technology application as it is one of the ways to lower clinker content for constant cement performance, thereby lowering CO2 emission per tonne of cement.

This aspect is expected to have increasing impact on cement production around the globe.

2.0 APPLICATION OF CEMENT ADDITIVES

As briefly introduced above, a wide range of cement additives are extensively used by cement producers worldwide. The factors driving their economic attractiveness can be quite diverse and thus their use also represents a wide range of applications, including:

* Increase in cement mill output, with associated reduction in cement mill system kWh/tonne, reduction in mill run hours and reduction in cement grinding costs.
* Increase production capacity to meet sales volume.
* Improving cement flowability (reduce pack-set) to shorten loading/unloading operations and reduce distribution costs.
* Improve cement performance, to meet customer needs, satisfy Standards, meet/exceed competition, reduce complaints/claims and improve market position.
* Improve cement performance to allow clinker chemistry changes or to lower raw material/fuel costs from use of alternative materials.
* Improve cement performance to increase use of supplementary cementitious materials (i.e. non Portland cement clinker) to satisfy market conditions, to utilise availability and to meet environmental requirements.
* Improve cement performance to use supplementary cementitious materials to reduce the clinker factor to lower compositional costs, to increase cement volume per unit of clinker, to reduce environmental impact (e.g. CO_2).
* Improve cement performance to permit higher class of cement or new cement type or to meet new market needs with potential implications to market value and pricing

2.1 CO_2 Reduction

A growing importance on a global scale is the desire to reduce the carbon footprint of cement. There are a number of approaches to reduce the footprint for cement and some are already highly developed, such as energy efficiency and alternative fuels. Reducing the clinker factor in cement, by utilising higher amounts of secondary cementitious materials, is an additional approach and this can be facilitated to a significant degree by the appropriate use of cement additives.

Cement is the most prevalent man-made material in the world with an annual production of more than 2.5 billion tonnes. That is enough material to produce some 1.5 cubic metres of concrete for every person on the planet. With such a large volume, it is not surprising that every aspect of its manufacture has the potential of having major impact, economically, and environmentally. The cement industry has a long history of continuous improvement, including issues such as energy efficiency, alternative fuels, SOx, NOx, Dust, etc. One issue, which has come under increasing scrutiny, is the emission of carbon dioxide, much talked about in the context of global warming. Sustainable development is taken very seriously; reference the WBCSD Cement Sustainability Initiative.

The cement industry accounts for a significant part of man-made carbon dioxide, which arises predominantly from fossil fuel burning and raw material de-carbonation. Many manufacturers having made a public self-commitment to significantly reduce net carbon dioxide emissions and, during recent years, protocols have been established and legislation implemented around the globe to reduce carbon dioxide emissions, including carbon dioxide trading schemes to meet reduction targets.

Approximately, each 1 tonne of Portland cement clinker requires 1.25t of limestone, which on conversion to CaO releases 0.5 tonne CO2. Primary energy is typically supplied from burning fossil fuels, which, depending on source, process type and efficiency, release a further 0.2 to 0.5 tonnes of CO_2. Thus each tonne of clinker has an associated 0.7 to 1.0 tonnes of CO_2. (A default value of 862 kg CO_2 per tonne was adopted for bought clinker by the Cement Sustainability Initiative CO_2 Protocol).
CO_2 reduction initiatives are being increasingly implemented and their application and diversity can be expected to increase as the "cost" of CO_2 increases. Possible measures to reduce CO_2 include:

* Increased energy efficiency (lower GJ/t)
* Utilization of waste heat
* Utilization of alternative/waste fuels (zero carbon rated)
* Utilization of de-carbonated raw materials
* Reduced tri-calcium silicate content
* Increased amount of secondary cementitious material (SCM) in cement (lower clinker factor)

Other possibilities could include forest plantation/ management, CO_2 capture and storage or hydrogen based energy (solar, nuclear).
Improvements in energy efficiency together with greater utilization of alternative fuels have been highly developed for decades for cost reasons as well as CO_2 reduction. De-carbonated raw materials exist, such as blast furnace slag, but are either utilized as a SCM directly in cement or can create operational issues, such as raised MgO level. A reduction in C_3S can in theory reduce CO_2 per tonne of clinker by some 24%-, but then reduce early strength potential and thus limit subsequent SCM levels in finished cement. However,

a contrary approach is to produce a Portland cement clinker with a high C_3S level, for example facilitated by mineralization, to allow an increased level of SCM and consequent lower level of CO_2 per tonne of cement. A further method of lowering the clinker factor as a means to reduce CO_2 per tonne of cement is to use a strength enhancing cement additive.

Not surprisingly the clinker content of cement largely correlates with the CO_2 per tonne of cement. The utilization of secondary materials in cement, such as blast-furnace slag, fly ash, pozzolan and limestone, has been practiced for many years on the basis of market needs and economic attractiveness. Interest in SCM is further increasing as an economic means to reduce CO_2 emissions.

However, a lower clinker factor, as a result of increased percentage of SCM, usually results in some reduction in cement performance characteristics. For example, each 1% increase in SCM can reduce the 28-day mortar strength by some 0.2 – 0.8 MPa (depending on many factors, such as SCM type, fineness, mill system, clinker characteristics, etc). More commonly it is the slower early strength development that is the limiting factor.

Increasing the amount of these clinker substitutes and maintaining market acceptance can be significantly assisted by an increase in cement performance, for example by increased clinker quality (e.g. high C_3S, mineralization, high fineness) or by the appropriate application of a chemical cement additive.

The selection of the appropriate additive is largely dependent on the influence of the clinker substitution material on cement performance. For example, slag and fly ash have most influence on the early strength and set time and so formulations are used that can shorten set time and increase early strength. In limestone cement an additive is needed that can increase strength at 28-days, whilst some fillers may require the additive to provide a reduction in water demand.

2.2 Facilitating Alternative Fuels and Raw materials

The use of waste materials in the manufacture of cement has also been growing rapidly, owing to the need to find responsible ways to dispose of such materials and due to their economic advantage to the cement producer. However, the use of such materials can introduce minor elements that can have a negative impact on certain cement quality parameters necessitating re-investing some of the savings from the waste material use into mitigating the quality issues.

Treating the quality issues with chemical additives to the finished grinding system represents a cost effective way of mitigating the potential negative quality impacts that may be originating from the use of waste materials in the cement manufacturing process.

Waste materials used in the preparation of raw kiln feed include fly ash, metallurgical slag, waste sand, waste iron, recycled refractory, filter cake and furnace dust. Waste materials used as fuel substitutes include petroleum coke, waste lubricating oil, chlorinated hydrocarbons, solvents, plastics, rice husks, tyres, paint, refuse derived fuel (RDF) and waste derived fuel (WDF). These can bring input of many minor elements and depending on the volatility of the compounds, the resulting minor elements may or may not survive the kiln process to end up in the clinker crystal structure and hence affect the cement characteristics.

Finally, waste materials introduced into the finished grinding phase of cement manufacture include such things as by-product gypsum sources (e.g. FGD gypsum and phosphogypsum) and kiln dust, as well as fly ash and slag. Fly ash and slag are generally considered as secondary cementitious materials (secondary to Portland cement clinker) and are not considered as waste streams. However they can also present capacity to introduce minor constituents into cement, for example ammonia, carbon and mercury are becoming issues of focus for fly ash.

Not all of the minor elements involved are present in sufficient amounts in cement to affect performance in mortar or concrete and some such as Mercury, Gallium, Indium, Selenium and Thallium etc. have such low melting points and high volatilities that they tend to be concentrated in kiln dusts (collected or emitted) rather than find their way into clinker in any great amounts. Additionally, environmental emission concentrations may well limit the use of some waste streams before they can be introduced in sufficient amounts as to cause a negative quality impact. Health and safety issues may also limit the use of some waste streams (such as those containing hexavalent chromium) before levels required to impact quality parameters can be reached.

It is not a straightforward task to establish a definitive effect of a single element on quality as noted by Taylor, "Minor components can affect the properties of a clinker phase…such as by causing changes in crystal size, morphology or structural perfection, and can also modify the microstructure of the clinker as a whole." And from the same source, "The effects of adding more than one minor component are not simply additive and can be complex". However the role of some minor elements has been studied sufficiently to predict certain potential effects.

The effects can generally be grouped by their influence on the principal cement (and concrete) properties.

* Increased water demand
* Decreased early strength
* Decreased Late Strength
* Shorter Set times
* Longer Set Times

Clearly any one of these principal quality problems listed above in any given cement plant may have numerous potential sources. Often for this reason alone the symptoms of the problem are treated rather than looking for the actual cause. In any case, even if a minor element from the process inclusion of a single or multiple waste materials was identified as the culprit, the economics behind the use of these waste streams usually demands that the quality issue be resolved in some manner other than ceasing to use the waste materials. Consequently the decision to continue with the waste material use will prevail and alternate solutions to the problem will be sought.

In the case of strength degradation problems (early or late), often the Blaine will be increased to help resolve the issue. Yet this solution itself can cause additional negative side effects such as degradation in concrete strengths due to an increase in water demand from the increased cement fineness. Even more pressing perhaps is the loss of mill throughput, which comes along with increasing cement fineness. As a rough rule of thumb one can expect a 5% mill throughput reduction for every 10 m2/kg increase in Blaine SSA. The costs associated with this loss in mill output can substantially negate the savings realized from the use of the waste materials due to increased kWh/t costs, increased repair & maintenance costs and potentially lost sales due to lower cement grinding capacity.

What is needed is a solution to the basic issues above that does not require a loss in mill throughput, promotes maximum plant capacity utilization and promotes the use of the many available waste material streams even if their use introduces elements that may compromise cement quality.

One clear alternative is to look to Cement Additives that can be added at the finished grinding phase (or sometimes post grinding in a blending stage) which have the capability of reducing or eliminating altogether the negative quality impacts mentioned above. To this end, research and development programs, carried out over the past 80 years, have culminated in a full range of cement additive formulations known as Quality Improvers specifically designed to help solve cement quality problems.

In addition to the functions required of generic grinding aids (increased grinding efficiency, improved flowability and "Pack-set" control), these families of chemicals have been shown to address the quality issues of strength degradation, set time control and even water demand issues in concrete.

Formulated cement additives have been used for more than 80 years and strength gains in the range 2 – 10 MPa (both early and at 28-days) have been achieved. Thus it is quite evident that cement additives have the capability to be a significant tool in considering alternative raw materials, alternative fuels and increased SCM for the many advantages, including lower CO2 emission.

3.0 CEMENT ADDITIVE CHEMISTRY

Cement additives contain various combinations of organic and inorganic salts. Cement performance additives typically contain triethanolamine or higher alklanolamines as a grinding aid and to enhance cement hydration, as well as other components specifically selected to tailor the performance of the cement. Some components are able to behave as catalysis for the hydration reactions of C_3S and water to produce earlier initial set and strength. Others have retarding properties and interact with the C_3A, leading to the formation of stable complexes in solution that later precipitate coating the C_3A phase. Such an ability to form a complex is correlated with improved flow and set properties of cement. The inorganic and organic salts as Na/Ca Chlorides and Na Acetate/Formate are known to be strong accelerators for C_3S, increasing early strengths of cement. Other polymers are adsorbed on the surface of the cement particles, and impart repelling charges to the particles, releasing the water normally entrapped by the surrounding cement particles, which can then contribute to the fluidity of the mix.

Several higher, proprietary alkanolamines have been found to exhibit both excellent grinding aid properties as well as hydration enhancing properties (US Patents 1991- 1992) (Sandberg 2003). The most widely used higher alkanolamine as a cement additive, tri-isopropanolamine, is known to solubilize iron and accelerate the hydration of the interstitial phases similar to triethanolamine. Unlike triethanolamine, tri-isopropanolamine remains active in the pore solution for several days (Figure 1), thereby having a strong impact on the solubility of ferrite and iron-rich hydrates, preventing them from blocking the surface of alite and belite.

The iron-solubilizing effect of tri-isopropanolamine over time has a strong strength enhancing effect at 28-days (Figure 2), with a stronger effect for coarse, iron rich cements related to the membrane effect of otherwise poorly soluble iron hydrates. The strength

enhancing effect of tri-isopropanolamine is therefore less prominent for cements with high fineness (less blocking effect of the ferrite phase) and low iron content.

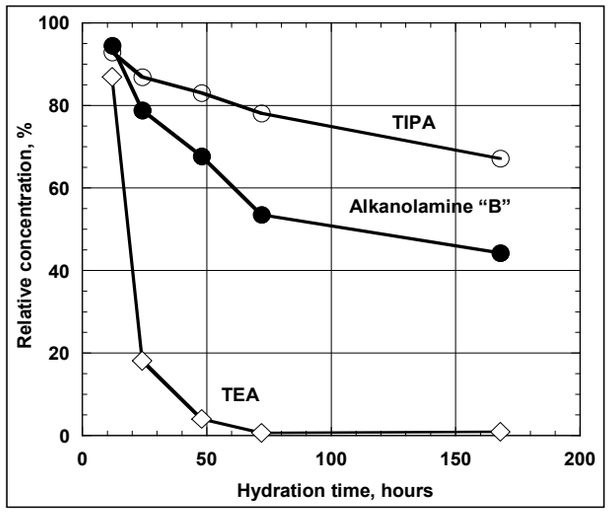

Figure 1. Additive in extracted pore water as a function of hydration time

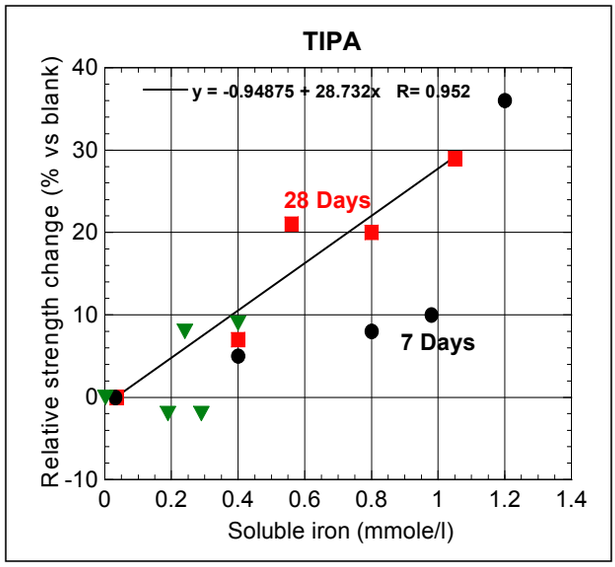

Figure 2. Correlation between strength enhancement and iron in porewater for Tri-isopropanolamine (TIPA).

Tri-isopropanolamine is known to be especially powerful as a strength enhancing cement additive for limestone blended cements. It has been shown (Ichikawa et. al., 1997) that tri-isopropanolamine also enhances the formation of carbo-alimunate hydrates in limestone cements, thereby reducing the porosity and improving strength by the incorporation of calcium carbonate as an integral part of the structure of the cementitious binder.

3.0 ECONOMICS

Successful use of cement additives to reduce costs clearly requires a detailed analysis of the constraints and flexibility of any given cement manufacturing business together with knowledge of the capabilities of cement additives.

The economic benefits from the application of a cement additive will vary enormously from region to region and cement plant to cement plant, given the diversity of individual market forces and differences in process equipment. The treated cost of using a cement additive will also vary over a wide range according to the additive cost and its required dosage for the optimum effects. Clearly the cost of the cement additive per tonne of cement has to be less than the benefits it can provide. However it is also evident that cement producers are faced with a wide range of costs and benefits from using cement additives and it can be difficult to put in the effort to choose the application providing the highest economic return. It is often easier to select traditional additives with low cost and accept modest benefits and thus risk losing out in achieving the maximum return on investment.

Some of the benefits from cement additives are relatively simple to assess whilst others can be less tangible but equally important.

The economics from grinding aid benefits at the milling system are usually relatively straightforward, with tonnes/hour correlating to kWh/t, although electricity cost structure can create some complications in the economic calculation. There are also associated mill operating benefits, for example concerning repair & maintenance costs and operating hours. Improved cement flowability can also bring real savings in distribution costs arising from faster loading and unloading operations.

The economic benefit arising from lower clinker factor largely depends on the differential cost of SCM to clinker and this can be of the order of $0.05 – $0.30/tonne cement for each 1% SCM. Hence a 5% substitution of clinker can provide a saving of $0.25 – $1.50/tonne of cement in addition to the process benefits typically of the order of $0.30 - $0.50/tonne (e.g. kWh/t, repair & maintenance, lower packset as discussed above). Cost of additives will depend on a number of factors but can be of the order of $0.2 – $1.5/tonne of cement.

The additional economic benefit of CO_2 reduction depends on the reduction of the CO_2 per tonne of cement and the value of the CO_2 (e.g. within ETS, CDM, JIT, etc). Since the CO_2 is a function of the clinker, each percentage of SCM typically reduces CO_2 per cement tonne by approximately 8 – 9 kg/tonne. Thus at a CO_2 cost of $25/tonne a 5% clinker replacement would represent approximately $1.0/tonne cement.

Thus cement performance additives are able to readily provide an economic benefit in cement production and can be an important tool in reducing CO_2. (Table 1).

Table 1. Example Benefit/Cost for Cement Additives Range of Benefit/(Cost) per tonne Typical Benefit/

	Range of Benefit/(Cost) per tonne	Typical Benefit/(Cost) per tonne
Cement Processing Additive[1] Cost	**(0.2 – 0.5)**	**(0.35)**
Cement Performance Additive[2] Cost	**(0.5 – 1.5)**	**(0.75)**
Processing Cost Benefit[3]	**0.3 – 0.5**	**0.4**
Compositional Cost Benefit[4]	**0.25 – 1.5**	**0.5**
CO_2 Cost Reduction[5] (at $25/t)	**0.25 – 2.0**	**1.25**

1. "Grinding Aids"
2. "Quality Improvers", include "grinding aid" effect
3. Reduction in kWh/t, Repair & Maintenance and distribution costs
4. Reduction in material costs
5. CO_2 cost avoidance

4.0 EVALUATION PROCESS TO MAXIMIZE BENEFITS

The type and magnitude of the influences of a cement additive depends on many parameters, such as the additive formulation and chemistry, dosage, application, mill system design and operation, cement characteristics and the market requirements.

Ideally, cement additives should be designed to suit the requirements of a specific cement and indeed some have been formulated to be plant specific since cements tend to be unique to a given process and plant. For that reason often an iterative approach to finding the optimum formulation for a given plant must be employed which may include pre-screening of a particular plant's cement with various chemical additions to assess the effect of each at various dose rates in laboratory trials. This approach, by necessity, demands a partnering over time to achieve the best results.

Thus cement additives are formulated with the cement plant process and material characteristics and objectives in mind. Components are carefully chosen to meet a diverse range of targets, where it is possible to influence water demand, setting time and strength development for cement, mortar and concrete.

In some cases the formulation and resultant cement additive could involve a relatively straightforward analysis for the impact of increased tonnes/hour and reduced kWh/tonne on production costs against the used cost of the cement additive. However, where clinker substitution is considered, a more detailed analysis will be required, for example in understanding the influence of the non-clinker material and of the Cement Additive on process and cement performance characteristics. This in turn will involve a combination of prior experience, known relationships, laboratory testing and plant evaluations.

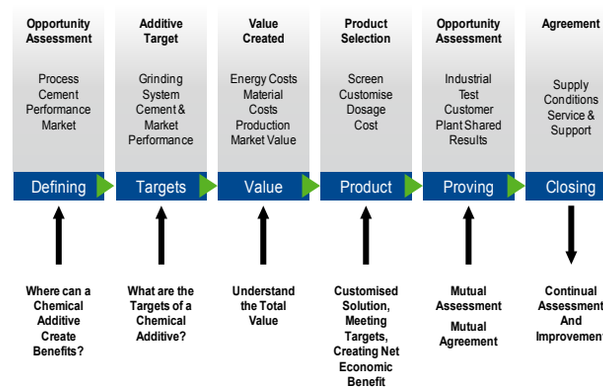

Figure 3. Systematic Evaluation, Customized Solution, Maximum Benefit

Grace cement additive development and application is increasingly employing a truly customized approach to solve the complexity of cement plant variables and chemical interactions by utilizing a proprietary experimental technique for advanced customization of cement quality improves. The methods require specialized testing and advanced statistical tools, proprietary testing equipment and methodologies to identify and formulate multi-component additives for maximum performance and economic benefit. This involves relying on a large unique and proprietary data base correlating compositions of various cements

around the world, with processing parameters and equipment, and additives response.

The process allows greater accuracy and magnitude of results by more fully exploiting synergies and combinations of chemicals to cement characteristics. An example applying such a process is shown in Table 2.

Table 2. Customized "XS" additive versus Traditional Cement Additives

Additive	Dosage	2 Days		7 days		28 days		Cost Index	Grinding process
		MPa	%	MPa	%	MPa	%		
Reference	-	14,6	100%	27,3	100%	40,7	100%		
CBA®	400	16,3	112%	30,8	113%	45,3	111%	$$	+++
ESE®	1000	16,8	115%	31,7	116%	48,3	119%	$$$$	+++
XS	400	17,5	120%	32,5	119%	48,3	119%	$$	++++

With all cement additives, whether standard or formulated or even customized, before introducing to the market, an essential requirement is to consider compliance with relevant local cement standards, such as EN 197 and ASTM C-465. They also need to satisfy the relevant Health & Safety issues, including compliance to chemical listings, such as EINECS (and now REACH) and TSCA and production to ISO 9000 and ISO 14000 standards. The influence on cement performance and the durability of concrete manufactured with the cements treated by cement additives also needs to be carefully evaluated and the product selection, development and evaluation by laboratory and plant trials ensures that there is no risk of impairing the cement, mortar and concrete properties.

5.0 SUMMARY

Cement Additives have the ability to provide cement producers with many benefits with a wide range of costs and a wide range of associated economic value. The potential to achieve high economic return on investment exists. But higher expenditure to attain greater net return involves increasing complexity and risk. To ensure success in achieving the maximum benefits of using chemical additives requires close co-operation and an increasing application of customization of the cement additive formulation. Using the right approach, backed up with the appropriate tools and experience can help increase the success in attaining significant financial contribution to a cement business.

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FLSmidth releases QCX/RoboLab® and QCX/AutoSampling™ V8

FLSmidth has released a new version of its QCX/AutoSampling and QCX/RoboLab software. The V8 release of the QCX® software is a major leap forward in laboratory automation solutions, with improvements especially directed at improved usability for the operators and maintenance personnel.

This is achieved through outstanding integration of sampling equipment, sample preparation equipment and the software, optimizing system availability and minimizing operational costs. The 8th version of the QCX software is based on more than 40 years of experience and feedback from our extensive installed base. The aim has been to create the most operator and maintenance friendly sampling and sample preparation system for the cement and minerals industries.

The new QCX software is highly flexible with well-designed user interfaces which provide unmatched overview of the automated laboratory and sampling system. Designed for the purpose, standard tasks like making new sample preparation recipes or tracking samples and results have been made fast and intuitive.

With the new QCXSYS V8 programming standard, all FLSmidth sampling, sample transport and sample preparation equipment is delivered with predefined, uniform and comprehensive equipment diagnostics achieved through deep integration of the QCX equipment with the QCX software.

The availability of relevant equipment KPI's reduces the need for specialized knowledge to operate and maintain the equipment and enables maintenance personnel to plan and conduct preventive maintenance in a fast and direct manner with the required wear part at hand.

Prior to this launch, the QCX/RoboLab and QCX/AutoSampling V8 software has successfully been undergoing industrial testing for the past 6 months at 4 major sites.

To find out more about QCX/RoboLab, QCX/AutoSampling or our process and quality control solutions, please visit **www.flsmidth.com/automation.**

Höganäs Bjuf introduces Magnus – a new range of high-performance magnesite bricks

Höganäs Bjuf is a world-leading producer of high-quality refractory solutions for a wide range of applications. The most important market segment is cement production where Höganäs Bjuf supplies smart refractory products for the entire production process – from the cyclone tower to the cooler. With more than 450 customers in over 60 countries Höganäs Bjuf is the true cement specialist.

In order to continue the successful tradition of providing high-quality products, a comprehensive product portfolio of magnesite bricks called 'Magnus' was added in November 2014. Magnus is designed to maximize performance in the upper transition zone, the burning zone and the lower transition zone of the rotary kiln. A wide range of qualities is available and our experts help the customers to choose the optimal ones based on a sophisticated calculation program developed in-house. All Magnus magnesite bricks are based on pure raw materials and every aspect of Höganäs Bjuf's modern, automated production is monitored and controlled.

"The special demands of cement manufacturing have always required specialized refractories", says Jonas Oldin, Business Manager Cement at Höganäs Bjuf. "Each stage in the process places unique challenges on the refractory lining. The Magnus range of bricks is designed to beat

the toughest conditions. It features excellent thermo-mechanical properties, optimized permeability and elasticity, high thermal shock resistance, exceptional corrosion resistance and small pore size distribution to decrease liquid infiltration phase penetration."

Höganäs Bjuf has a long history of service to cement makers around the world. With deep insight into customers' needs, the company can provide everything from detailed pre-delivery consultation and design to installation follow-up and complete Refractory Management.

For more information about Magnus, contact Jonas Oldin **at +46(0)42 855 00 or jonas.oldin@hoganasbjuf.se.**

Höganäs Bjuf began producing refractory bricks in 1825. Today the company has an extensive knowledge and experience in refractories, offering industrial customers a complete range of refractory products and turnkey solutions. Höganäs Bjuf is a multinational organization, and member of Borgestad ASA, which is listed on the Oslo Stock Exchange in Norway. The company is headquartered in Bjuv, Sweden, with subsidiaries in France, Germany, Russia, the Middle East, Malaysia and the Philippines, and agents and representatives around the world.

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"I was very glad to meet officials in the Russian cement and building materials industries and would look forward to having the opportunity of meeting all of you again in near future. I reiterate my cordial congratulations for the grand success of the event".

Ahmad Al-Rousan, Secretary General, Arab Union for Cement and Building Materials (AUCBM) (Syria)

"I had a very interesting stay in St. Petersburg. Both Meeting and other programs were interesting and well organised. Also the big number of participants and their high positions in the companies or organisations were could be noticed. I got a picture what is happening in the cement market in Russia and also in other countries. The producer-user discussions were also interesting to hear. Thank you for acting as a host during my visit".

Pekka Pajakkala, Professor, Senior Advisor, Chairman and Partner, FORECON Oy (Finland)

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For participation please fill the application form on the website. The business meeting will be held in Russian and English with simultaneous translation.

ABB introduces new solution to optimize production planning in cement plants

The new Knowledge Manager Production Scheduler supports plant managers to find the optimal production schedule by constantly adapting it to operational constraints .

Baden, Switzerland, January 22, 2015 – ABB, the leading power and automation technology group, has launched Knowledge Manager Production Scheduler, a new software solution to manage and optimize production scheduling in cement plants. It provides the customers with optimal planning functionalities based on real-time information, considering production goals, business constraints as well as volatile energy tariffs to increase the overall process efficiency.

Frequently varying production constraints in a cement plant – like lower performance of equipment, fast increasing material stock or failure in one of the production lines – demand immediate adjustments in the production schedule. Thus, production scheduling is one of the most important activities for plant or production managers in order to achieve maximal operational efficiency.

ABB bundled its outstanding cement process knowledge to develop its Knowledge Manager Production Scheduler. This application allows the user to create, evaluate and compare multiple scenarios before deciding which one to use. These scenarios are readily available when a production situation changes so that plant managers can quickly activate them. This enables a very agile response, for example when it comes to an unplanned repair activity.

So, Production Scheduler optimizes the decision-making process leading to a more efficient operation and higher productivity. Making the right changes can bring vast benefits: cost savings for energy consumption, optimized stock management or enhanced equipment performance.

Knowledge Manager Production Scheduler main features are:

· Forecast of inventory and energy consumption
· Setting of goals and configuration of constraints
· Scenario management

The solution has been successfully tested for over a year at selected pilot plants at Holcim, one of the world's leading cement and building materials company, leading to the decision of rolling out the Production Scheduler globally. Over 20 installations have been completed during 2014, with more planned for the coming months.

The Production Scheduler is a new add-on to Knowledge Manager, one of ABB's Collaborative Production Management solutions (CPM) for cement industries. Knowledge Manager collects, stores, consolidates and presents relevant information while making it easily accessible to all relevant stakeholders. With ABB's CPM solutions all operation, control, optimization and business systems are integrated into one.

ABB (www.abb.com) is a leader in power and automation technologies that enable utility and industry customers to improve performance while lowering environmental impact. The ABB Group of companies operates in around 100 countries and employs about 145,000 people.

Knowledge Manager Production Scheduler — managing operational planning efficiently

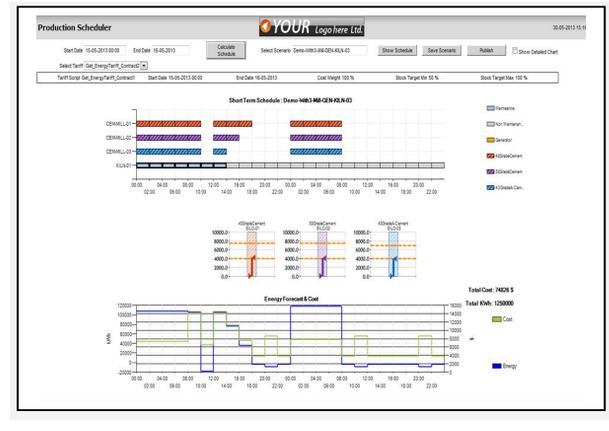
Customer challenges
– Evaluating complex and changing operation restrictions
– Generating optimal production plans meeting production, inventory and total cost goals
– Promptly activating new production plans when unexpected events occur

ABB's solution
Knowledge Manager Production Scheduler generates the optimal schedule considering multiple operation goals and complex constraints.

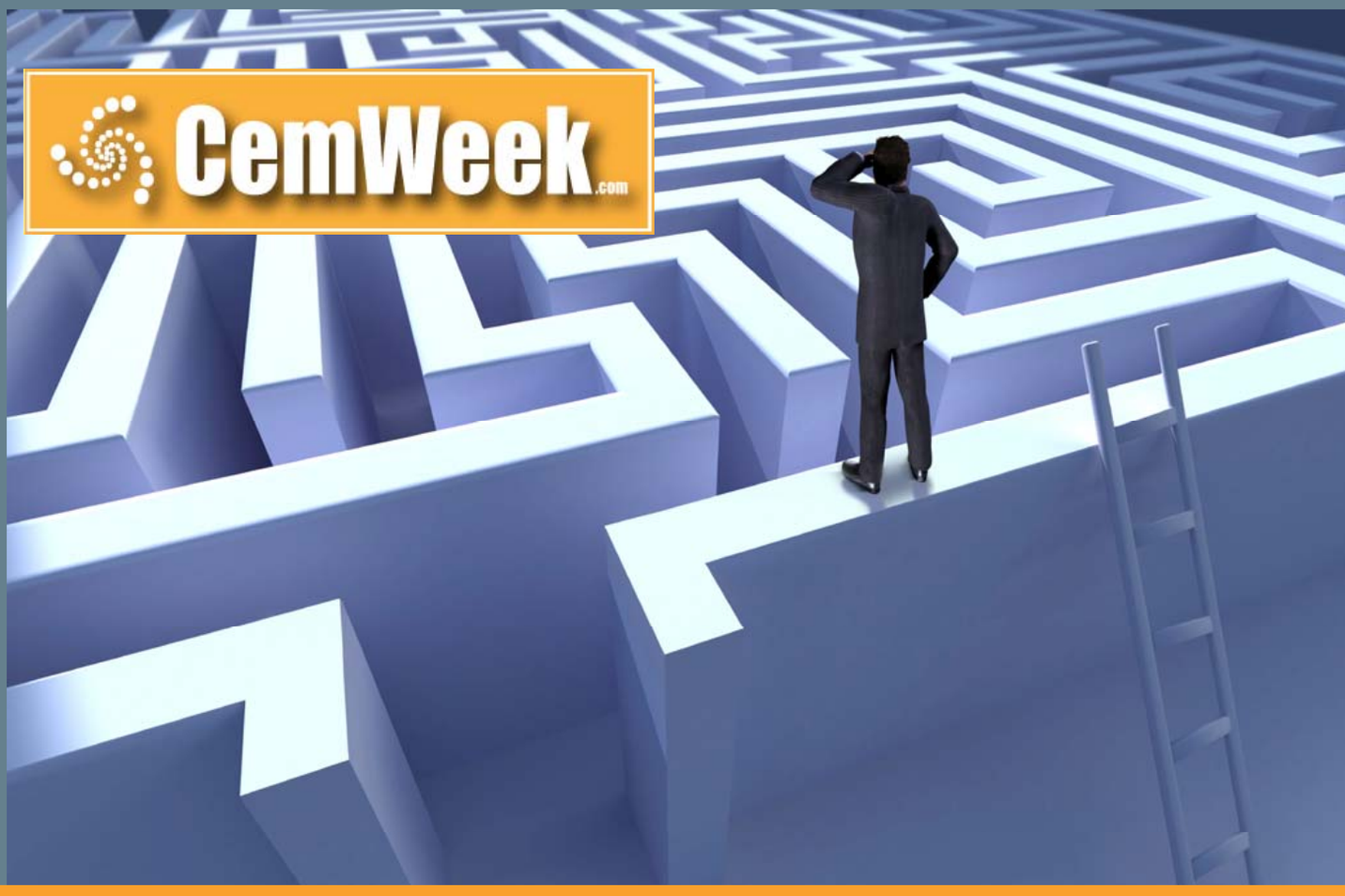
Features
– Summarized and detailed schedule visualization
– Forecast of inventory and of energy consumption
– Setting of goals and configuration of constraints
– Scenario management
– Maintenance and repair data entry screens
– Settings for energy tariff

Benefits
– Optimized short term production schedule
– Reduced overall production costs and increased equipment efficiency
– Overcome complex scheduling constraints
– Increase efficiency and agility of planning tasks
– Consistent decision making criteria

For more information please contact:
ABB Switzerland Ltd. Emmanuel Chabut
Communications Cement Phone:
+41 58 586 7312
email: emmanuel.chabut@ch.abb.com



The detailed and summarized visualization of the schedule is easily accessible for all relevant stakeholders.detailed and summarized visualization of the schedule is easily accessible for all relevant stakeholders.



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VPVision now manages all energy flows

At its launch in 2007, VPVision was the first monitoring system for compressed air. And VPVision is still the front runner. Recent innovations mean that VPVision version 3.1. is also suitable for other energy flows. Moreover, the software is now fully web-based. VPVision can be accessed from any PC, tablet or phone. VPVision is the cornerstone of any energy management system with ISO 50001 certification.

Applications of VPVision are monitoring compressed air usage, technical gases, electricity, steam, natural gas and water. By default, VPVision comes with an SQL database and an easy-to-configure web interface. The user is able to add sensors, create screens and configure reports.

Clever innovations

VPVision version 3.1 has three further clever innovations that make monitoring easier:

- Alarm module: easy to configure monitoring of limit values. Several channels can be combined into an alarm. If exceeded, a visual alarm follows and/or an email with a detailed alarm report.
- Virtual channels: virtual channels are easy to create. For example, using two flow meters to visualise three channels by adding or subtracting partial flows.
- SQL database connector: VPVision can now be linked to other systems such as an ERP system, a building management system or a collective database for several production sites.

Demonstration

For a demonstration of VPVision, have a look at www.vpinstruments.com. VPVision is obtainable through a distributor.

VPInstruments quickly repays itself

VPInstruments provides real-time insight into the usage of compressed air and technical gases. The equipment shows where, when and how much the usage is. That is almost always significantly more than necessary. VPInstruments' innovative and user-friendly meters and monitoring equipment guarantee substantial savings. Investments in products by VPInstruments very quickly pay for themselves.

For more information, please contact:
VPInstruments, Pascal van Putten, Buitenwatersloot 335, 2614 GS Delft. Tel. 015 213 1580,
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Greater productivity in industry thanks to digitalization

- **Technologies and products for the industry from the comprehensive electrification, automation and digitalization portfolio**
- **End-to-end automation for the manufacturing industry ("Digital Enterprise")**
- **"Effortless Communication" simplifies administration of large machine and plant networks**
- **Totally Integrated Power: an integrated approach for a future-oriented power supply**

Digitalization has developed into a decisive lever for growth in practically every sector of industry. Because digitalization is the central key to greater productivity, efficiency and flexibility, it forms the focus of the Siemens presentation at the 2015 Hannover Messe. Speaking at the press conference prior to the fair, CEO of the Digital Factory Division Anton S. Huber said: "True gains in efficiency can only be achieved today by optimizing and networking systems and processes along the entire product and production life cycle. Digitalization opens up whole new scope for producing companies to develop and manufacture products and solutions quickly and efficiently. Anyone who consistently leverages these opportunities will benefit from a decisive competitive edge". Over an exhibition area of 3,500 square meters, the Siemens booth D35 in Hall 9 will feature a wide range of solutions and products from its group-wide growth fields of electrification, automation and digitalization under the banner "On the way to Industrie 4.0 – Driving the Digital Enterprise". As well as the integration of renewable energies into the energy system, a variety of industrial solutions such as Totally Integrated Automation (TIA), Integrated Drive Systems (IDS), Industry Software and plant data services will all be featured in the Siemens presentation. Also located within the booth will be the "Digitalization Forum", where Siemens will be presenting concrete examples of digital technologies in application in the manufacturing and process industry as well as machine building.

Siemens offers a future-proof platform based on high-performing software technologies aimed in particular at customers from the manufacturing industries under the title of "Digital Enterprise", which will allow the extensive demands of Industrie 4.0 to be met over the coming years. "We already have the capability for full integration of the entire production and production lifecycle. This allows us to enhance the productivity and efficiency of our customers and so boost their business", explains Anton S. Huber. Siemens pays particular attention here to merging the virtual with the real world: "The digital factory is no longer just a vision. We are already making a significant contribution to its achievement today. Our Teamcenter software solution functions as a central data backbone. A decisive factor for improved production with greater efficiency and a shorter time to market is the complete digital representation of a company's entire value chain", said Anton S. Huber.

Sustainable solutions for the process industry

Siemens is also breaking new ground in the process industry. "Current market trends are moving in the direction of modularization, digital mapping of production steps and communication between the individual machines in the plant," said Peter Herweck, CEO of the Process Industries and Drives Division. "With our portfolio for the process industry, we offer sustainable solutions from design and engineering to maintenance and modernization." At the stand's

"Digitalization Forum," a hydraulic circuit demonstrates digital integration of a component in the existing plant. Planning and engineering with the software solution Comos in conjunction with the Simatic PCS 7 process control system enable data from engineering and automation to be pooled. Comos Walkinside visualizes the integration realistically in 3D.

A key step toward the digital plant is simplified administration in industrial networks. Siemens is presenting a current project on this topic at the Hannover Messe: "Effortless Communication." Assignment of addresses from engineering is relocated to the automation devices. As a result, devices can automatically assign themselves unique addresses without the need for a central instance such as an address server. Moreover, the system simplifies the use of remote services and increases their security. The results from the project might be used to build and run future production networks.

Siemens is presenting new drive technology components in the field Integrated Drive Systems (IDS). Simotics reluctance motors offering maximum energy efficiency and dynamism, a new shaft height for the Simotics FD low-voltage motors, and the modular Simotics HV M high-voltage motors expand the extensive portfolio. Herweck notes: "Our customers from process industries now have to deal with a high degree of complexity, yet strive for maximum energy efficiency. With IDS, we offer a comprehensive, end-to-end range of integrated drive systems: Almost any Siemens drive component can be integrated seamlessly into any drive system, any automation environment and the plant's entire lifecycle. As a result, we improve the entire workflow across all the steps in the value chain." End-to-end networking of the drives with the control and production level enables intelligent, self-optimizing and autonomous production processes.

Future-oriented, cost-effective power supply

In order to master the growing complexity of energy systems resulting from greater integration of renewables, these systems have to become more agile and smarter in the coming years. That means industrial power grids will also become more digital, in other words, be equipped with more means of measurement, automation, control and regulation. As part of this digitalization, industrial enterprises face new challenges when it comes to increasing their plants' efficiency, ensuring supply security and protecting increasingly complex plants and systems against overloading or short-circuits by means of state-of-the-art concepts. That requires intelligent hardware and software products such as monitoring systems and measurement equipment: End-to-end energy management at the campus is needed. Increasing local power generation, including at their own plants, means that the way industrial companies interact with power suppliers is changing. This calls for new planning and energy management concepts for grids and plants in order to ensure a robust, cost-optimized power supply. "With Totally Integrated Power (TIP), we offer an extensive package for a future-oriented, cost-effective power supply with intelligent and digital solutions from planning to operation," says Ralf Christian, CEO of the Energy Management Division. Siemens has bundled its power distribution portfolio in TIP and specifically offers industrial enterprises end-to-end solutions that enable energy systems to be planned, controlled, protected and optimized cost-effectively. They comprise software and hardware products, systems and solutions for all voltage ranges – from high-voltage power supply to the low-voltage consumer – which can be integrated in industrial automation technology thanks to intelligent interfaces. As part of its protection concept, Siemens is also presenting in Hanover an enhanced version of the communication-capable compact circuit breaker from the 3VA series for low-voltage power distribution. Compact 3VA circuit breakers are the heart of electric power distribution and ensure fault-tolerant, highly available production processes. Extensive data is also available to engineering and can be integrated in all common planning and project management tools.

Compact advanced controllers combine small size with high performance

- **Particularly compact Simatic S7- 1511C and S7- 1512C**
- **CPU plus inputs and outputs in one enclosure**
- **Technology functions such as metering, measuring, and positioning already integrated into hardware**
- **Rounds off advanced controller portfolio**
- **Engineering via updated TIA Portal V13 Service Pack 1**

Siemens is expanding its portfolio of advanced controllers in the Simatic S7 -1500 family with the addition of two particularly compact controllers. Simatic **S7- 1511C** and **S7- 1512C** combine CPU (including front display) with inputs and outputs in one enclosure. The compact design means that Simatic **S7- 1511C** with 32 digital IO ports is just 85 millimeters wide and Simatic **S7- 1512C** with 64 digital IO connections only 110 millimeters wide. Both models can be expanded to include additional connections using signal modules if required. Key technology functions such as metering, measuring, and positioning are already integrated into the hardware. The new Siemens controllers are suitable primarily for compact designs, such as those used in series production machines. Other benefits for customers include the low cost compared with modular controllers with processing units and easier storage or

warehousing.

The new advanced controllers from Siemens are small in size but big in performance. Simatic **S7- 1511C** has a bit performance of 60ns; the equivalent performance for the somewhat larger Simatic **S7- 1512C** is 48ns. Just by switching from older generations of controllers, users therefore benefit from the large range of functions in the high-performance hardware. For integrating into networks, both models have a Profinet connection with two ports and an integrated Web server.

Simatic **S7- 1511C** and **S7- 1512C** engineering is through the TIA Portal. Siemens has updated the TIA Portal V13 with Service Pack 1. The latest version offers high-performance functions such as variant management. Automatic address adjustment and option handling – centrally, locally, and via networks – open up new opportunities for machine manufacturers to design modular and expandable machines. Other advantages include the clear potential cost savings in the manufacture, commissioning, and documentation of machinery.

Background

Since the launch of the new Simatic **S7- 1500** generation of controllers in 2012, Siemens has systematically expanded its controller portfolio. The new compact range provides users with a total of fourteen **S7- 1500** central processing units (of which 6 have Safety Integrated) for a huge variety of applications – from small series production machines to complex plant with significant requirements in terms of speed and deterministics. At the SPS IPC Drives 2014 trade fair, Siemens also presented for the first time a software controller based on the Simatic **S7 - 1500** for use in PC-based automation. The **S7 - 1500** software controller based on Simatic **S7- 1500** PLC is available for Simatic industrial PCs. It runs independently of Windows and is therefore available for a wide variety of systems. An overview of the complete range of automation controllers can be accessed at siemens.com/simatic-controller.

Further information is available on the Internet at:
www.siemens.com.
http://www.siemens.com/press/PR2015020122DFEN

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United Arab Emirates Cement Portal Web Site

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The www.uaecement.com portal website is a place for getting latest cement news, events and worldwide conferences.

We hope the above matters help the improvement of Cement industry in the U.A.E which needs more cement based projects in the future.

We kindly appreciate your comments and suggestions to improve the web site contents and information.

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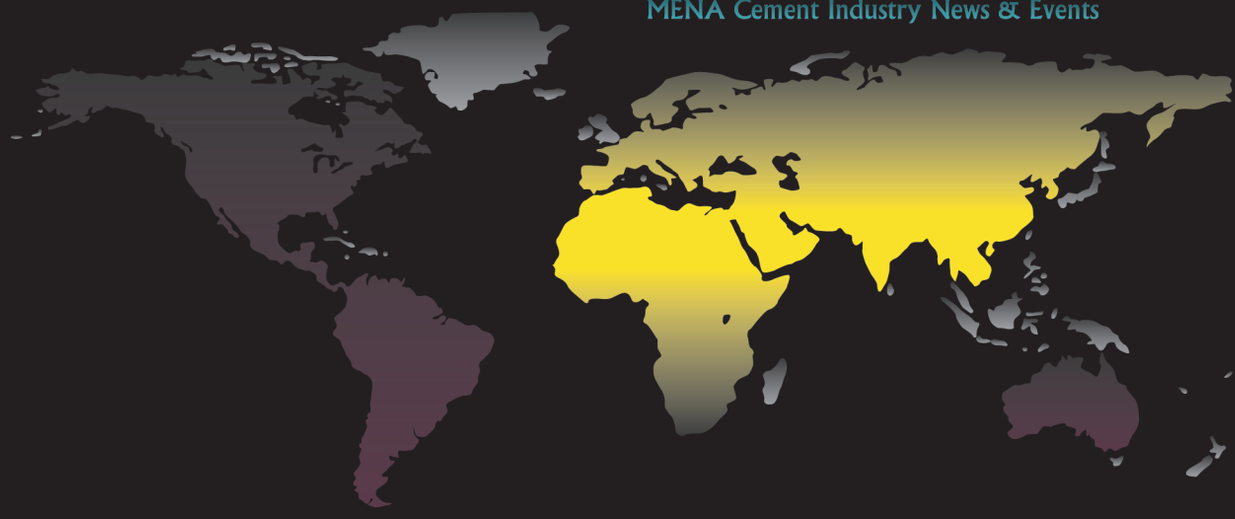

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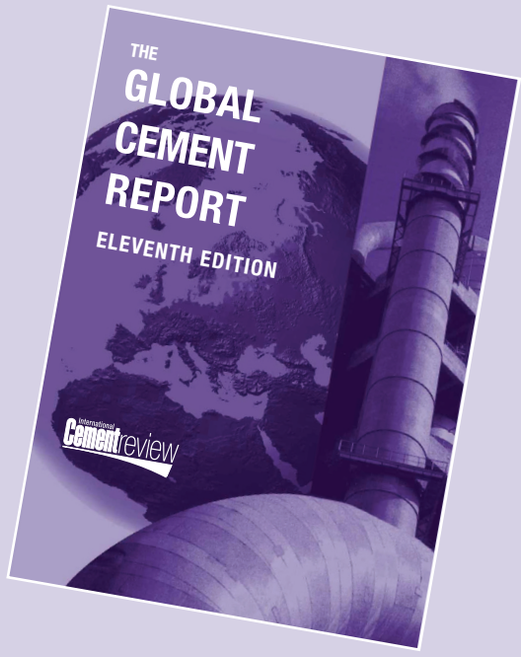

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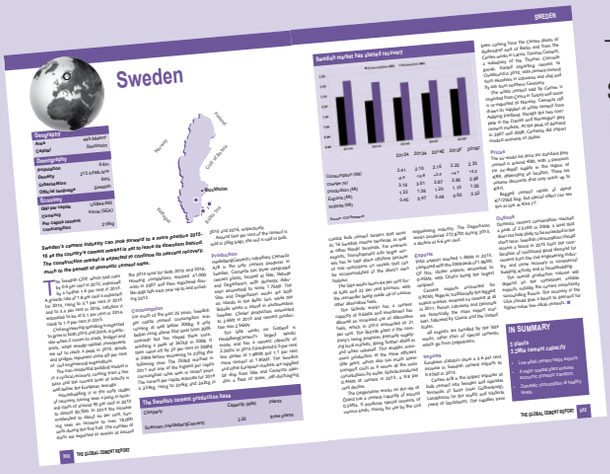
The Eleventh Edition of the Global Cement Report presents the latest market information covering the 2012-14 period, alongside short-term forecasts for the period up to 2016.

Cement consumption and production data, import and export statistics plus recent pricing information and new plant projects combine to make this a comprehensive and invaluable resource.


Sweden

The report's well-known country-by-country format is supplemented with an in-depth world overview of key industry trends and company profiles of the leading cement producers.

Thoroughly researched by ICR's experienced team of analysts, this report integrates all available market data and combines detailed quantitative analysis with expert assessments to produce the only truly global overview of the cement sector available.

For more information or to order your copy, please visit:

www.CemNet.com/GCR11

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DIARY DATES

GENERAL

5th Global Maintenance & Refractories Conference
Date : 12 - 13 May 2015
Venue: Istanbul, Turkey
For more information please visit:
www.GlobalCement.com

9th ERBIL BUILDING Exhibition
Erbil Int'l Building-Construction, Municipality Equipment, Machinery & Natural Stone Exhibition
Date : 14 - 17 May 2015
Venue: Istanbul, Turkey
For more information please contact:
Mr. Behnam Ghasemi, Int'l Sales Executive
PYRAMIDS GROUP
Tel.: +90 216 5752828 / 228
Fax: +90 216 5751101 -02
Email: behnam.ghasemi@pyramidsfair.com

The 3rd International Exhibition of mine, Mineral Industries and mineral processing
&
The 1st International Exhibition of mining and construction machinery
Date : 26 - 29 May 2015
Venue: Istanbul, Turkey
For more information please contact:
Rastak Pad Vision Co.
Email: int@rastak-expo.com / Info@rastak-expo.com / expo.rastak@gmail.com
Tel: +98 21 88346455- 7
Fax: +98 21 88346457
Http:\\ www.rastak-expo.com

MODULAR CONSTRUCTION
For Residential and Commercial Buildings
Date : 3 - 4 June 2015
Venue: Bangkok, Thailand
For more information please contact:
Mr. John Karras
Tel: +603 2775 0001
Fax: +603 2775 0005
Email: johnk@trueventus.com

THERMO PROCESS - 11th International Trade Fair and Symposium for Thermo Process Technology
Date : 16 - 20 June 2015
Venue: Dűsseldorf, Germany
For more information please visit:
www.thermoprocess.de
www.tbwom.com

CBI Africa 2015
Date : 25 - 26 June 2015
Venue: Johannesburg, South Africa
For more information please contact:
Ms. Beatrice Ene
Client Development & Marketing Director (Global)
Email: be@gmiforum.com
Tel: +1 - 203 5212 987
Ms. Raluca Neagu
Conference Producer (Global)
Email: rn@gmiforum.com
Tel: +1 - 203 5212 987
www.gmiforum.com

5th ICC YAF Global Conference
Date : 26 - 27 June 2015
Venue: London, UK
Language: English
For more information, please visit: http://
www.iccwbo.org/Training-and-Events/All-events/Events/20155/th-ICC-YAF-Global-Conference/

CW Summit Americas 2015
Date : September 2015
Venue: (Miami)
Tel: +1 - 203 - 516 - 7424
Fax: +1 - 928 - 832 - 4762
Email: sales@gmiforum.com
http://www.gmiforum.com

SFS India 2015
Date : 03 September 2015
Venue: Mumbai, India
Tel: +1 - 203 - 516 - 7424
Fax: +1 - 928 - 832 - 4762
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13. ULUSLARARASI INTERNATIONAL TEKNİK TECHNICAL SEMİNER SEMINAR

7-10 EKİM / OCTOBER ANTALYA / TURKEY

TÇMB 2015
TÜRKİYE ÇİMENTO MÜSTAHSİLLERİ BİRLİĞİ

Main Theme: "Sustainable Environment and Energy"

Low Carbon Technologies in Cement Production
Industrial Symbiosis
Use of Wastes
Innovation and New Technologies
All other subjects related to sector

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Gala Dinner: **Aybars Makina**
Opening Cocktail: **ABB**
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Cement Business & Industry India 2015
Date : 03 - 04 September 2015
Venue: Mumbai, India
Tel: +1 - 203 - 516 - 7424
Fax: +1 - 928 - 832 - 4762
Email: sales@gmiforum.com
http://www.gmiforum.com

AshTrade India 2015
Date : 04 September 2015
Venue: Mumbai, India
For more information, please contact:
Mr. Abhishek Jayakumar
Business Development Manager
Email: aj@gmiforum.com
Mobile: +919004469779
Ms. Raluca Neagu
Conference Producer
Email: rn@gmiforum.com
Mobile: +40741 520 372
GMI Global Sales
Tel: +1 - 203 - 516 - 7424
Email: sales@gmiforum.com
www.gmiforum.com

World Paper & Pulp India 2015
Date : 08 - 09 September 2015
Venue: Mumbai, India
Tel: +1 - 203 - 516 - 7424
Email: sales@gmiforum.com

World Fertilizer Business & Technology India
Date : 10 - 11 September 2015
Venue: Mumbai, India
Tel: +1 - 203 - 516 - 7424
Email: sales@gmiforum.com

MSE 2016 – Materials Science and Engineering
Date : 27 - 29 September 2016
Venue: Darmstadt, Germany
For more information please visit:
www.mse-congress.de

Slag & AshTrade Americas
Date : 30 September – 01 October 2015
Venue: Rio de Janeiro, Brasil
Tel: +1 - 203 - 516 - 7424
Fax: +1 - 928 - 832 - 4762
Email: sales@gmiforum.com
http://www.gmiforum.com

EURO PM2015 Congress & Exhibition – International Congress & Exhibition
Date : 04 - 07 October 2015
Venue: Reims, France
For more information please visit:
www.epma.com

Turkey Stone
Date : 14 - 17 October 2015
Venue: Antalya Expo Center, Turkey
For more information please contact:
Pyramids Fair Group
Kucukbakkalkoy Mah. Koca Sinan Cad.Gumrukcu Sok.No.7 34750
Atasehir, Istanbul, Turkey
Email: pyramidsfair@ebultenim.com
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12-13 MAY 2015 **RENAISSANCE POLAT HOTEL, ISTANBUL, TURKEY**

5th global cement refractories & maintenance

CONFERENCE • EXHIBITION • BUSINESS • NETWORKING

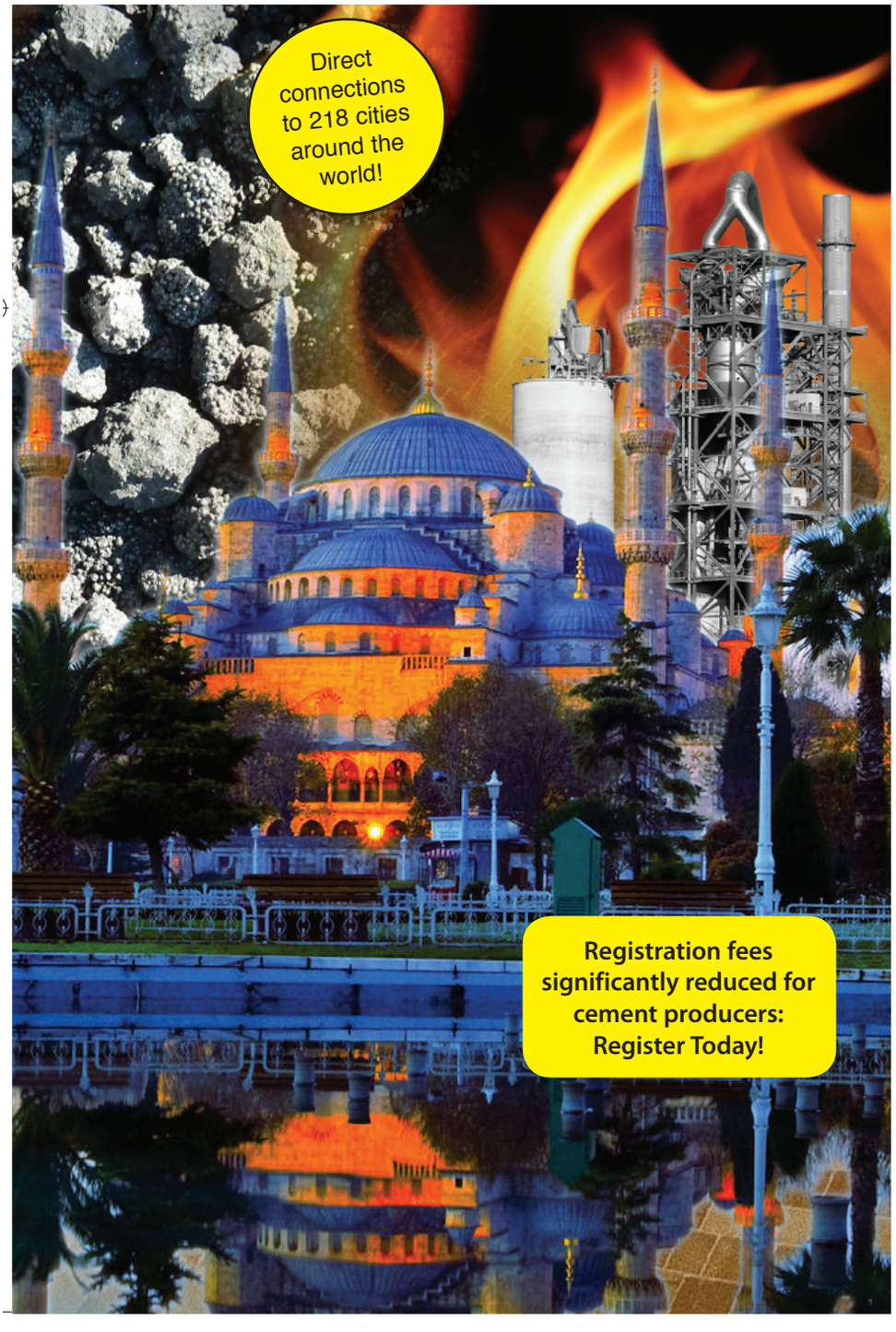
Organised by: global cement MAGAZINE

Conference partner: Arab Union for Cement and Building Materials

Conference partner: TÇMB Türkiye Çimento Müstahsilleri Birliği

Global Cement's Refractories & Maintenance (GC-RM) will bring cement and lime producers together with suppliers and service providers for technical exchange, business and networking, in good time for the autumn/winter northern hemisphere maintenance shut-down.

GC-RM will take place in the right place and at the right time for all your maintenance needs - Save time, effort and money and be there!



Refractories
Wear & abrasion
Maintenance

Global Cement's refractories conferences took place in London in 2007 and 2008, and the Global Cement Wear & Maintenance conferences took place in Düsseldorf in 2010 and in Ankara in 2011. By bringing together the conferences, a 'critical mass' is assured!

#refandmaint

Who should attend?

Maintenance staff
Refractories managers
Procurement officers
Refractories suppliers
Equipment suppliers
Service suppliers
Project managers

REFRACTORIES & MAINTENANCE EXHIBITION

A major exhibition of refractories and maintenance equipment and services will take place at the event.

Contact Paul Brown for full details:
paul.brown@propubs.com
Tel: +44 1372 840950
Mobile: +44 776 7475 998

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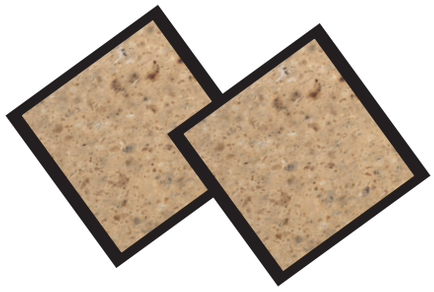

CERAMIC

CERAMICS China 2015
Date: 01 - 04 June 2015
Venue: Guangzhou, China
For more information please visit:
www.ceramicschina.com.cn
email: overseas@ceramicschina.com.cn

14th Biennial Worldwide Congress – UNITECR 2015
Date : 15 - 18 September 2015
Venue: Vienna, Austria
For more information please visit:
www.unitecr.org

Tecnargilla 2015
Date: 27 September – 1 October 2015
Venue: Rimini, Italy
Tel. 39 - 541 - 744 111 / 744 206
Fax 39 - 541 - 744 200 / 744 850
Email: infovisitatori@riminifiera.it
For more information please visit:
www.tecnargilla.it

CERAMITEC 2015
Date: 20 - 23 October 2015
Venue: Munich, Germany
For more information please visit:
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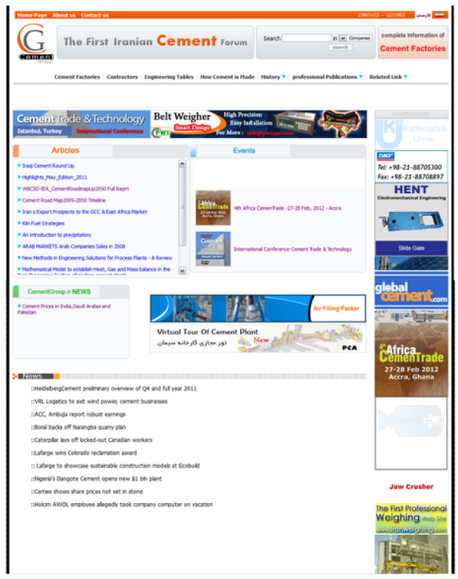

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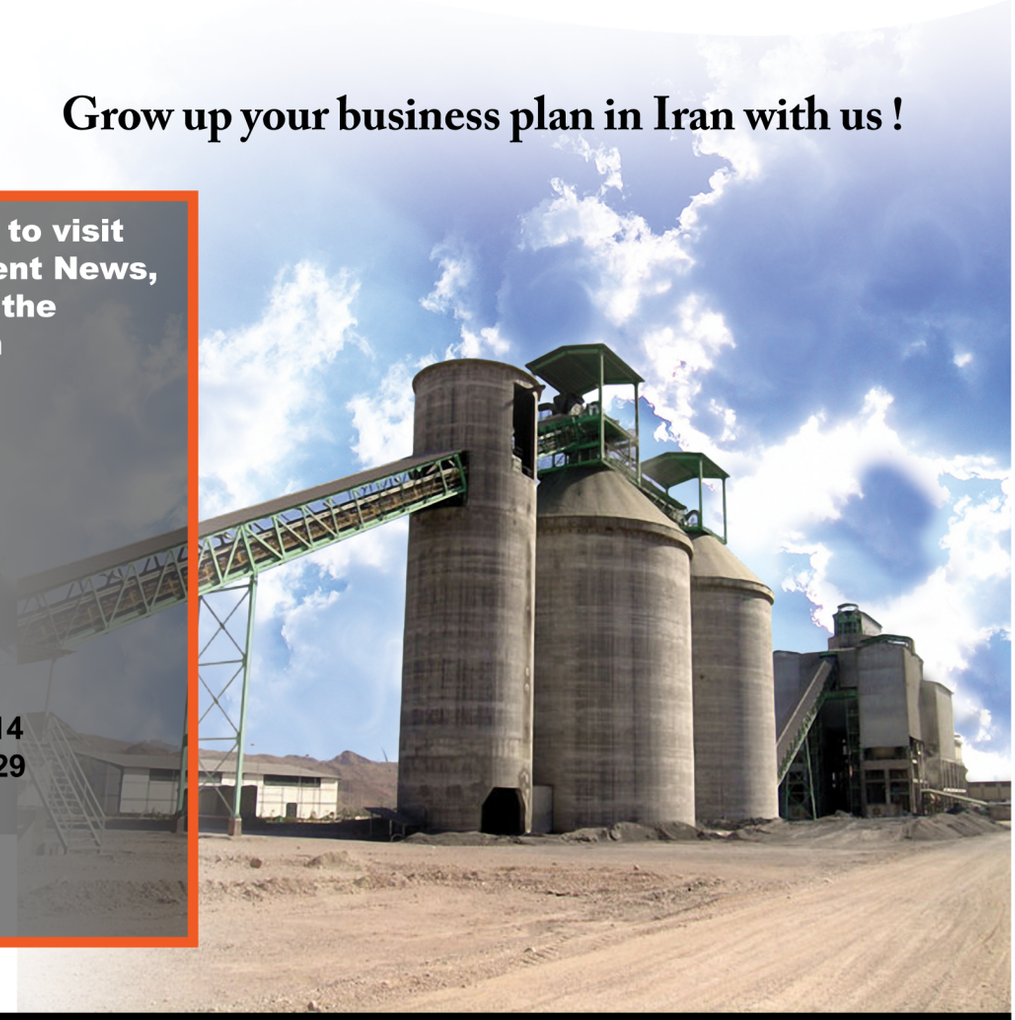

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