



CEMENT & BUILDING MATERIALS REVIEW

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110 أعوام من الابتكار الهندسي

تقوم شركة LOESCHE GmbH ، منذ عام 1906 ، ببناء المطاحن الأسطوانية العمودية . واستمر تطور تكنولوجيا الطواحين الأسطوانية العمودية ، والتي حصلت على براءة الاختراع عام 1928 ، وكانت دوماً مرادفة لتكنولوجيا LOESCHE GmbH .

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Cement and Building Materials Review

Arab Album

International News

New Products

Technical Articles

Diary Dates

Editor-in-Chief

Eng. Ahmad AL-Rousan

CONTRIBUTIONS

- *The Magazine editorial staff welcome the contribution of experts to enrich the contents of the magazine .*
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2015 Cement Companies' Results

OMAN

Raysut Cement profit drops in fourth quarter

Raysut Cement reported a 21.5% drop in fourth-quarter net profit. The largest cement firm by market value in the sultanate made US\$13.4m in the three months ending 31 December 2015, compared with US\$17.0m in 2014. Raysut's net profit for 2015 was US\$54.6m, down by 23.6% on the US\$71.2m it earned in the previous year.

www.globalcement.com

Oman Cement profit improves

Oman Cement Company reported a net profit of US\$12.2m in the fourth quarter of 2015, a 172% year-on-year rise and a 208% quarter-on-quarter rise. Sales revenues were US\$37.7m, a rise of 4% year-on-year.

The company did not provide further details on cement unit sales or prices, but it is possible that the company may have been able to sell a larger-than-expected quantity of cement during the quarter.

www.globalcement.com

QATAR

Qatar National Cement announces 10% rise in 2015

The adjusted financial statements of Qatar National Cement Company showed a 10% rise in its annual profit for the fiscal year 2014/ 15.

Source: [INTERCEM Markets](#)

SAUDI ARABIA

Najran Cement profit rise by 5%

Najran Cement Company profits rose to 255.62 million

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"I was very glad to meet officials from the Russian cement and building materials industries and would look forward to having the opportunity of meeting all of you again in the near future. I reiterate my cordial congratulations for the grand success of the event. Thank you again for your continued support and looking forward for more cooperation with your highly esteemed organization."

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 organized. 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)


white-nights.info

Contact: Anatoly Klyushov, Business Events Manager

events@alitinform.ru, +7 (812) 380-65-72, ext. 218

riyals by the end of 2015 at rate of 5%, compared with profits of 243.2 million riyals during the same period in 2014.

The company said the reason for the high profits during the current period compared with the corresponding period of the previous year was the high volume of quantities sold and other income despite a decline in average selling price.

Saudi Cement's net profit falls 12% YoY in 2015

Saudi Cement Co., the Kingdom's largest cement producer, reported a net profit of SAR 944 million for the 2015 fiscal year, marking a year-on-year (YoY) decrease of 12%. Annual profit was hurt by lower local sales and impairment losses from kilns four and five at Hofuf plant.

The cement producer reported a net profit of SAR 180 million in Q4- 2015, a 33% drop YoY as impairment losses from kilns four and five were recorded during the quarter, as well as higher general and administrative expenses and a drop in other income.

Source: argaam.com

Southern Province Cement's net profit down 0.8%

Southern Province Cement Co. reported a net profit of SAR 103 million for the 2015 fiscal year, marking a 0.77% year-on-year (YOY) decrease which the company attributed to a one-off other income the previous year due to the sale of assets, increase in cost of sales, and higher general and administrative expenses.

Source: argaam.com

Tabuk Cement's net profit drops 35% in FY15

Tabuk Cement Co. reported a net profit of SAR 89.9 million for fiscal year (FY) 2015, marking a 35% year-on-year (YOY) decline which the company mainly attributed to on lower sales volumes and prices.

The cement producer's Q42015- net profit fell 22% YOY to SAR 22.6 million. However, profit for the quarter surged 146% when compared to Q3- 2015; an advance supported by higher sales volumes, lower sales costs and administrative expenses.

Source: argaam.com

Yanbu Cement's net profit rises 0.5% in 2015

Yanbu Cement reported a net profit of SAR 806 million for the 2015 fiscal year, marking a 0.5% YoY rise which the company attributed mainly to higher sales and the increase in operating profit.

Source: argaam.com

Qatar

Al Khalij Cement Company adds new cement line

Al Khalij Cement Company has added a duplicate production line to take its total cement production capacity to 15,500t/day, which will help Qatar meet rising cement demand in view of the strategic infrastructure projects being undertaken ahead of the 2022 FIFA World Cup.

The Company's Managing Director highlighted that the estimated total cement demand in Qatar is 20,000 - 22,000t/day, with the addition of production capacity from Al Khalij, the country will be able to meet the growing demand domestically.

In 2013, Denmark's FLSmidth won a US\$95.9m order for the supply of a complete cement production line for Al Khalij's plant in Umm Bab. The production line is identical to the existing line, which was supplied by FLSmidth in 2007. The strategy to have identical production lines, according to al-Mana, will make the maintenance and sourcing of spare parts easier.

www.globalcement.com

UAE

UCC's financial results of 2015

Union Cement Company, UAE, announced the financial results of year ending December 31, 2015. Net profit registered Dirham 103.7 Mill during the year, as compared to Dirham 84.8 Mill during 2014.



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Confirmed speakers include (March 2016)

Keynote: Climate Action Plan

Environmental Ministry of North Rhine Westphalia (tbc)

Using alternative Fuels as reduction agent in the steel industry

Nina Kieberger, Voest Alpine Steel, Austria

Biomass utilization at Ohorongo cement, Namibia

Michael Hoppenberg, Schwenk Cement, Germany

Energy optimization of a ball mill at Heidelberg

Paul Bektschev and Julian Lindhorst, Heidelberg Cement, Germany

Mechanical & biological treatment & production of RDF

Stefan Minius, Sutco, Germany

Use of granulated blast furnace slag

Speaker tbc, CEMEX Germany

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- ▶ Carbon capture
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Register after 15 May: EUR 890 (+ 19% VAT).



Arab Cement Companies News

ALGERIA

Lafarge Algeria cement plant to start production in 2016

A US\$277m joint venture cement plant between Lafarge Algeria (51%) and Algeria's Souakri (49%) in Biskra will start operations in 2016.

The plant, which will produce 2.7Mt/yr of cement, will raise the group's overall production to more than 11Mt/yr. Lafarge Algeria currently has two cement plants in M'sila and Oggaz with 8.7Mt/yr of capacity. It also holds the 1Mt/yr Meftah cement plant in partnership with Algeria (GICA).

www.globalcement.com

FLSmidth to supply cement plant in Algeria

A Euro 200m engineering, FLSmidth procurement and construction (EPC) contract has signed by FLSmidth with SARL Amouda Engineering for the supply of a greenfield cement plant. The plant will be located in El Beida, Laghouat.

The order includes engineering, equipment supplies, construction, commissioning and training. Once completed, the cement plant will have a capacity of 6000t/day.

Source: Industrial Angles

Production resumes at Société des Ciments Sour El-Ghozlane plant

Cement production has resumed at the Société des Ciments Sour El-Ghozlane plant following maintenance work and an upgrade to add an electrostatic precipitator filter. The 1Mt/yr plant, a subsidiary of Buzzi Unicem, has been shut for nearly two months causing a shortage of cement in the central region of the country. This has led to some construction projects stalling and the cost of cement rising.

www.globalcement.com

Orascom Construction to build cement plant in Algeria

Orascom Construction has signed a contract to build a 6000t/day greenfield cement plant in Algeria. The deal is part of a wider set of industrial and infrastructure projects worth US\$200m the engineering and construction contractor has announced including infrastructure work for an industrial complex in Algeria and an order to manufacture and supply all structural steel for the West Nile Delta gas development project.

www.globalcement.com

BAHRAIN

Abu Dhabi Financial Group to acquire 10% stake in Falcon Cement

The Abu Dhabi Financial Group (ADFG) has signed a sale agreement with GFH Financial Group to buy a 10% stake in the Falcon Cement Company.

Falcon Cement has a cement production capacity of 0.35Mt/yr. Production capacity is expected to increase to 0.85Mt/yr when the second production line launches at the end of 2016.

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EGYPT

Arabian Cement launches Al Nasr Cement

Arabian Cement Company (ACC) has launched Al Nasr branded Ordinary Portland Cement. The new branded cement is intended to penetrate new segments of the market. It has been launched in Cairo, Giza and Qlayoubia. ACC will continue to produce Al Mosalah branded cement in the other Delta markets.

ACC also recently announced that it has renewed its plant operation agreement with NLSupervision (NLS). The agreement commenced on 1 February 2016 and run until 31 January 2021. NLSupervision is fully owned by FLSmidth, and will be operating both production lines at ACC's plant located in Suez Governorate.

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FLSmidth signs operation and maintenance contract with Arabian Cement Company

Denmark's FLSmidth has signed a contract with Arabian Cement Company (ACC) for operation and maintenance of the production lines at their cement plant near Suez. The contract covers five years of operation and maintenance of two production lines with a capacity of 6000t/day each. FLSmidth has been operating and maintaining the two lines since 2008 and 2010, respectively. Both lines were built by FLSmidth.

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Suez Cement to convert Helwan and Torah plants to use coal & RDF

Suez Cement plans to spend US\$77m to convert its Helwan and Torah cement plants to use coal and refuse derived fuel (RDF). The Kattameya and Suez cement plants were converted in 2015.

The company intends to start the conversion process in February 2016 at Helwan and July 2016 at Torah. The upgrade is expected to take 12 - 18 months. Subsequently both plants would use 70% coal for their energy. Helwan Cement will supplement this with 20-25% RDF and 5% natural gas. Torah Cement will use 30% heavy fuel oil. These conversions are expected to reduce the company's operating costs.

www.globalcement.com

South Valley Cement to convert to coal for US\$14m

South Valley Cement has signed a contract with Sinoma CDI to convert its plant to coal burning for US\$14m. The contract is expected to be complete by April 2017. In August 2015 South Valley Cement signed a US\$38m contract for Sinoma to build a grinding line for the plant.

Source: [Industrial Angles](#)

MOROCCO

Italcementi and Grupo Puma to launch joint plant in Morocco

Spanish mortar producer Grupo Puma and Italian cement maker Italcementi have signed an agreement for the construction of a plant in Morocco.

The companies have set up a joint venture named Meastro Drymix, which will distribute the products in Morocco. Meastro Drymix was incorporated in May 2015 by FYM, the Spanish subsidiary of Italcementi, and Grupo Puma.

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SAUDI ARABIA

Eastern Cement starts trial operation of new cement mill

Eastern Province Cement has started the trial operation of its new cement mill, which is expected to continue for three months until mid-June 2016. Commercial operation of the new mill will begin in the second quarter of 2016, the company said in a bourse statement. It added that the relevant financial impact is difficult to determine at this stage as it depends on market supply and demand.

www.globalcement.com

Saudi Cement Company stops line and cancels upgrade due to cement export ban

The Saudi Cement Company has decided to temporarily stop producing clinker on one of its production lines and postpone replacing three cement mills due to poor market conditions and a cement export ban. The company will stop its 3500t/day clinker kiln 6 until market conditions improve. The stoppage is not expected to affect the cement producer's financial results as its inventory currently stands at 4Mt. A plan to replace three 360t/hr cement mills with two 440t/hr mills has also been delayed due to market conditions. The upgrade was expected to add 0.6Mt/yr cement grinding capacity to the plant.

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Largest ever cement contract for Thyssenkrupp in Saudi Arabia

Germany's Thyssenkrupp has won a contract from Yamama Saudi Cement Company, one of Saudi Arabia's biggest cement producers, to build two turnkey cement clinker production lines. The two lines with an overall cement capacity of 20,000t/day will be built at a new site around 80km east of the capital Riyadh. It is the largest cement contract ever secured by Thyssenkrupp.

Yamama Saudi Cement and Thyssenkrupp have been working together since the 1960s when the company placed an order for an initial 300t/day rotary kiln. Six larger cement production lines have since been added.

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2016 China International Cement Industry Exhibition

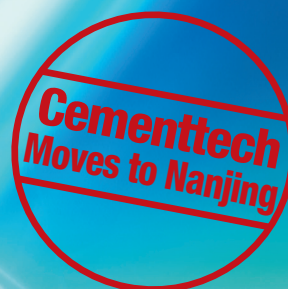
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Construction waste and Cement Industry Summit

May 12-14, 2016

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CEMENTTECH

AUMUND: Extensive Package for Arabian Cement to Rabigh

Arabian Cement Co. (ACC) is presently building a new Brownfield-cement mill in Rabigh (Saudi Arabia) with a clinker production capacity of 10,000 tons per day. AUMUND Fördertechnik GmbH now received the order for delivery of a substantial package of machines for the grinding plant presently being constructed in Rabigh. Initially it will grind externally produced clinker. Already ten years ago, AUMUND got a chance with the placement of an order for the lines no. 5 / 6.



Arched plate conveyor Type BPB



CENTREX® (©AUMUND)

Until July 16 bucket elevators, seven deep drawn pan conveyors, four arched plate conveyors and two CENTREX®-Machines will be delivered by AUMUND. Depending on their field of operation, the 16 bucket elevators are equipped with belt or chain and have elevating heights between 22 and 73 meters. They will be utilized for the transport of cement from the grinders to the cement hoppers, for the clinker transport, for the charging of the grinders and for the grinder circulation. One of the bucket elevators will be used for charging the grinders with additives (pozzolana, limestone and gypsum). The conveying capacity of the individual machine is between 120 and 660 tons per day.

Five of the seven deep drawn pan conveyors (axis-centre distance: 50 - 148 meters, conveying capacity: up to 800 tons per day) will be equipped with baffles. The deep drawn pan conveyor with baffles (KZB-Q type)

has been constructed for inclination angles up to 45 degrees and axis-centre distances up to 78 meters. Baffles bolted to the pans and stabilized by catches pressed into the side panels, provide for flexibility and an efficient, reliable transport during conveying up the inclination.

With the pan conveyor, conveying capacities between 33 and 1,300 cubic meters per hour and pan widths between 400 and 2,400 millimeters can be realized. The conveyor utilized at ACC Rabigh has a pan width of 1,800 millimeters and will be used for transporting clinker to the clinker hoppers.

Since the customer wants to do completely without the use of spillage conveyors, AUMUND developed special discharge chutes with spillways during lay-outing the plant. Besides, special spatial demands had to be considered. Since the optional transfer of the material to two different conveyors should be a possibility, the chutes were designed to serve a deep drawn pan conveyor on both sides respectively.

Four arched belt conveyors with a pan width of up to 2.40 meters are utilized for the transport of clinker, gypsum, additives and pozzolana. The highest performance machine for the transport of clinker has been designed for a capacity of 1,200 tons per hour.

The package of delivery is completed by two machines of the CENTREX® type with a diameter of five meters for the discharge of FGD gypsum.

About the AUMUND Group

The AUMUND Group is active worldwide. The conveying and storage specialists have special expertise at their disposal when dealing with bulk materials. With their high degree of individuality, both its technically sophisticated as well as innovative products have contributed to the AUMUND Group today being a market leader in many areas of conveying and storage technology. The manufacturing companies AUMUND Fördertechnik GmbH (Rheinberg, Germany), SCHADE Lagertechnik GmbH (Gelsenkirchen, Germany), SAMSON Materials Handling Ltd. (Ely, England), as well as AUMUND Logistic GmbH (Rheinberg, Germany) are consolidated under the umbrella of the AUMUND Group. In conjunction with the headquarters of the manufacturing companies, the global conveying and storage technology business is spearheaded through a total of ten subsidiaries in Europe, Asia, North and South America and supported by four warehouses in Germany, Hong Kong, USA and Brazil.

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www.aumund.com

The Adana cement works do not only grind slag but now also cement raw material using a LOESCHE vertical roller mill



A LOESCHE mill of type LM 46.4 in the Yaqui cement works in Mexico.

Adana Çimento Sanayii T.A.Ş. relies on the experience of LOESCHE and, for grinding white cement, also opts for a LOESCHE vertical roller mill.

Adana - The OYAK Group is one of the largest Turkish groups of companies. This group currently comprises approximately 55 companies from the industrial as well as the financial and service sectors with a total of 28,000 employees. With their products, sales, exports and taxes paid, the group companies create a sustained and increasing added value for the economy in Turkey and at their other international locations.

The industrial shareholdings of the OYAK Group include leading companies in the iron and steel sector, the energy sector, cement production and the automotive sector. The services sector, the other centre of activity for the group, includes among others shareholdings in the building industry, in foreign trade, logistics and technology.

The company Adana Cement is a subsidiary company of the OYAK Group, which was established in 1954 and opened its first factory in 1957. Today, the company has a production capacity of more than 4 million tons of cement per year and is

the first company in Turkey to be awarded the TS-EN-ISO 14001 Certificate for Environmental Management.

In 2007 the Iskenderun cement works were newly built by Adana Çimento Sanayii T.A.Ş. and equipped with

a LOESCHE mill of type LM 53.33+ CS for grinding clinker slag.

Now, Adana Çimento Sanayii T.A.Ş. has placed an order for a LOESCHE mill of type LM 46.4 for the Adana works in Southern Turkey, a Brownfield plant. This vertical roller mill with a transmission power of 2,750 kW is used for grinding 200 t/h of raw material to white cement. The material is ground to a fineness of 8 % R 90 µm.

Adana Çimento Sanayii T.A.Ş. exports the cement and clinker produced in part to Europe and Asia.

A period of 9 months is allowed for delivery so that the LOESCHE roller mill can already be put into operation during the fourth quarter in 2016.



The customer's LOESCHE mill of type LM 53.33+ CS Adana Çimento Sanayii T.A.Ş. at the Iskenderun Cement Works, Turkey.

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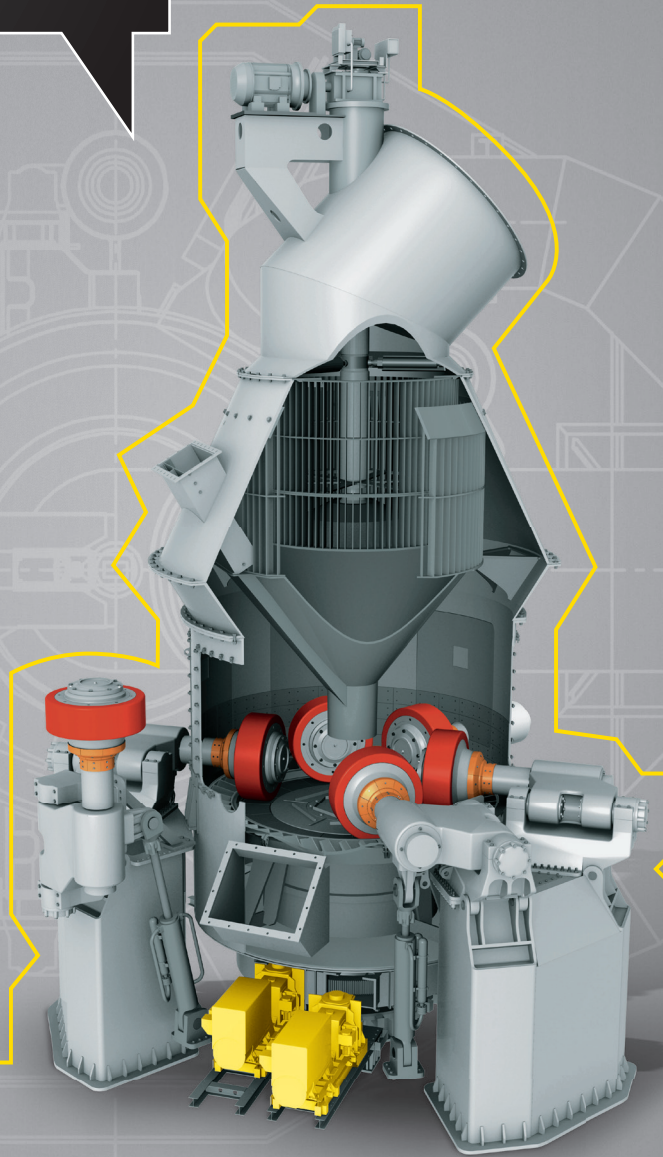
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Pfeiffer. Progress is our tradition.

Siwertell delivers road-mobile unloaders for cement-handling operations in Libya and Vietnam

Siwertell, part of Cargotec, has delivered two more of its market-leading 10 000 S road-mobile unloaders for cement unloading operations in Libya and Vietnam. The new trailer-based, diesel-powered machines are fitted with a double bellows system and dust filters and can handle cement at a rated capacity of 300t/h.

Following an order signed with Tenovar International Ltd in Malta in late June 2015, the first unloader was delivered promptly in August the same year. In February 2016 it will be commissioned in Tobruk, Libya and will operate for Mediterranean Cement, also known as Al Bahar Al Mutawaset Cement.

The second unloader was ordered in November 2015 by Koastal Industries Pte Ltd, on behalf of leading Vietnamese cement exporter, the Vissai Cement Group and was also delivered only a month later in December 2015. It will be used for cement unloading at two sites in Vietnam and was ordered as part of the Group's ongoing expansion plans. The contract includes spare parts appropriate for two years of operation. Commissioning is scheduled for spring 2016.

"In the cement bulk-handling business Siwertell stands for reliability and therefore we believe that by choosing our units, the customer chooses the best tool in the business," says Jörgen Ojeda, Director, Siwertell Mobile Unloaders.

"The ease of setting up, operating and folding away our road mobile unloaders makes them extremely flexible and cost effective for multi-terminal operations. For example, the Vissai Group's operation will use its mobile unloader at a number of ports in central Vietnam, separated by distances of up to around 300km," continues Mr Ojeda.

"Both customers were influenced by the reliability offered by Swedish-built technology and by Siwertell's ability to offer scrupulously clean unloading operations and excellent references from the cement industry," he adds.

Siwertell mobile systems were originally developed for unloading cement. Years of experience and



development reflect the company's deep understanding of cement handling and gives it the ability to provide valuable advice to its customers.

The Siwertell road-mobile unloader is one of the most reliable, eco-friendly and sustainable systems on the market today for cement operations. Its flexibility and capacity combined with low operational and maintenance costs are major selling points. As there is no need for any civil engineering works, our mobile unloaders can start operations almost immediately after arrival on site.

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New EKO kiln, sales to the global ceramic industry's major players have already topped 50

Unbeatable reductions in fuel consumption, together with design features that ensure maximum line flexibility and efficiency to cope with ever-more frequent size changeovers and pauses in production: Sacmi brand firing excellence continues to gain market shares worldwide.

Fume volumes reduced by 20% compared to traditional kilns, 25% less consumption during pauses in production and record-breaking operational consumption rates. These, then, are the latest advantages to be provided by the Sacmi Group that, with the new line of EKO kilns, is gaining ever-larger market shares all over the world; over 50 machines have already been sold, 70% of which have already been started up successfully at plants belonging to the global ceramic industry's major players.

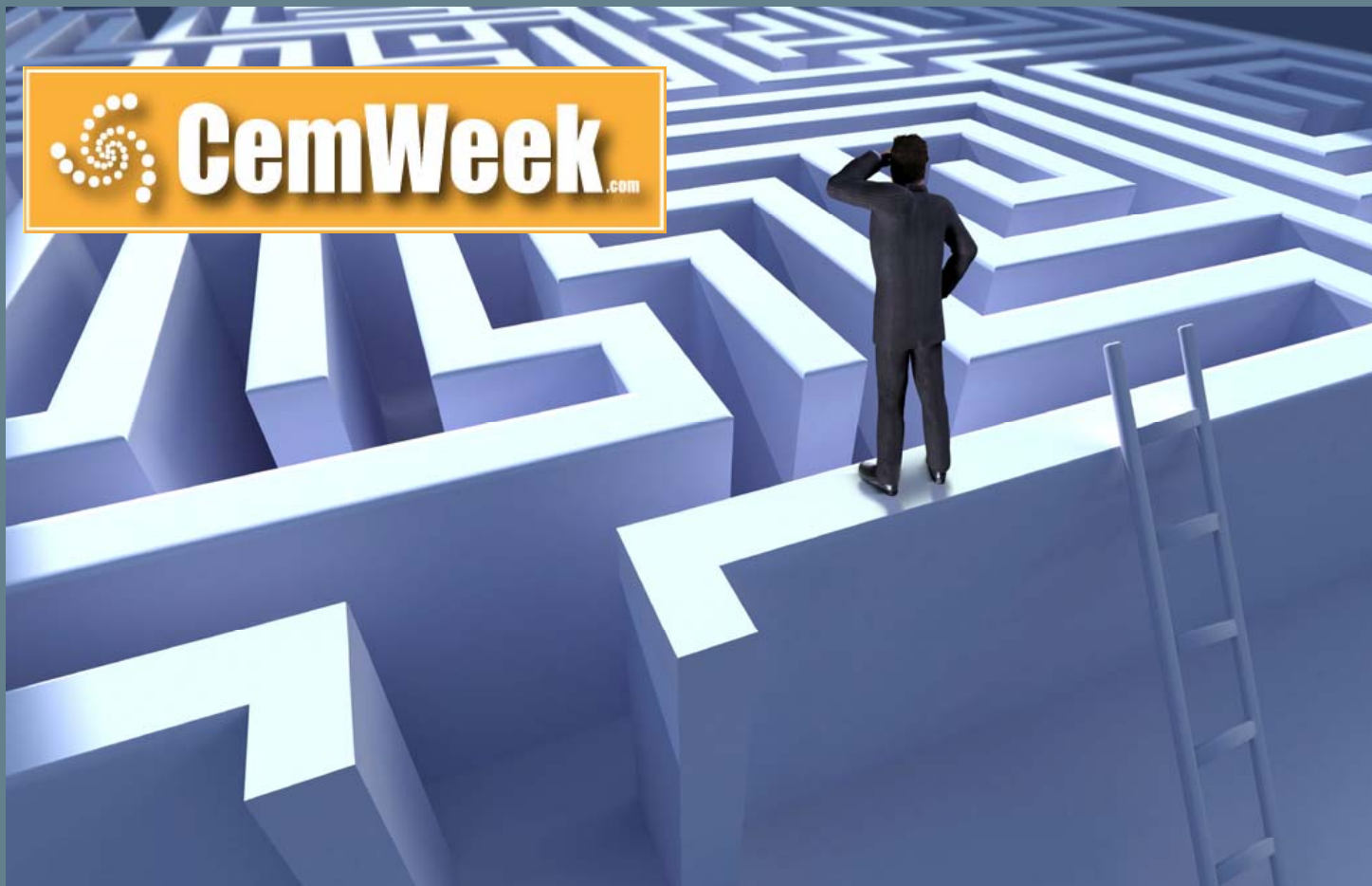
Primacy in terms of consumption is certainly not the only EKO strong point: advantages extend to design features that boost market competitiveness and full compliance with all the most modern production requirements.

First of all, Sacmi has responded to the need for frequent size changeovers and accurate management of increasingly smaller production batches by cutting kiln

consumption during pauses in production (by 25%) and by implementing firing curve monitoring and control systems to minimize temperature variation inside the firing chamber (within 2 °C); this allows for high-precision material yields regardless of size or thickness, thus minimizing waste.

The decision to place kiln consumption data at the disposal of customers ensures they can monitor kiln performance in real time via an advanced, user-friendly interface. On Sacmi machines, the supervision system provides, in fact, all essential system information and can be interfaced with external control tools, a factor vital to the proper management of modern manufacturing facilities.

With numerous references from key players in European and international ceramics - over 50 EKO ovens have been sold in 10 countries around the world - Sacmi is a complete plant engineering partner-provider, capable of offering all-round consultancy services thanks to an in-depth understanding of consumption and resource optimisation procedures at every stage of the production sequence.



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Sulphate resistance and eco-friendliness of geopolymer concretes

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The geopolymer concretes (GPCs) have inorganic polymer of alumino-silicates as the binder whereas the conventional concretes have Portland cement (P-C) generated C-S-H gel (besides free lime). It is well known that mechanisms of attack by sodium and magnesium sulphates are different. Conventional concretes are generally not resistant to prolonged exposure to very high concentrations of $MgSO_4$ solutions because decalcification of C-S-H to form magnesium silicate hydrate (M-S-H). Attack by sodium sulphate is severe on P-C composites, basically due to formation of expansive salts such as gypsum and ettringite in the hydrated cement matrix. It would be interesting to know whether GPCs also get affected by these sulphates even though GPCs have geopolymer, not the C-S-H (also no free lime), as the main binding material. This aspect was studied in the investigation presented here. Test specimens of typical GPCs (GGBS based, with fly ash contents of 25 percent and 50 percent) and Portland Pozzolana Cement Concrete (PPCC) were submerged separately in 5 percent Na_2SO_4 and 5 percent $MgSO_4$ solutions for 90 days. The test results indicate that for 30 and 90 days exposure, there were small changes in weights, ranging from weight gain of about 2 percent to weight loss of about 2.4 percent only, there were quite different significant losses of strength in the concretes

– the ranges being about 2 percent to 29 percent for GPCs as compared to 9 percent to 38 percent for PPCC depending upon the exposure time and type of sulphate. However, GPCs were found to resist sulphate attack (both magnesium and sodium based) always better than PPCC as seen from their higher residual strengths after exposure to sulphates. Eco-friendliness of GPCs were examined by computing parameters such as 'Embodied Energy' and 'Embodied Carbon' or 'Embodied CO_2 Emission', per unit volume of concrete, Energy and CO_2 emission involved to produce unit strength in concretes, etc. It was observed that GPCs were superior to PPCC in terms of these parameters also.

Keywords: Geopolymer, sulphate resistance, Portland Pozzolana cement, fly ash, slag, sodium hydroxide, sodium silicate.

Portland cement (P-C) is used as binder in production of cement concretes which have been found to be satisfactory in most of the civil engineering structures.¹⁻³ However, Portland cements are highly internal-energy-intensive and cause emission of green house gas, CO_2 during their production.¹ These P-C based conventional concretes (CCs) are found to be less durable in some of the very severe environmental conditions; therefore there is a need for development of alternate concretes.²

Table 1a. Properties of Portland pozzolana cement (PPC)

No	Descriptions	PPC
1	Fineness, m ² /kg	306
2	Normal consistency, %	31
3	a) Initial setting time, minutes	55
	b) Final setting time, minutes	100
4	a) Soundness Le Chatelier expansion, mm	0.5
	b) Soundness autoclave expansion, %	0.08
5	Compressive strength at 28 days, MPa	56
6	Specific gravity	3
7	Loss on ignition (%)	1.31

In this regard, geopolymer concretes (GPCs) are considered as potential candidate materials.⁴⁻¹⁰ These new concretes utilize industrial wastes such as fly ash (FA) and Ground Granulated Blast Furnace Slag (GGBS) to produce inorganic polymer binder in the form of alumino-silicates.

Many new alternatives to Conventional Concretes (CCs) are being explored to make the constructions more sustainable and eco-friendly. In this regard, GPCs are quite useful. In order to make them acceptable in practical applications, these new concretes should be shown to possess adequate strength and durability characteristics, if possible, superior to CCs. These aspects are being studied in the investigations undertaken at CSIR-SERC, Chennai, and the test results available in this programme are related to understanding of both durability and strength characteristics.¹¹⁻²¹ However, this paper deals with resistances of the concretes to sodium and magnesium sulphates, besides rate of strength development and quantifying the eco-friendliness of the GPCs.

Scope and objectives of present study

Since Portland pozzolana cement (PPC) is the most easily available cement in the market at present, it was chosen to produce conventional cement concretes identified as PPCC in this paper. Two typical GGBS based GPC mixes was selected based on the earlier works at CSIR-SERC; the mix GPC1 had binder made of 75 percent GGBS+25 percent FA and the other mix GPC2 had equal

Table 1c. Properties of Fly Ash

No	Components	IS 3812 (2003)	Fly ash used
1	SiO ₂ + Al ₂ O ₃ +Fe ₂ O ₃	70% minimum	98%
2	SiO ₂	35% minimum	59%
3	Al ₂ O ₃	-	21%
4	Fe ₂ O ₃	-	18%
5	MgO	5% maximum	0.22-0.34%
6	Total sulphur as SO ₃	2.75% maximum	-
7	Alkalis as Na ₂ O	1.5 % maximum	0.54%
8	LOI	12% maximum	1.05-1.08%
9	CaO	-	0.86-1.02%
10	Specific gravity	-	2.2
11	Bulk density	-	950 kg/m ³
12	Fineness (Blaine)	-	3435 cm ² /gm

Table 1d. Properties of aggregates

No	Property	Coarse aggregate	Fine aggregate
1	Specific gravity	2.72	2.65
2	Water absorption	1.20 %	0.50 %
3	Fineness modulus	6.68	2.4
4	Bulk density, kg/m ³	1650	1550
5	Source	Crushed granite stone	River bed

contents of GGBS and FA. As the sulphate is one of the most common deteriorating agents in the concrete structures, the present programme was undertaken to evaluate the GPC mixes through accelerated sulphate attack by employing cylindrical specimens (75 mm dia x 150 mm height) and solutions of Sodium and Magnesium Sulphates at a concentration of 5 percent to create severe environment. The 100 mm cubes were used for evaluating compressive strengths. Besides visual observations, changes in weight were recorded. A selection of this high concentration was done with a view to achieve faster deterioration of concretes so that the test period can be short to get measurable and noticeable changes in the specimens. It was also reported by Bonen that increase of MgSO₄ concentration beyond 4.2 percent leads to severe deterioration due to formation of M-S-H.²² This observation was made after a detailed study of the microstructure of Portland cement paste subjected to attack for one year by magnesium sulphate solutions of 2.1% and 4.2% concentrations.

Any new material of construction should be assessed for both strength and durability characteristics. Among

Table 1b. Properties of GGBS

Loss of ignition %	Glass content %	Fineness cm ² /gm	Specific Gravity	Chemical composition, %						
				CaO	SiO ₂	Al ₂ O ₃	Na ₂ O	K ₂ O	MgO	LOI
2.1	85	4000	2.92	40.3	43.4	12.5	0.9	0.6	1.5	2.1

Table 1e. Properties of sodium silicate solution

Specific gravity	1.56-1.66
Na ₂ O	15.5-16.5
SiO ₂	31-33
Weight ratio	2.2
Molar ratio	2.2
Iron content, ppm	<100
Baume	51-55

(Source : <http://www.pqcorp.com>)

Table 1f. Properties of Sodium hydroxide flakes (SHf)

Molecular formula	NaOH
Molar mass	39.9971 g/mol
Appearance	White solid
Density and phase	2.1 g/cm ³ , solid
Solubility in water	111 g/100 ml (20°C)
Melting point	318°C
Boiling point	1390°C
Basicity (pKb)	-2.43
Exposure to air	Highly hygroscopic in nature
Amount of heat liberated when dissolved in water	44.45 kJ/mole = 1.1111 kJ/gram = 266 calories/gram
Storage	Air tight container (absorbs CO ₂ from the air)

Source : <http://www.answers.com/library/Wikipedia-cid-76614>)

various sulphates, Sodium and Magnesium Sulphates are reported to be highly aggressive chemicals for CCs.²³⁻²⁹ GPCs have to fare better than CCs with regards to sulphate resistance if these new concretes are to adopted in the field. The test data in this paper will enable the engineers to examine the comparative durability and strength aspects of the GPCs and consider them in construction of actual structures in view of their quantifiable eco-friendly nature, as shown in this paper.

Details of experimental work

Materials used

Properties of materials are described in Tables 1a to 1f.

Preparations of test specimens

The mix proportions (Table 2) were arrived by trial mixes, so that the slump value of at least 100 mm is achieved and the mix was easily compactable buying a laboratory table vibrator.

Table 2. Details of concretes

Mix Id		GPC1	GPC2	PPCC
Binder Composition	% FA,	25	50	28
	% GGBS	75	50	0
	% OPC	0	0	72
Binder / Activator Solution		0.55	0.55	0.45
Activator solution		AAS	AAS	Water
Na ₂ O content in AAS as % binder		5.58	5.58	0
Superplasticiser % Binder		0	0	0.75
Slump, mm		110	125	130
Density, kg/m ³		2360	2350	2353
Ingredient contents, kg/m ³				
Fly ash		106	212	98
GGBS		319	212	0
OPC		0	0	252
Sodium hydroxide in flakes form (SHf)		23	23	0
Sodium silicate solution (SSS) with Molar Ratio =2.2		47	47	0
Distilled water (DW)		164	163	0
Water		0	0	158
Superplasticiser (SP)		0	0	3
Sand		638	635	862
Coarse aggregate (SP)		1063	1059	981
Activator solution sp Gr		1.16	1.16	1.00

Ingredients were weighed in digital balances; mixing was done in a pan mixer for a minimum of 5 minutes to achieve the uniformity in the mix. The freshly prepared mix was weighed for density and placed into a steel mould in three layers and compacted using a laboratory table vibrator. The specimens were demoulded after 24 hours of casting. GPC specimens were self cured by storing them openly under ambient conditions (temperature 25 to 35 °C, relative humidity 65 percent to 85 percent). The PPCC specimens were kept submerged in water for effecting the curing.

Sulphate attack test on concrete specimens

The sodium sulphate solution was prepared by dissolving 5 gm of Na₂SO₄ solids in 95 gm of distilled water to get 100 gm of solution. Similarly, the magnesium sulphate solution was prepared by dissolving 5 gm of MgSO₄ solids in 95 gm of distilled water to get 100 gm of solution. The cylindrical specimens were submerged

Table 3a. Test data on concretes

1	Mix Id		GPC1	GPC2	PPCC
2	Binder Composition	% FA	25	50	28
		% GGBS	75	50	0
		% OPC	0	0	72
3	Binder/ AS		0.55	0.55	0.45
4	Activator solution (AS)		AAS	AAS	Water
5	Na ₂ O in AS as % binder		5.6	5.6	0
6	Compressive Strength (fc), MPa	1day	25	22	12
		7day	30	26	25
		14day	34	29	31
		28day	51	52	41
		90day	54	53	67
7	Rate of strength development	fc1d/fc28d (%)	49	42	29
		fc7d/fc28d (%)	59	50	61
		fc14d/fc28d (%)	67	56	76
		fc28d/fc28d (%)	100	100	100
		fc90d/fc28d (%)	106	102	163

in the solution in plastic tubs such that there was a minimum of 30 mm depth of liquid over the top surface of specimens. The specimens are taken out from the tubs at end of test duration for visual observation and washed with tap water before weighing in a digital balance of 0.1 mg accuracy.

Discussion on test results

Fresh concrete properties

Workability of about a 100 mm for all the concrete mixes was obtained. There was no or very little bleeding. The fresh concrete density of GPCs and PPCC were similar (Table 2).

Compression strength

The average 28 days compression strengths of GPC1, GPC2, and PPCC were 51, 52, and 41 MPa. GPCs had gained almost its full strength at the end of 28 days where as PPCC continued to gain considerable strength after 28 days also (Table 3a, Figure 1a and 1b). It may be noted that the strength levels here are quite adequate when compared with the minimum structural grade recommended in IS 456:2000.³⁰ In present study, the 1 day strengths of GPC1 and GPC2 were 25 and 22 MPa which are quite useful in faster construction of structures, moreover, the GPCs studied do not require any external curing and only ambient conditions are enough for the geopolymerisation reactions and subsequent strength gain. In contrast, OPC based concretes such as PPCC need always careful curing through exposure to moisture or water. It is noted here that the PPCC had a

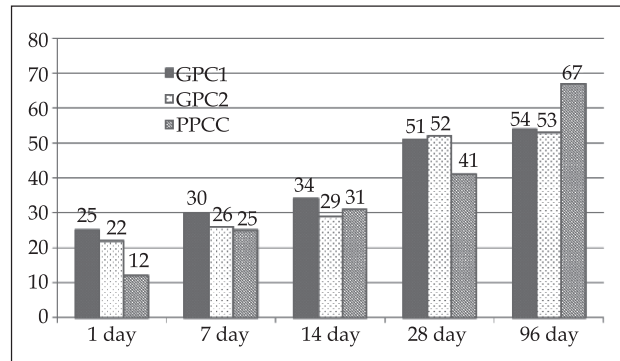


Figure 1a. Compressive strengths (MPa) of concretes

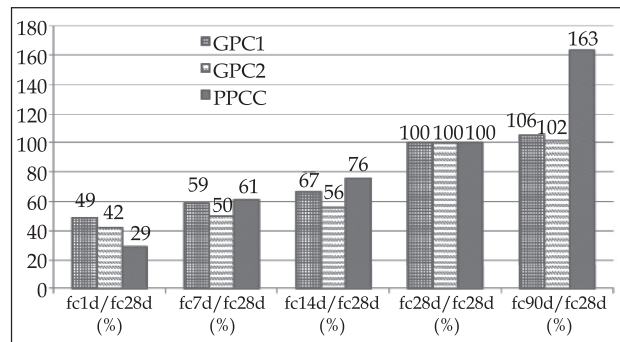


Figure 1b. Strength development rates for concretes

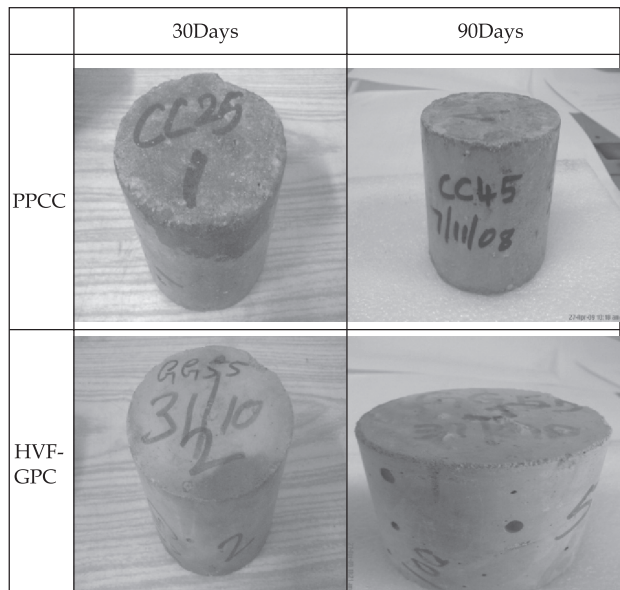


Figure 2a. Typical condition of specimens after exposure to 5%Na₂SO₄

Table 3b. Test data on concretes

1	Mix Id			GPC1	GPC2	PPCC	% Reduction in GPCs	
							GPC1	GPC2
2	Binder Composition		% FA	25	50	28		
			% GGBS	75	50	0		
			% OPC	0	0	72		
3	Binder/AS			0.55	0.55	0.40		
4	Activator solution (AS)			AAS	AAS	Water		
5	Na ₂ O in AS* as % binder			5.6	5.6	0		
6	Exposure to Na ₂ SO ₄	Weight loss (%)	30 days	-0.84	-0.43	1.09	74	79
			90 days	1.47	1.53	2.41	59	66
7	Exposure to Na ₂ SO ₄	Strength loss (%)	30 days	1.78	4.36	12.18	80	80
			90 days	28.9	18.9	38.6	41	27
8	Exposure to MgSO ₄	Weight loss (%)	30 days	-2.06	-0.55	-0.64	91	82
			90 days	1.38	1.38	1.43	57	56
9	Exposure to MgSO ₄	Strength loss (%)	30 days	6.48	10.24	9.08	63	60
			90 days	15.8	21.28	19.33	31	58

Note: Binder/AS ratio in PPCCs is water-binder ratio or water-cement ratio, AS= Activator solution for GPC is made from mixture of sodium silicate (molar ratio 2.2) and sodium hydroxide solutions, GPC = Geopolymer Cement Concrete, PPCC=Portland Pozzolana Cement Concrete, % Reduction in GPC = 100*(PPCC-GPC)/PPCC

1day strength of only 12 MPa which is much less than those of GPCs.

The data in Table 3a (and Figure 1b) shows that the ratio of f_{1d}/f_{c28d} of GPC1 and GPC2 were 49 percent and 42 percent and these values for ratio of f_{7d}/f_{c28d} were 59 percent and 50 percent; these ratios are much higher than those of PPCC indicating much faster rate of development than PPCC. The strength increase

beyond 28 day up to 90 day in case of PPCC is 63 percent which is substantial as compared to this value being only about 6 percent for GPC1 and 2 percent for GPC2. Thus, it is confirmed that the GPC develops fast its ultimate strength compared to PPCC. This is a useful and desirable property in structural concretes.

Effects of exposure to Na₂SO₄ and MgSO₄

The Figure 2a shows typical GPC and PPCC specimens at the end of 30 and 90 days of exposure; weight and strength losses are given in Table 3b. At the end of 30 days, there were minor changes in the weight in a the range of -0.4 percent to 1.1 percent, but there was noticeable strength loss of about 12.2 percent in PPCC where as the strength loss in GPC specimens was almost negligible, the actual values being 1.8 percent for GPC1 and 4.4 percent for GPC2. But, at end of 90 days of exposure, there was noticeable weight losses in both concretes, but, very low values, and therefore, the specimens had maintained their integrity with very minor distress seen on the surface when examined visually. But, significant losses in strengths were observed. The mixes GPC1 and GPC2 had strength losses of about 29 percent and 19 percent respectively. But, the PPCC had recorded still significantly higher strength loss of about 39 percent thereby proving the superiority of GPCs.

The above observed loss in strength of P-C based concretes may be attributed to the fact that Na₂SO₄ attacks the cement hydration products – CSH, CH and CAH to form gypsum and ettringite which are expansive in nature causing cracks in the matrix.³¹⁻³³ It may be

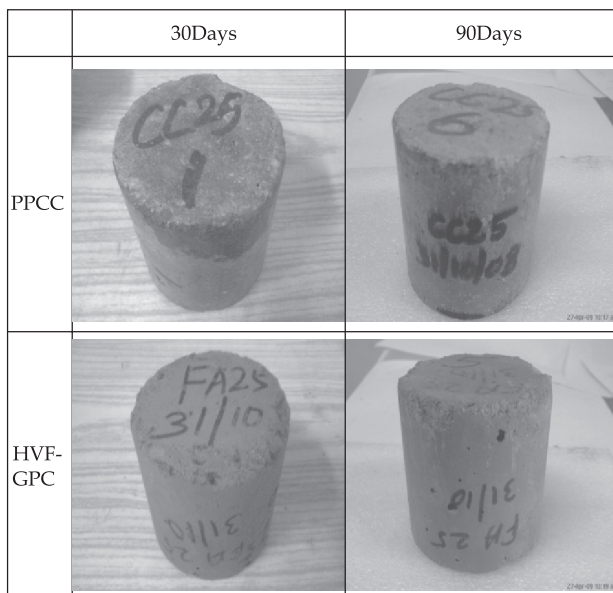


Figure 2b. Typical condition of specimens after exposure to 5%MgSO₄

noted here that actually ettringite is formed during initial hydration reactions and this formation though results in a volume increase in the fresh, plastic concrete, due to the concrete's plastic condition, this expansion is harmless and unnoticed. But, in case of cured/hardened concrete matrix, ettringite causes expansive stresses in concrete matrix resulting in cracking. Destruction of CSH due to decalcification also occur and cracks lead to loss of concrete strength. However, sulphate attack occurs only when the sulphate ion concentration exceeds a certain threshold and therefore often somewhat contrasting test results reported on the sulphate attack. Therefore, if lower concentrations of Na₂SO₄ are considered for exposure conditions, the test results may be numerically different from those reported in this paper, however, the test duration has to be lengthened considerably to get test results similar to those observed in the present study.

With regards to MgSO₄ attack (Figure 2b, Table 3b), at the end of 30 and 90 days of exposure to sulphate solution, both the PPCC and GPC specimens had maintained their integrity with very minor distress seen on the surface when examined visually. The specimens had only minor changes in mass (-0.6 percent to +1.4 percent), but, accompanied by observable losses in strength in the range of about 6 percent to 21 percent depending upon type of concrete and exposure period. The mixes GPC1, GPC2 and PPC had percent strength losses of about 6.5, 10.2, and 9.1 percent after 30 days of exposure and these values increase to 15.8, 21.3, and 19.3 at end of 90 days of exposure. Thus, there is no clear distinction between the GPC and PPCC mixes in respect of resistance to attack by 5 percent MgSO₄ solution. However, GPC1 containing 25 percent fly ash and 75 percent GGBS, seems to lose marginally less strength than both GPC2 (containing higher amounts of fly ash) and PPCC.

The above observed loss in strength of P-C based concretes may be attributed to the fact that MgSO₄ has a more far reaching action than other sulphates.³¹⁻³³ It attacks cement hydration products - CSH, CH and CAH to form gypsum, Mg (OH)₂ (brucite) and aqueous silica.^{22,34} Because of the very low solubility of Mg (OH)₂, the reaction proceeds to completion thereby making

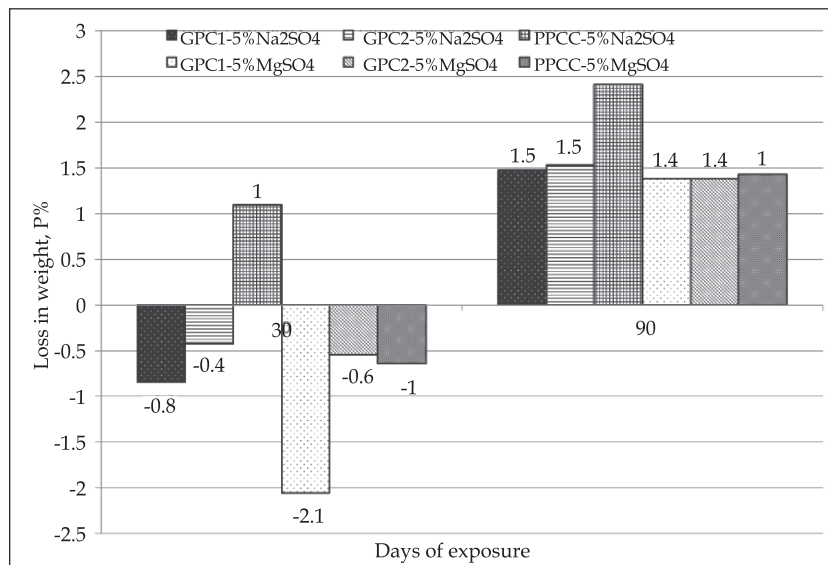


Figure 3a. %Loss in weight on exposure to 5 % sodium and 5% magnesium Sulphates

attack by MgSO₄ more severe. Destruction of CSH due to decalcification leads to loss of concrete strength because of reduced cohesion in Hydrated Cement Paste (HCP) and lowered bond between HCP and aggregate. Higher duration of test could lead to almost full collapse of C-S-H leading to considerable strength losses with negligible residual strength levels. Biczok had identified that in the first step, C-S-H gel reacts with the sulfate and magnesium to form gypsum, brucite, silica gel, and water and in the second step, M-S-H is formed.²⁵

Table 4a. Data on EE and EC for ingredients of concrete and processing

Ingredient	EE MJ/kg	ECO2e kgCO2e/kg	Cost Rs/kg
Fly ash	0.1	0.008	1
GGBS	1.6	0.083	3
OPC	5.5	0.93	5
SHf	3	0.015	20
SSS	3	0.015	12
DW	0.01	0.0008	2
Water	0.01	0.0008	0.01
SP	9	0.38	50
Sand	0.15	0.0051	1
CA	0.083	0.0048	1
Processing	0.014	0.018	0.5

Table 4b. Benefits of GPCs relative to PPCC Advantage of GPC relative to PPCC=AdvGPC (%) = 100*(PPCC-GPC)/PPCC

Parameter	Units	GPC1	GPC2	PPCC	AdvGPC (%)		Remarks
					GPC1	GPC2	
fc28,	MPa	51	52	41.0	-24.4	-26.8	GPCs are Stronger
EE	MJ/m ³	950	787	1665	43.0	52.7	Less energy intensive
ECO ₂ e	kgCO ₂ e/m ³	79	71	288	72.4	75.3	Less CO ₂ emission
Cost	Rs/m ³	5300	5066	4510	-17.5	-12.3	Costlier
EE/fc28	MJ/MPa	19	15	41	54.1	62.7	Require less energy for unit strength
ECO ₂ e/fc28	kgCO ₂ e/MPa	2	1	7	77.8	80.5	Emit less CO ₂ for unit strength
Cost/fc28	kgCO ₂ e/MPa	104	97	110	5.5	11.4	Lower cost for unit strength

However, nature of attack in GPCs is to still to be established. In the present case of GPCs, the residual strengths in GPC1 and GPC2 were about 84 percent and 79 percent respectively after 90 days of 5 percent MgSO₄ exposure. The residual strengths after 90 days of 5 percent Na₂SO₄ exposure were about 71 percent for GPC1 and 81 percent for GPC2. Similar observations recently were made by Thokchom where 79 percent to 90 percent residual strengths were reported after 24 weeks of exposure to 5 percent MgSO₄ exposure of geopolymer mortars made from high temperature activation of fly ash by sodium silicate and hydroxide.³⁵ Bakharev immersed geopolymers for a period of 5 months in 5 percent solution of sodium sulfate and observed residual strengths of 82 percent for sodium silicate

activation.³⁶ Negligible changes in mass of geopolymers on exposure to sulphates, as seen in the present case, were also reported by Bakharev and Wallah.³⁶⁻³⁷ The crystallization of sodium sulphate within the pore structure of concrete itself can be particularly damaging to concrete (Winkler, 1972).³³

Based on the test data in the present paper, we can conclude that GPCs can be considered as more resistant to attack by sodium sulphate compared to conventional cement concretes, even though, the magnesium sulphate seems to affect both GPCs and PPCC. It may also be noted here that detailed studies at SERC have indicated

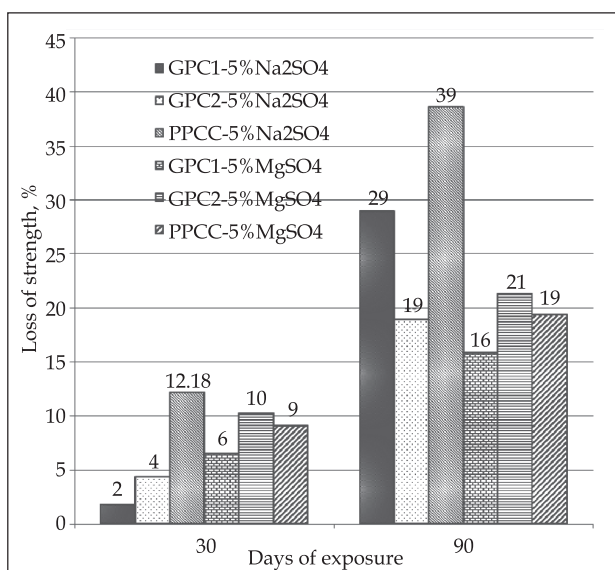


Figure 3b. Loss of strength (%) on exposure to 5% sodium and 5% magnesium sulphates

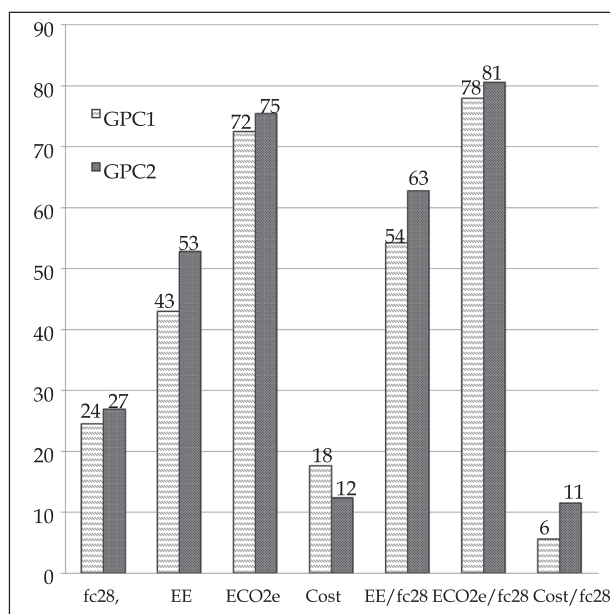


Figure 4. Advantages of GPCs relative to PPCC [100*(PPCC-GPC)/PPCC]

that GPCs are also superior to PPCCs when tested for exposure to even 10 percent sulphuric acid solution and these test results are being discussed in separate publications.

Ecological analysis of concretes

Embodied energy (EE) and Embodied Carbon (ECO_2e) of concretes can be computed to examine the ecological effects of the concretes [Cement & Concrete Institute, 2011; URL1].³⁸⁻³⁹ The EE of a product is defined in the literature as the energy consumed for the raw material extraction, transportation, manufacture, assembly, installation, disassembly and deconstruction for any product system over the duration of a product's life. The Embodied Carbon (ECO_2e or EC) is the CO_2 released for the raw material extraction, transportation, manufacture, assembly, installation, disassembly and deconstruction for any product system over the duration of a product's life. The data on EE and EC for the ingredients and the concretes were taken from the literature [Cement & Concrete Institute, 2011; URL1; URL2; Flower, 2007; BCA, 2008; URL3, Hammond, 2011].^{38,39,40,41,42,43} The computations are shown in Table 4a. The benefits of GPCs over PPCC are given in Table 4b and shown in Figure 4. The numerical values shown here are only indicative in nature, the actual quantities may change when detailed analysis is done in any particular case of application.

The EEs of GPC1, GPC2 and PPCC were 950, 787 and 1665 MJ/m^3 (Table 4a) and thus the GPC1 and GPC2 had 43 percent and 53 percent lower in energy requirement (Figure 4). The ECs of GPC1, GPC2 and PPCC were 79, 71 and 288 MJ/m^3 (Table 4) and thus the GPC1 and GPC2 had 72 percent and 75 percent lower Embodied Emission of CO_2 (Figure 4). Thus, the GPCs should be considered as more eco-friendly. It may be noted here that the PPCC considered here itself had 28 percent fly ash and if the conventional concrete is made of OPC only (which is often the case still in many projects), the GPCs would still look more advantageous. Because of high cost of AAS, the GPC1 and GPC2 were found to be about 18 percent and 12 percent costlier than PPCC, but, they had much higher early strengths (compared to PPCC) at 1 day and 7 day there by offering many construction advantages which are not accounted here in costing.

However, if 28 day strength is taken as criterion, the energy required to produce one MPa of concrete strength is 41 MJ/m^3 for PPCC and this value reduces to 19 for GPC1 and 15 for GPC2. Thus, energy required to produce

one unit strength in GPC1 and GPC2 would be 54 percent and 63 percent lower than PPCC. Similar advantages of GPCs in respect of Embodied CO_2 emission can also be observed. The CO_2e emitted to produce one MPa of strength is 2 kg/m^3 for GPC1 and 1 kg/m^3 for GPC2, whereas this number is as high as 7 for PPCC (Table 4b, Figure 4). Thus, the GPCs can save more than 80 percent CO_2 emission as compared to PPCC.

Data and discussion above on ecological parameters for evaluating the sustainability and eco-friendliness of concretes, demonstrate that the GPCs are indeed more suitable, desirable and durable alternate to Portland cement based concretes. It should be recognised here that the EEs of SHf and SSS used in the present calculations are only indicative in nature and the calculations have to be repeated again when the actual values in any particular case are available. Moreover, the manufacture of these chemicals is done in several ways using varieties of raw materials and processes; improvements in technology are occurring continuously.

Concluding remarks

- Fly ash and GGBS are used in the present study to produce geopolymeric reactions with the help of sodium hydroxide-silicate based alkaline activator solutions (AAS). The geopolymers are able to produce structural grade concretes much more than the minimum grade specified in IS 456-2000.
- The GPC mixes were produced easily using equipment similar to those used for production of conventional cement concretes.
- As the GPCs do not have any Portland cement, they can be considered as less energy intensive (i.e., low 'Embodied Energy') since Portland cement is a highly intensive energy material next only to Aluminium and Steel.
- Apart from less energy intensiveness (actually almost negligible 'Embodied Energy'), the GPCs utilize the industrial wastes for producing the polymeric binding system in concrete, they should be considered as highly eco-friendly material.
- The GPC and PPCC mixes indicated minor changes in weight, but, significant reduction in compressive strengths after exposure to sodium and magnesium sulphates. The PPCCs had

strength losses of 9 percent to 39 percent, in contrast to lower strength losses of 1.4 percent to 21.3 percent indicated by GPCs, depending upon the type of sulphate and exposure period for sulphates. Decalcination of C-S-H gel and formation of gypsum and ettringite in P-C based concretes and release of alkalis from geopolymers into solution in GPCs could be considered as major reason for deterioration of strength on attack by Na_2SO_4 . However, GPCs can be considered as more resistant to attack by sodium sulphates as compared to conventional cement concretes.

- The GPC and PPCC mixes were found to be almost similar in respect of resistance to attack by 5 percent MgSO_4 solution. There were minor changes in weight, but, significant reduction in compressive strengths after 90 days of exposure. Decalcination of C-S-H gel of P-C based concretes and release of alkalis from geopolymers into solution in GPCs could be considered as major reason for deterioration of strength on attack by MgSO_4 .
- GPCs have higher strength development rate than that PPCC and this may be advantageously exploited in actual constructions.
- Eco-friendliness of concretes quantified in this paper indicate that GPCs are superior to conventional Portland cement based concretes and hence have potential to become preferred material of construction for sustainable modern infrastructure developments

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References

1. Mehta, P.K. and Monteiro, P.J.M., (2005). *Concrete: Microstructure, Properties and Materials*. Third Ed., New York: McGraw-Hill
2. Neville A.M. (1995). *Properties of concrete* Fourth edition. By A.M. Neville. Addison-Wesley Longman Ltd., U.S.A. 844 p
3. Shetty M.S., (2006). *Concrete technology*, S C Chand Company, New Delhi.
4. Bakharev T., J.G. Sanjayan, Y.-B. Chen, (2003). "Resistance of alkali-activated slag concrete to acid attack", *Cem. Concr. Res.*, Vol 33, pp 1607- 1611.

5. Davidovits, J., (1991). "Geopolymers: inorganic polymeric new materials", *J. Therm. Anal.* 37, 1633-1656.
6. Davidovits, J., (2010). "Geopolymer Cements from Low-Tech to High-Tech Applications", *Proceed of the 7th Structural Engineering Convention SEC 2010*, Annamalai University, Annamalaiagar, 8-10 December, pp 1-17
7. Davidovits, J., (2010). "International Workshop on Geopolymer Cement and Concrete" 7, December, Annamalai University, Annamalaiagar, 8-10 December, 57 pp
8. Cheng, T. W. and J. P. Chiu, (2003). "Fire-resistant Geopolymer Produced by Granulated Blast Furnace Slag." *Minerals Engineering* 16(3), 205-210.
9. Warner, R. F., B. V. Rangan, A.S. Hall, K.A. Faulkes. (1998). *Concrete Structures*. Melbourne, Addison Wesley Longman Australia Ltd.
10. Palomo A., Fernu' A' ndez-Jimenez A., Criado M., (2004). "Geopolymers: one only chemical basis, some different microstructures", *Mater. Constr.*, 5, 77-91.
11. Rajamane, N. P., (1992). "Discussion on Review of recent research in alkali activated concrete in China", *Magazine of Concrete Research*, 44(159), 137-139
12. Rajamane, N. P, Sabitha D., Sajana Mary James, Gopalakrishnan S., (2005) "Studies on development of geo-polymeric low-energy cement from fly ash for structural applications", *Proceed. of the International Conference on Advances in Concrete Composites and Structures, ICAS 2005*, 6-8 Jan., Chennai, pp 219-226
13. Rajamane, N. P., Sabitha, D., and Sajana Mary James, (2005). "Potential of industrial wastes to produce geo-polymeric mortar of practical utility - a study", *Indian Concrete Institute Journal*, 5(4), 9-20.
14. Rajamane, N. P., Sabitha, D. and Shijna, P. K., (2005). "Feasibility of achieving 40 MPa in 40 hours in mortars without Portland cement using Class F fly ash and blast furnace slag powder", *Civil Engineering and Construction Review*, New Delhi, 18 (4) 36-44.
15. N. P. Rajamane, D. Sabitha, (2005). "Studies on geo-polymer mortars using fly ash and blast furnace slag powder", *International Congress on Fly Ash, Fly Ash India 2005*, 4 - 7 December 2005, at Convention Hall, Hotel Ashok, New Delhi, India, In CD form, Chapter VI, Paper No 0019, 1-7 (won Best Paper Prize)
16. Rajamane N. P., P. S. Ambily and D. Sabitha, (2006). "Studies on Geopolymer Concretes Containing Sintered Fly Ash Aggregates and Granite Aggregates", *Proceed of Fifth Asian Symposium on Polymers In Concrete, 5TH ASPIC*, 11-12 September, 2006, SERC, Chennai, India, Vol 2, pp 513-520
17. Rajamane N.P., M.C. Nataraja, N. Lakshmanan, and J.K. Dattatreya, [2011], "Applicability of Acceptance Criteria of IS:456-2000 to GGBS based Self Curing Geopolymer Concrete", *Proceed of the National Conference on Advances in Materials and Structures, "AMAS - 2011"*, February 3-4, 2011, Pondicherry, pp 370-378.
18. Rajamane, N. P., N Lakshmanan, P S Ambily and M C Nataraja, [2010], 'Effect of molar ratio of sodium silicate on compressive strength of geopolymer concretes', *Civil Engineering and Construction Review (CE & CR)*, Vol. 23, No. 8, August, pp. 94-101
19. Rajamane N. P., Nataraja M. C, Lakshmanan, Dattatreya J. K and Sabitha, [2010], "Sulphuric acid resistance of geopolymer concretes", *Proceed of the Asian Conference on Concrete ACECON 2010*, Organised by the Indian Concrete Institute and the Indian Institute of Technology Madras, 5-9 December, pp 789-794
20. Rajamane N.P., M.C. Nataraja, N. Lakshmanan, and J.K. Dattatreya, [2010], "Flexural Behaviour of Reinforced Geopolymer Concrete Beams", *Proceed of the 7th Structural Engineering Convention SEC 2010*, Annamalai University, Annamalaiagar, 8-10 December, pp 617-625

21. Rajamane N.P., M.C. Nataraja, N. Lakshmanan, and P.S. Ambily, [2009], "Geopolymer concrete -An ecofriendly concrete", The Masterbuilder, , Vol.11, No. 11, November, pp 200-206.
22. Bonen David and Menashi D. Cohen, Magnesium sulfate attack on Portland cement paste - I Microstructural analysis, CEMENT And CONCRETE RESEARCH. Vol. 22, pp. 169-180, 1992.
23. Biczok, I. Concrete Corrosion, Concrete Protection. 8th edn. Akademiai Kiado, Budapest, 1980
24. Mangat, P.S. and El Khatib, J. M. Influence of initial curing on sulphate resistance of blended cement concrete. Cement Corur. Res. 1992, 22(6) 1089-1100
25. Rasheeduzzafar, Al-Mana. A. I., Haneef, M. and Maslehuddin. M. Effect of cement replacement, content, and type on the durability performance of fly ash concrete in the Middle East. Cemenl, Concr. Aggreg. 1986, 8(2), 8696
26. Mather, M. Field and laboratory studies of the sulphate resistance of concrete. In Performance t/f Concrete, ed. Swenson, E. G., University of Toronto Press, 1968. pp 6676.
27. Cohen, M. D. and Bentur, A. Durability of Portland cement silica fume pastes in magnesium and sodium sulfate solutions. ACI Mater. J. 1988, 85 (3). 148-157.
28. Rasheeduzzafar, Al-Amoudi, O. S. B., Abduljauwad, S. N. and Maslehuddin, M. Magnesium-sodium sulfate attack in plain and blended cements. ASCE J. Mater. Civ. Eng. 1994, 6(2), 201 222.
29. Omar Saeed Baghabra Al-Amoudi, "Performance of 15 reinforced concrete mixtures in magnesium-sodium sulphate environments", Construction and Building Motriuh Vol. 9. No. 3, 149-158, 1995 IS:456.
30. Manu Santhanam, Menashi D. Cohen, Jan Olek, (2002), "Mechanism of sulfate attack: A fresh look Part 1: Summary of experimental results," Cement and Concrete Research Vol 32 pp 915-921.
31. Manu Santhanam, Menashi D. Cohen, Jan Olek, (2003), "Mechanism of sulfate attack: A fresh look Part 2: Proposed mechanisms," Cement and Concrete Research Vol 33, pp 341-346.
32. Winkler, E.M. and Singer, P., (1972), "Crystallization pressure of salts in stone and concrete", *Bull. Geol. Soc. Am.*, Vol 83, pp 3509-3514.
33. Neville Adam, "Review article The confused world of sulfate attack on concrete", *Cement and Concrete Research* 34 (2004) 1275-1296.
34. Thokchom S., P. Ghosh and S. Ghosh, (2010), "Performance of Fly ash Based Geopolymer Mortars in Sulphate Solution," *Journal of Engineering Science and Technology Review*, Vol 3, No 1, pp 36-40.
35. Bakharev T., (2005), "Durability of Geopolymer materials in sodium and magnesium sulphate solutions", *Cement and concrete research*, Vol 35, No 6, pp. 1233-1246.
36. Wallah S. E., Rangan B. V. (2006), Low-calcium fly ash based Geopolymer concrete: long-term properties, Research report GC2, Australia.
37. Cement & Concrete Institute, "Sustainable concrete" ISBN 978-0-9584779-4-9 Cement & Concrete Institute, Midrand, South Africa. P 37, 2011 URL1, <http://www.sustainableconcrete.org.uk/> URL2, http://www.cnci.org.za/Uploads/CandCI_Footprint_Report_V16.pdf
38. BCA CSMA UKQAA. Embodied CO2 of UK cement, additions and combinations. Information Sheet P1, P2, November 2008. URL3, <https://wiki.bath.ac.uk/display/ICE/Home+Page>.
39. Hammond Geoff and Craig Jones, "Inventory of Carbon & Energy (ICE) Version 2.0", Sustainable Energy Research Team (SERT), Department of Mechanical Engineering, University of Bath, UK, 2011.



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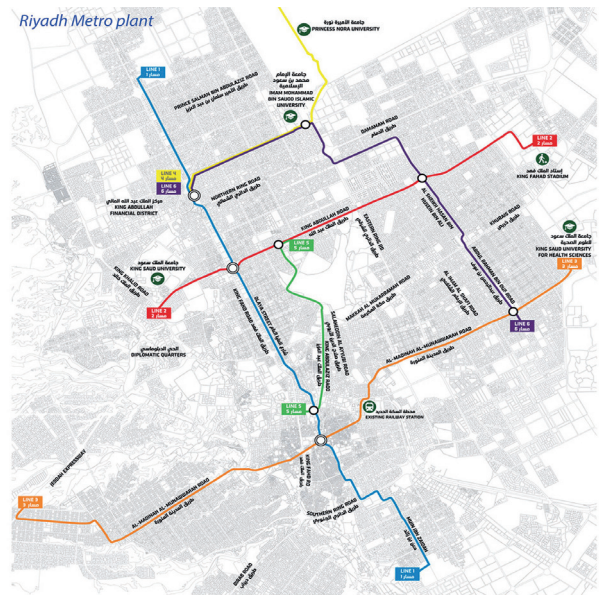


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IMPROVING RIYADH'S VIABILITY

Eng. Carmelo Sortino introduces the key role of Euromecc for the third lane of Riyadh Metro

In 2014 Civil Work Group JV (CWG) composed of Ansaldo, Salini-Impregilo, Bombardier, Larsen & Toubro and Nesma on behalf of Ar Riyadh Development Authority (ADA), was awarded the tender for the building of the third lane of Riyadh Metro for a total amount of \$6 bln. Italy-based Euromecc was chosen to provide the batching plant for a whole production of concrete around 240 m3/h confirming its position as one of the most important manufacturers of concrete batching plants and strengthening its partnership with one of the most important construction Companies all over the world.



THE PROJECT

This project belongs to a bigger one that consists in the construction of an underground network that includes 6 lines with a total length of about 180 km. In particular, the third line runs for about 41 km, starting from the west (near the Jeddah Expressway) and ending in the east (near the National Guard Camp of Khashm El Aam) for a total of 22 stations, divided into four different types, around 26 km run over concrete slab viaducts, 10 km in other kind of tunnels and 2 train maintenance depots.

This project has a fundamental role for the city's viability considering that by 2030 the population will increase from 5,7 million to 8 million; therefore the new metro system will fulfill the demands of growing population, as well as reducing traffic congestion and improving air quality.

Works begun on October 2013 and are expected to create thousands job opportunities in Saudi Arabia.

EUROMECC PROPOSAL

Starting from the customer's requests, the design of the batching plant was carried out by the technical department of Euromecc made up of more than 15 engineers. All the aspect and all the critical issues were considered in the design in order to avoid any kind of problem allowing the customer to have a reliable batching plant.

The plant was designed to produce up to 240 m3/h with two loading stations equipped with a twin shaft mixers of 3 m³ of compacted concrete yielded per cycle each. The main features of this plant are:

- N. 1 aggregate batching unit divided in 5 compartments in line, equipped with safety barriers, for a total storage up to 255 m³ of aggregates.
- Lateral extraction on both sides with N. 2 extractor belts of 14 m length and 800 mm width each having capacity of 260 m³/h for each of them.
- N. 2 loading belts, one with a length of 31 m and one with a length of 32 m, equipped with a galvanized lateral footpath platform.
- N. 6 cement silos of 225 m³ each linked to the hoppers by conveyor screws Ø273.
- N. 2 microsilica/fly ash silos of 75 m³ each linked to the hoppers by conveyor screws Ø273.
- N. 2 aggregate hoppers of 15 m³ each.
- N. 2 4,5 m³ waiting hoppers for aggregate above

- the mixers.
- N. 2 cement scales of 2 m³ each and N. 2 fly ash scales of 0,7 m³ each.
- N. 2 galvanized water tank batchers of 1 m³ each.
- N. 6 24l stainless steel batchers for admixtures.
- N. 2 twin shaft mixers with a production of 3 m³ of compacted concrete per cycle each, supported by two carrying structures 5,25 m high. On each mixer was installed a power electric command board to manage the two motors of 55 kW.
- N. 1 automation system totally customizable according the customer's needs.



CUSTOMER NECESSITIES

The challenge to which Euromecc was subjected was, over the normal operation of the plant and high quality of manufactory, working on two or three shifts to avoid the plant stopping during daily activities since its start-up. Euromecc accepted the challenge and met its target effectively. In fact, first of all, Euromecc guaranteed a kit of spare parts to prevent any kind of delays in commissioning and also supplied spare parts for one year in order to guarantee fast replacements directly at site. Moreover, Euromecc guaranteed the shipment of any kind of products within the day of request. Even a team of 10 workers, including mechanics and electricians was available within 48 hours to go to the job site to fix any issues, although until today there were none thanks to the high quality of the plant. Finally, to solve easier problems, Euromecc supplied remote IT assistance.



CONCLUSION

Once again Euromecc confirmed itself as one of the most important concrete batching plants manufacturers all over the world, supplying a plant that met customer's needs both from technical to service points of view. Particularly, Euromecc won the challenge to guarantee a reliable plant without stops or delays during the commissioning and the daily activity. Moreover, Euromecc confirmed its activity in Saudi Arabia where several plants had been installed over the years thanks to its strong sales networks. Besides this, Euromecc established in Saudi Arabia a network for post-sales assistance too in order to meet many customers needs.



Automated Drymix Mortar Application - Is the Middle East Ready for the Industrial Revolution?

By: Ferdinand Leopolder, drymix.info, MEDMA, Germany

Abstract

Throughout the Middle East, the problems linked to traditional mortar preparation on-site have been identified and recognised. And this applies not only to recent boom Nations such as UAE and Qatar, but also to the Nations with higher native population such as Saudi Arabia, Egypt, Iran and Jordan. For the traditional method of jobsite mixing, the author explains the waste of materials, the negative impact on jobsite traffic, the inferior, uneven quality and the loss in efficiency. Also, the socio-economic loss of such methods as well as the stalling impact on the education of the labor force will find mention.

The author will present solutions for this dilemma by using drymix (factory-blended and packaged) mortar in combination with jobsite machinery for volume mortars such as masonry mortars, renders, plasters and screeds, followed by the second step of employing silos and pumps in conveying bulk, wet materials to the point of use. It will be shown how jobsite traffic can be improved, and the entire construction process is being sped up. The new technology leads to massive savings while at the same time improving the quality and durability of flooring and wall rendering (plastering). In the end, the author undertakes a performance comparison between traditional method and drymix mortar application using jobsite technology. The use of modern drymix mortars in combination with jobsite automation for volume applications can really be called an industrial revolution for the region.

1 Definition, Classification of Drymix Mortars

Drymix mortar is a blend of certified sands, binders (mostly cement) and additives that are mixed, quality controlled and packaged in a highly automated production facility and transported dry to the construction site where they are applied after mixing

only with water.

The main applications are (sorted by complexity): Masonry Mortars, Cementitious Renders, Gypsum Plasters, (thick) Flooring Screeds, Aerated Lightweight Concrete Block Adhesives (ALC), Decorative Renders, Tile Adhesives and Grouts, Thermal Insulation System Mortars (EIFS), Concrete Renovation systems (including Precision Grouts), Waterproofing Slurries, (thin) Self-Levelling Underlayments (SLU).

Remark: cementitious renders are also called plasters in some regions, however, in this paper the author uses the term "render" for all wall covering materials and the term "plaster" only for gypsum based, interior wall levelling materials (from: plâtre de paris, historic name for gypsum stucco or putty).

Volume mortar is a (mostly cementitious) material used for finishing raw structures. The main substrates are bricks (for masonry mortars, renders and plasters) and concrete slabs (for screeds). Depending upon the quality of wall and floor workmanship, more or less of such volume mortars are needed to even out the respective surface. All other applications mentioned above are being classified as specialty mortars (both categories are listed in Table 1).

2 Traditional Method

The conventional way of preparing mortars is by hand-mixing sand and cement on the jobsite. For this, the contractor orders sand in bulk to be shipped and dumped at the site, cement is being brought packaged in paper bags and stacked on a pallet (see figure 1). The components are manually shovelled into a batch type tumbling mortar mixer by unskilled laborers and mixed with water there to obtain the right consistency. The mix is then emptied into portable tubs and or wheelbarrows and transported into the building by hand or using a power hoist.

	Volume Mortars	Specialty Mortars
Types	Masonry Mortars, Cementitious Renders, Gypsum Plasters, (thick) Flooring Screeds	ALC adhesives, Decorative Renders, Tile Adhesives & Grouts, EIFS, Concrete Renovation, Waterproofing Slurries, (thin) SLU, others
Application	by machine or manual	mostly manual
Consumption	from 8 to 25 kg/m²	from 0,5 to 10 kg/m²
Packaging	Silos, big bags or bags up to 40 kg	mostly 25 kg bags

Table 1: Classification of drymix mortars

The main misunderstanding by contractors and developers alike when using the traditional method is the fact that unskilled and badly paid laborers can carry out a highly technical mixing and application process with inferior materials. The result (not only in the Middle East!) are rapidly ageing, cracking surfaces, that discolor fast and attract the growth of mold, algae and mildew. The living quarters not only become ugly but unhealthy, too (see Figure 2).

Hand mixing of mortars leads to various problems during the construction process such as contaminations, high wastage, high material loss, high dust load, high traffic on elevators and stairways, uneven mixing ratios, uneven mixtures (low-shear mixer!) and logistic obstructions. Conventional mixing of mortar by hand generally leads to highly extended completion times, since the mixing and the application takes a long time and curing is not fast and well controlled.

Such jobsites also have an increased danger for accidents and personal injuries, mainly because so many people are on-site. The finished product is usually very rough, shows an uneven quality of finish, starts cracking immediately after application, already during curing, de-laminates in places, de-colors and encourages growth on the facade (see Table 2).



Figure 1: Conventional jobsite in Borneo (Malaysian part)



Figure 2: Cracking and water damage on a residential complex in Mumbai

DRY MIX MORTAR ?

	disadvantage	rating of impact
sand	uncertain origin, no defined granulometry and sieve-line, no defined water content, exposed to weather and public, storage area, contaminated with clays and/or soil and organic matter	very bad
mixing	low shear mixer does not disperse properly, dosage varies, cement can be over- or under-dosed, water (contaminated?) dosage varies, uneven ratios, uneven mixing, different mortars from batch to batch (usually visible on the building)	bad
transport to point of use	high space requirement, jobsite traffic obstructions, contamination, false curing, spillage, danger of injuries	slow
application	long curing, rough surfaces require several layers, very hard to create bond to substrate (=> labor intensive, low efficiency), need of finishing renders or plasters, poor adhesion to final paint layer (often the wrong, non-breathing paint is being used, which leads to all problems below)	very slow
labor force	many workers needed (up to ten times more than with modern technology), laborer remains unskilled, badly paid, uneducated, never becomes an expert, injuries	very costly
final product	very rough, uneven quality of finish, cracks, de-laminations in places, de-coloration, algae, mold and fungi growth, low durability, need of permanent maintenance and repair	bad, need of repair early in project lifecycle

Table 2 Disadvantages of the Traditional Method, sorted by socio-economical impact

3 Modern Technology for Volume Drymix Mortars

The advantages of pre-formulated, pre-mixed mortars are obvious: they contain all components in the right mixing ratio, are fully dispersed (=evenly mixed fine and coarse particles), use certified raw materials such as graded, washed sand and controlled quality cement and have a defined water demand (usually printed on the bags).

Even when hand working them, these drymix mortars are ready to go by just adding them to the measured water, stirring them with a suitable tool (usually mixing bit for the power drill), letting the wet mixture sit for 5 min and then re-stirring it.

Three types of applications of volume drymix mortars are possible

1. manual application (e.g. bricklaying mortar)
2. mechanised application, pumping (e.g. cementitious underlayment materials)
3. mechanised application, spraying (e.g. plasters or renders)



Figure 3 Typical Continuous Type Mortar Mixer (cut view show-model; image courtesy of m-tec)

For Volume Mortars it is advisable to abandon the use of small (25 kg) bags, they mostly come already in 40 kg bags (which are of course hard to handle and usually too heavy for the laborers) - but still, this size is too small, a 40 kg bag lasts in some cases where the wall is very uneven only for 2 m². Big bags with 1 m³ or even better silos with up to 18 m³ bring a real boost to efficiency.

3.1. Applications using Jobsite Machinery

Mixing, pumping and spraying machinery improves the handling and application of mortars tremendously and thus allow a specialised crew to work up to ten times more efficient than with the traditional method. There are

several stages to realise this advantage, they are depicted in Table 3

Technology	description	impact on efficiency (factor)
mix in bucket with wooden pole	poor mixing and dispersion, uneven mortar, small batches, carry by hand, labor intensive, small quantities only	negative (-5)
mix in bucket with suitable mixer on power drill	good mixing and dispersion, small batches, carry by hand, labor intensive, small quantities only	neutral (0; comparative basis)
batch mortar mixer	excellent homogeneity of individual batches of mortar, carry by hand or crane (time for 1 m ³ = 90 min)	medium (3)
continuous mortar mixer	excellent homogeneity of mortar, high volume continuous production, carry by hand or crane (time for 1 m ³ = 40 min)	medium to high (4)
combination: mix & pump	excellent homogeneity of mortar, continuous production, convey by hose directly to point of use	high (5)
combination: mix, pump, spray	excellent homogeneity of mortar, continuous production, convey by hose directly to application, apply mortar by spraying	high (67-)
Silo + mix, pump, spray	all advantages as mentioned above plus increase in volume, no waste packaging to remove, no obstruction to jobsite traffic	very high (8 to 10)

Table 3: Efficiency increase on the jobsite by use of suitable machinery, sorted by improvement

3.2. Application Machinery for Jobsite Use

Mortar mixers are continuous, automated mixers that ensure the fixed, proper mixing ratios of water with mortars (thus also the water/cement ratio W/C). Combined with pumps, the wet mortar can be transported to the point of use via hoses (up to 10 floors high). At the point of use, an additional pump can be used to spray the render (plaster if gypsum based) to the wall, floor screeds are usually applied directly from the hose.

(Dry) mortar silos are brought by truck from the mortar plant to the jobsite and can contain up to 18 m³ of mortar. Usually they carry their own mixer mounted right under the discharge nozzle. From here the wet mortar can be transported to the point of use automatically with high speed.

In some cases, it is also suitable to pressurize the silo with air and convey the dry mortar near the point of use (=pneumatic conveying). At the receiving station, the mortar is directly mixed by a mortar mixer and applied.

On large jobsites, silos are permanently installed for the entire duration of the works and subsequently filled by silo-trucks (similar to bulk cement silo trucks) with different types of mortars e.g. in the beginning with masonry mortars, then with floor screed, then with renders or plasters and in the end with decorative finishing render. Such an ideal jobsite is depicted in Figure 4.



Figure 4: Jobsite in Germany featuring three mortar silos and related equipment. Note the restricted space available in the finishing phase of the construction

4 The Industrial Revolution

The use of machines for the handling and application of dry mortars allows a number of advantages to be realised for the building sub-contractor and the main contractor as well as the developer and especially for the final owner or tenant. It creates a win-win situation for all process stages, from the mortar producer over the contractors to the developers. The efficiency increase in a low labor cost market such as India has been analyzed and calculated by Andreas Michelfelder¹ and is depicted in Table 5.

Job-Site Mix (500 m ²)		Mixing Pump (500 m ²)	
2 workers (at the floor, 8 h/d)	0.75 €	1 worker (operator, 8 h/d)	0.75 €
2 workers (for mixing, 8 h/d)	0.75 €	1 worker (for spraying, 8 h/d)	0.50 €
4 workers (for plastering, 8 h/d)	2.00 €	4 workers (for plastering, 8 h/d)	2.00 €
Total labour costs per hour (8 men)	3.50 €	Total labour costs per hour (6 men)	3.25 €
Average cost per hour of labour/man	0.44 €	Average cost per hour of labour/man	0.54 €
Performance per day (m ² /d)	80	Performance per day (m ² /d)	250
Working hours per day	8	Working hours per day	8
Number of workers	8	Number of workers	6
Total working hours per day	64	Total working hours per day	48
Total performance (m ² /d)	500	Total performance (m ² /d)	500
Performance per day (m ² /d)	80	Performance per day (m ² /d)	250
Total working days for 500 m ²	6.25	Total working days for 500 m ²	2
Total working hours for 500 m ²	400	Total working hours for 500 m ²	96
Total labour costs (500 m²)	175 €	Total labour costs (500 m²)	51.84 €
Difference/ respectively savings			123.16 €

Table 5: Efficiency increase when comparing the traditional method of (wall) rendering with modern drymix mortar technology (valuation base is man-hour; values in Euro)¹

The use of modern drymix mortars in combination with jobsite automation for volume applications can really be called an industrial revolution for the Middle East. Only by this technology, the region will be able to address the demands of its ever-growing population for sustainable, durable, high quality yet affordable housing. Positive side effects are the increase in efficiency (output per man-hour), profitability for sub-contractors, contractors and developers alike and the specialisation of the otherwise uneducated labor force.

References

{1} A. Michelfelder et al, The Handling of Drymix Mortar on the Building Site, in:



SIMAN NEWS

Iran Cement News Site

www.simankhabar.ir

پایگاه خبری تحلیلی صنعت سیمان ایران



www.cementgroup.ir

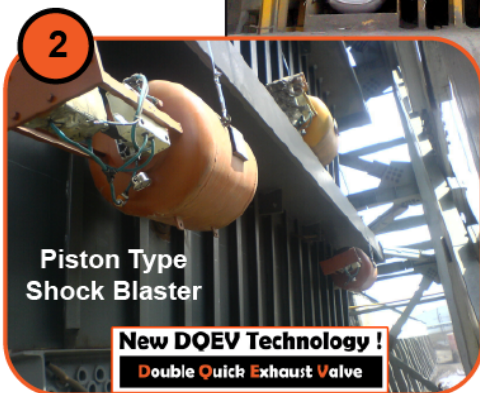
Complete Directory Of Iran Cement Factories & Engineering Companies

IRAN Cement Industry Capabilities and Equipments Production in Simankhabar.ir

SK Automatic Big Bag Filling Station With Lifting System



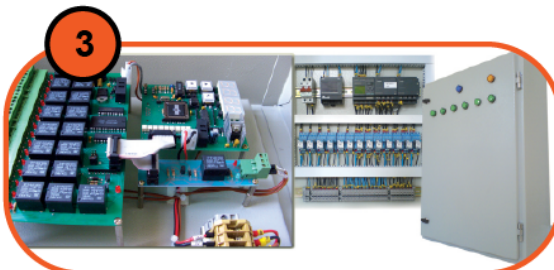
SK Cement Packer



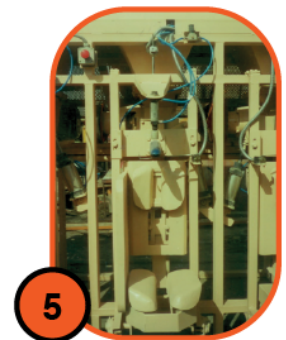
Piston Type Shock Blaster

New DOEV Technology!
Double Quick Exhaust Valve

SK Shock Blaster



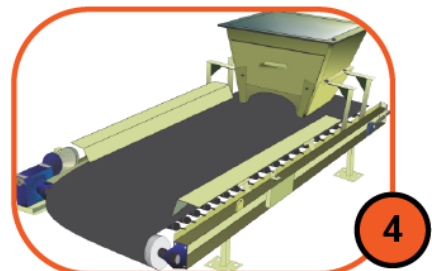
SK Bag Filter Jet Pulse Controller



5



SK Weigh Feeder & Belt Scale



4

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The new business segment AFR systems at BEUMER Group makes it possible for cement and lime plants to use alternative fuels:

Reliable energy supplier

Cement manufacturing is particularly energy-intensive. In order to reduce the use of expensive primary fuels like coal and oil, cement plant operators focus increasingly on alternative fuels and raw materials (AFR). The use is generally focused on the fuels. Neither the manufacturing process, the end product, nor the emissions may be affected. Therefore, high-caloric wastes that cannot be further recycled, e.g. from plastic and packaging residues, paper, composite material or textiles, have to be treated beforehand to be ready for co-processing.

In order to help customers efficiently convey, store and dose the treated fuels, BEUMER Group has established the new business segment AFR systems.

Germany, October 1973: For political reasons, Arab countries reduced their oil production, which caused oil prices to skyrocket. This was a very precarious situation, because crude oil was an important energy source, also for the cement industry to operate their rotary kilns. With this first oil crisis, plant operators started to shift towards using cost-effective fuels and raw materials.

Besides mineral waste that can be used as alternative raw material, the market primarily employs the use of fuel alternatives, because approximately 30 per cent of production costs are spent on energy. In addition to fluid alternative fuels, such as used oil or solvents, the majority of solid fuels consist of whole or shredded scrap tyres, used wood, or mixtures of plastic, paper, composite materials or textiles. After they have been treated and quality-controlled, they show calorific values similar to lignite. The calorific value of scrap tyres is even comparable to that of hard coal. When producing cement, it is also necessary to ensure that the quality of the ash residues matches the quality of the intermediate product clinker. As all material components are completely incorporated into the clinker and mineralised. Their use makes for an economic production process. In addition, primary raw and fossil fuel resources are conserved and landfill volume is reduced.

Pre-treated alternative fuels are mostly supplied from external vendors, ready for co-processing. BEUMER Group now offers tailor-made AFR systems to lime and cement works for a safe storage and transport of solid alternative fuels. Based on wide-ranging experiences and the customer's requirements, the systems comprise the entire chain, from receiving and unloading the delivery vehicle, up to storing, sampling, conveying, dosing and feeding solid alternative fuels. BEUMER Group, provider of intralogistics, supplies its customers worldwide now with customized systems, from one single source.

Tailored to every application

BEUMER Group's program includes the starter system that is used at the main burner. In the cement and limestone industry, primary fuels are usually ground to grain sizes of less than 100 micrometres and fed via the main burner. At the end of the rotary kiln, the burner heats up to 2000 °C, the temperature that is needed for limestone, sand, clay and ore to react and become clinker as an intermediate product. In order to use solid alternative fuels in the sinter zone burner, they should deliver a calorific value that is at least similar to lignite (approx. 22 ± 2 MJ/kg), have grain sizes of less than 30 millimetres and a levitating burn out.

The kiln-ready material is usually delivered in moving-floor trailers. BEUMER Group provides a docking station that also serves as storage on site. Once the trailer is discharged, it is completely replaced or refilled in the large tent using a wheel loader. The material is metered volumetrically and conveyed to the sinter zone burner. This solution is deliberately designed as a test system. This way, the operator can test their suppliers, the quality of the fuels and their kiln reaction or rather the emission behaviour.

Solution for the calciner

With the second system, the calciner can be fed with more coarse alternative solid fuels, such as chopped, tyre derived fuel or fuels as described above, but in a more coarse state. They are generally less pre-processed, contain more three-dimensional particles

and therefore require more time to burn out than the more intensively pre-processed alternative fuels for the main burner comprising exclusively only two-dimensional particles.

The coarse calciner fuel is delivered in moving-floor trailers or tippers. The alternative fuels are quickly unloaded and stored temporarily in a dust-proof way. Another storage serves as a buffer, which can hold the overall capacity of 900 cubic metres of the preceding bunker. From here, the Pipe Conveyor transports the material to the corresponding height of the calciner in the preheater tower. Here, the alternative fuel is weighed and dosed. During the feed towards the hearth in the calciner, there is often the risk of catching fire due to thermal radiation or pulsations of the calciner. For this reason, the valveless special feed was developed, so the material can be safely fed to the calciner.

In order to ensure safe and automatic fuel supply after successful testing, BEUMER Group provides systems for permanent operation with high thermal substitution rates. The systems consist of the receiving area and a storage system, where the crane system can store material of different quality into different storage zones and boxes. Experiences so far have shown that you always have to calculate with disruptives or quality deficits in the fuel. This is why the entire storage and conveying technology in the hall can be potentially

provided with equipment that is able to separate metal, wet and three-dimensional disruptives from the fuel for the main burner and keep disrupting oversized grains from each specific alternative fuel.

Equipped with the necessary sensor technology, the operation runs automatically. The crane can be used independently for homogenisation, in order to minimise quality variations or feed the lines towards the main burner and the calciner.

Pipe Conveyor stands the test

Schwenk Zement AG's production capacity make their plant in Bernburg one of the largest and most efficient cement plants in Germany.

In order to reduce energy costs, the cement plant is increasingly using alternative fuels that are engineered in external pre-processing plants into high-quality fuels with defined specifications.

Until now, the work has been using drag chain conveyors. After almost a decade of use and numerous modifications however, more and more maintenance was required. The fuel quality also improved over time, so that, due to its density of 0.2 t/m³, the existing technology was no longer sufficient to convey the required quantities towards the main burner. This



Picture 1: The alternative fuels are conveyed from the storage to the main burner, low in noise and dust-proof.



Picture 2: By using solid alternative fuels, the production process becomes more economical, and fossil resources are conserved and landfill volume reduced.



Picture 3: Fill level measuring probes and other measuring technology monitor the automated processes.

created the need for a reliable, eco-friendly and low-

maintenance solution. In addition, the new conveyor needed to be optimally adapted to the curved routing in the plant.

Schwenk Zement KG opted for the BEUMER AFR system with its Pipe Conveyor to feed the main burner with alternative fuels. The system works almost completely automatically, from receiving to the feeding system at the rotary kiln. Cranes pick up the engineered alternative fuels in the storehouse and fill them into the discharge bunkers with their equipment. From there, a chain belt conveyor transports the fuel continuously towards the Pipe Conveyor, which conveys it to the weigh feeders before the main burner.

The curved Pipe Conveyor at the core of the system requires little maintenance and its enclosed design and quiet operation protect against emissions and the wind-blown spillage of the fuel. It is able to connect long distances without interruption and navigate tight curve radii that adapt to the individual conditions of the plant.

The BEUMER Group is an international leader in the manufacture of intralogistics systems for conveying, loading, palletising, packaging, sortation and distribution. Together with Crisplant a/s and Enxco Teknologies India Limited, the BEUMER Group employs 4,000 people worldwide, and achieves an annual turnover of about 680 million EUR. With its subsidiaries and sales agencies, the BEUMER Group serves customers around the globe, across a wide range of industries. For further information visit:

www.beumergroup.com.

WE WILL PUT THE POWER OF TURKISH ENGINEERING OVER THE TOP IN INTERNATIONAL PLATFORMS



Fig. No. 01 Ali Aybars

Chairman of the Executive Board of Aybars Makina Sanayi, Ali Aybars answered our questions. He stated that they aim to put the power of Turkish Engineering over the top on international platforms by work they performed and he also stated that they will proceed on their way with the same stability.

Aybars Makina in service with its 200-person staff has an annual manufacturing capacity of over ten thousand tons.



Fig. No. 02 Aybars Logo

"I REALIZED MORE THAN 10 CEMENT FACTORY"

AS FIRST, TELL USE ABOUT YOURSELF, PLEASE?

I graduated from Gaziantep Male Technical School, Turning Levelling (Mechanical Technician) Department in 1971, then I taught as Mechanical Technical teacher for a while. My first workplace was the site of Karabuk Demir Celik Isletmeleri in Konya Seydisehir Etibank Aluminum Facilities in 5 November 1971.

I started my undergraduate education in Cukurova University, Civil Engineering Department in 1972.

My second workplace was CIMSA Cimento Sanayi of SABANCI Holding in Mersin in 5 November 1973.

In my Cement career continued until 30 August 2006; I focused on white cement and alumina cement types outside well-known Grey Portland Cement, which are

resistant to high temperature, have a high whiteness degree, not produced in Turkey in that years.

I made some researches on these specific cement types and realized these projects.

To sum up briefly;

In my business life in SABANCI group I realized 5 and in my independent business life started in 2009 I realized 6 completed cement factories.

I think building over 10 cement factories is vouchsafed to a small number of engineers in their business lives.

Cement became my life, I'm honored to serve still in this sector.

"WE DESIGN, WE MANUFACTURE, WE CONSTRUCT, WE OPERATE AND DELIVER"

I left Sabanci in 30 August 2006 after my service for 33 years.

In the same year;

I founded the company of Aybars Çimento Müşavirlik ve Mühendislik Hizmetleri in Ankara in 5 November 2006.

We especially shared our knowledge, experiences with our customers we provide service.

We produce Basic and Detailed application projects with Process Engineering, Basic Engineering services.

Our projects that we reflected our obtained knowledge, experiences were accepted.

Later;

We said, since we produce these projects, why don't we realize them?

Therefore, we found the company of Aybars Makina Sanayi in Mersin in 15 April 2009 and we expanded our service range and we have started to produce our own technology.

So,

On the one hand, we make engineering calculations, produce projects,

On the other hand, we manufacture machinery and equipment for our projects.

We install and operate machinery and equipment that we manufactured.

Briefly,

We design, we manufacture, we construct, we operate and deliver.

You enter a land area and you build a facility on this

land area after 1,52- years.

Industrial facilities are not easy to be built.

So;

Civil, Mechanical, Electrical, Physics and Computer Engineers and Quality Control Engineers work in our company.

We have a high quality team specialized in this business by performing this work for many years.

Can you tell us about your fields of activity?

Especially cement plants,

We are in service in various sectors such as fertilizer manufacturing factories, glass, iron-steel, soda factories, etc.

We also make mass production of machinery and equipment that we call conveyors used to be common in these sectors.

We also make production by taking orders.

Manufacturing machinery for technologically differential sectors requires to do very careful engineering calculations.

Because each sector has so different design criteria.

For example, machinery we use in the cement sector is resistant to abrasion. Machinery for fertilizer or soda sectors should be resistant to corrosion.

In the Iron and Steel sector, high-temperature durability comes to the forefront.

If a system instead of machine is requested from us;

First, as solution-oriented;

We make process, design, basic and technical concept engineering and detailed engineering studies.

We select the most suitable, economic project and we pass to implementation phase.

It's an extremely important subject,

Because winning and losing occur on paper / in project-at desk.

Your project is your constitution, recovery in application of wrong decisions in the project is very difficult, it may not be possible.

MANUFACTURING AND INSTALLATION UPON ORDER

Can you tell us about your product groups?

Project and Engineering Services are our leading

product groups.

- Process, Basic Engineering and project services are the constitution the business. Our first step is always to carry out these works, then we continue with our following detailed engineering studies.
- Mechanical Engineering Projects
 - o Contain engineering calculations and drawings required for machine designs.
 - o Strength calculations & heat transfer, mass balance calculations are performed and
 - o Machine sizing drawings are made according to these strength calculations.
- Electrical Automation Engineering and Project Services
 - o Machine power requirement calculations
 - o Determination of machine drive unit (Determination of engine reducer requirements)
 - o Determination of measuring control instruments' requirements
 - o Electrical Automation operating diagrams, P & I diagrams
- Civil Engineering and detailed project services
 - o Static calculations and dynamic analysis for buildings are made
 - o Infrastructure and superstructure reinforced concrete construction projects are drawn.
 - o Steel Construction manufacturing and Installation Projects are made.

Manufacturing works are in the second line of our product group.

- Machinery Equipment Manufacturing
 - o (Special heavy-duty machinery such as Elevators, steel belts, Pan Conveyors, Helices, Rotary Feeders, Rubber Belt Conveyors, Air / Pneumatic conveying belts, Dampers, etc.)
- Technological Equipment Manufacturing
 - o Non-standard equipment manufacturing such as Production Cyclones, Bunkers, Steel Silos, Dust and gas pipes, Steel chimneys, special expansion joints

Our products

are subjected to surface cleaning by sand in Automatic Sand Blasting machine, before entering the manufacturing belt

Then, they are painted with paint to prevent corrosion in the manufacturing process (shock-prime)

After that, they enter cutting, bending belts and are

shaped in CNC benches,

They are assembled in the assembly line and welding works are performed.

Manufacturing is controlled at each stage by quality control staff,

Then, re-cleaned and painted for the final paint process.

Our painted Products are marked by our Quality control staff, labelled and packed for shipment.

Can you tell us about your standard products? Which products are available?

Yes,

In particular, we can say that we make mass-production of High-speed Central Forge Chained Bucket Elevators. We performed R & D studies on this subject and we were supported by Cukurova Development Agency.

We also make production of;

Bucket Elevators for;

Humid-free materials, clinker, cement and raw meal,

Lump coal and raw material elevators for,

High-humid materials and materials with a high adhesion risk.

So we have developed ourselves and we used our own elevators for our last 5 projects.

We constantly receive orders for the last 5 years and we make 12 -16 complete annual production.

However, outside of some of the common parts,

We cannot manufacture in series, it's already not possible.

Because there are different Design Criteria as sectors.

Capacities vary, there are differences in axle height.

Elevator capacities vary between 100 t / h to 1000 t / h,

Their heights vary between 30 meters to 55 meters.

We compete with European companies, we increased our market share two-three times within the last years.

We currently have about 6070%-

It's same for;

Our Steel Tracked Belts and Bucket / Teken belt conveyors.

Certain parts of these equipment have common use and we prepare them for mass production in advance.

Except those; We provide periodic check, maintenance support services with spare parts orders for machinery that we manufactured.

Our product range and technical information can be seen on www.aybarsmakina.com



Fig. No. 03 - Single-Double Forged Chained Bucket Elevators



Fig. No. 04 - Steel Pan Conveyors



Fig. No. 05 - Cell Wheels and Valves, Bag and Electro Filters

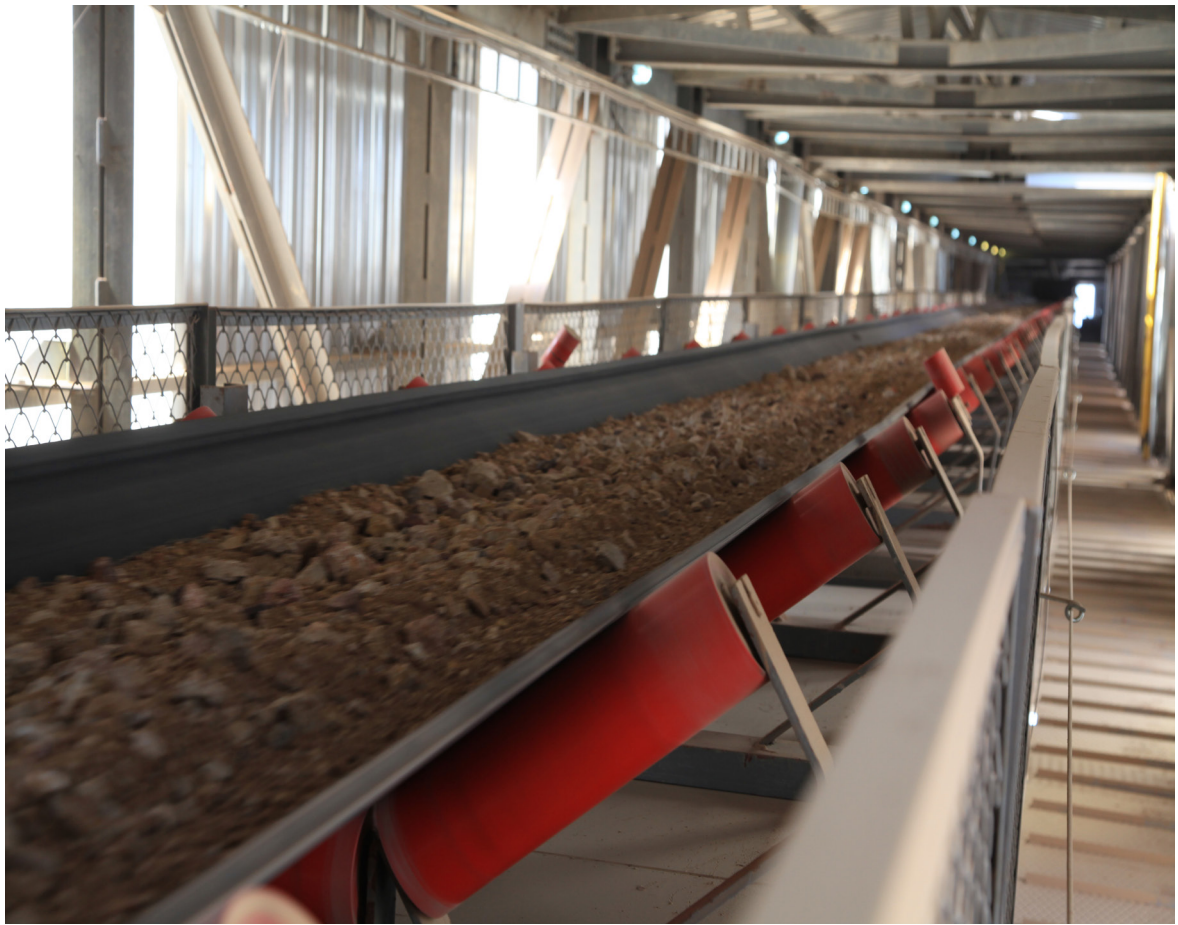


Fig. No. 06 - Deep Drawn Pan Conveyors



Fig. No. 07 - Hammer and Jaw Crushers



Fig. No. 08 - Belt Conveyors



Fig. No. 09 - Apron Feeders

Do you take orders as request based? What are these products?

Yes, we have many orders as request based.

Except construction of the Cement Factory, Sometimes these requests can be a part of the entire system and a system to be established on a different place, these can also be a machine or spare part of a machine.

Usually;

Requests from glass, soda, fertilizer sectors are different. We can sort these products as machinery equipment such as Rubber Belt Conveyors, Chain Conveyors, Helices, Damper valves, etc.

The process technology also causes this situation.

Another factor is; These facilities were designed or established by European companies.

In order to prevent a different backup in the system, same as the original should be done.

Therefore, there are continuously different requests from different sectors and production projects are given by the request owner.

And sometimes;

These are requested the system to be visited in-site and planned and manufactured.

"OUR TASK WAS TO MEET THE REGION'S NEED FOR CEMENT"

You built a cement factory in Van, Askale, after the earthquake... It was kind of a social responsibility project. Can you tell us about it?

Manufacturing of the Clinker Production Line with a daily capacity of 3.500 tons was started in February 2011.

We shared pains of our citizens lost their lives after two devastating earthquakes occurred in late 2011 with our team with the deepest feelings.

By this disaster; our task was to complete immediately construction of the factory to meet the region's need for cement. Although, it was the coldest winter in the last 48 years, we completed our cement factory in a short period of 17 months by using all of our material and moral means, and commissioned in July, 2012.

"WE TOOK A BIG STEP TO BECOME THE CEMENT CENTER"



Fig. No. 10 - Turnkey Cement Plant Project Aşkale-Van-Turkey

What is the production capacity of your facilities?

We established a totally-new and modern facility on a 10.000 m² area on 2. Organized Industrial Zone in Mersin. We took a big step to become the Cement Technology Center with this new facility.

We make a wide variety of productions in our facility.

We make evaluations under 3 headings as Steel Construction Manufacturing, Technological Manufacturing and Mechanical Manufacturing. Labor hours per ton are also different for each group.

We calculate this capacity on mixed basis, which proportionally depends on the machinery.

We annually make approximately over 10.000 tons manufacturing of MACHINERY thanks to our infrastructure.

This tonnage will rise further until the end of this year.

"Energy production from waste gas" in contracting works section excited my attention. Can you bring it up?

The waste gas temperature is 370 - 450 degrees in Cement Factories.

This hot gas is normally used for drying in mills, but the temperature is high.

So, hot gas is used to obtain steam to turn the turbine to generate energy.

Briefly, steam is obtained from gas at high temperature, Exhaust gas or used gas at high temperature is around 200 - 270 degrees and it's supplied again to the system and used for drying.

Electrical power production from gas to be exhausted through chimney is the most priority investment project recently for a \mathring{s} cement factories.

This project is already realized in 8 -10 cement factories. If we deem that the gas amount from the chimney of a Cement Factory with a capacity of 3,500 TPD is approximately 750,000 m³ / h and its temperature is around 400 degrees,

Approximately 7 - 7.5 MVA of electricity can be produced by this gas. This energy is about 25% of the electricity consumed in the factory.

"WE OFFER SOLUTIONS PARTNERSHIP"

Can tell us about Aybars Group's service concept?

Our priority is respect for people and the environment. We offer our customers solutions in partnership with high reliability and customer satisfaction service concept. We have justified pride of performing our services with our well-established corporate structure, rich corporate culture, high quality human resources.

Do you have new projects in 2016?

Of course we do,

2015 was a year of hard working and busy year for Aybars Machinery. Aybars established a brand-new and modern facility on an area of 10.000 m² in the 2nd Organized Industry Zone in Mersin. Thus we are taking a significant step forward in direction of being a cement technology center with our experienced human resource in the cement sector. Right along with in the fields of project management, engineering and consultancy works, we continued to realize steel construction, mechanical and technological manufacturing and assembly works.

OYAK Bolu Cement, Ankara; New Clinker Production Line with 3.500 tons per day capacity was designed by our process experts inside the limited area of existing Cement Grinding and Packaging Plant. All the engineering and project management services, import and local manufacturing and erection works were completed by our implementation team with 500 people in a short time of 15 months.

We conducted BATIÇİM İzmir Plant-Capacity Increase Project. We finished Raw Shipment and Dosing Systems Construction, Manufacturing and Assembly work together with the manufacturing and the assembly work for Roller Press Conveying System.

Bandırma Fertilizer Factories for BAGFAS we have realized the Limestone Grinding Plant.

We finished the new silo facility for ÇİMSA in Mersin

CAC Steel and concrete work. Manufacturing and assembly work is still going on for Clinker Silo Basic-Top Construction Steel Fabrication and Erection, construction of roof and siding projects.

Beside these engineering, manufacturing and assembling projects, in the mean time we continue to manufacture elevators, steel band, rubber band, pan conveyors and other similar mechanical and technological design, manufacturing and assembly works for cement plants.

Activities of Aybars are not limited with domestic market;

With Italian Cementir Group in Russia and Egypt, With Rönesans Holding in Russia, Ukraine and Turkmenistan, With Czech Vitkovice in Turkey, Many projects were realized in cement and energy sectors;

Our efforts in 2016 will continue with the same intensity. We started very fast with the new year. Aybars already got engaged to the project of Roller Press Unit of OYAK Aslan Cement. We prepared the calendar for manufacturing and assembling works. In addition to this the raw material grinding plant project of OYAK Adana Cement, engineering, manufacturing and assembling works are all scheduled for the coming months.

I want to share with you the latest and hottest news of March 2016

We just signed the agreement with Aşkale Çimento T.A.Ş Trabzon-Akoluk Turnkey Project with 210 t/h capacity Cement Grinding together with Roller Press and 10.000 tones stock capacity with four eyed cement silo and packaging unit And also with Gökay Group, 100t/h capacity Turnkey Cement Plant Project in Algeria

We want to shift our products and the power of Turkish Engineering to the highest level in the international arena.

We will continue to serve for Cement sector with our innovative wide vision, and entrepreneurial spirit. We would like to accomplish first class projects in global market

With our courage and determination. We continue will to put steps onwards quickly and confidently in our way to become a Cement Technology Center.

Anything else you'd like to add?

We want to put our products and the strength of Turkish Engineering over the top on international platforms. We have an innovative and broad vision or that. We act by our entrepreneurial spirit, courage and stability.

We take rapid and firm steps for institutionalization and to become the Cement Technology Center. We are proud of our successes in the past, look to future with hope and excitement. We are ready to produce world-class excellent projects and meet our customers' expectations and demands in the best way and we proceed with confidence.

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“...the focus on new growing markets and commitment to address major issues through local experts is the reason Argus Mediterranean Solid Fuels is such a success”

Matt Vincent, Head of Coal Trading, **RWE Supply and Trading**

“The global leader in drawing attention to new emerging markets... one of the most educational and informative events on the development of solid fuels in the region”

Eng. Waleed Abouraya, President, **RGS Egypt**

“...great speakers, very interesting content and real opportunity to interact with the coal leaders in Mediterranean countries”

Zakariyae Tajani, Fuel Procurement Manager, **Office National de l'Electricité**

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Telecentric lenses for absolute distortion-free images of each individual particle

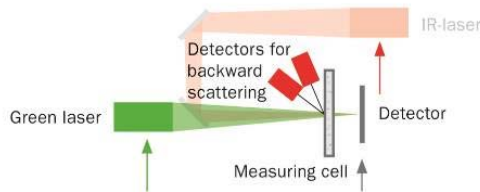
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Laser particle sizing at the push of a button: 10 nm – 2100 µm

New optical design, simple operation, fully automatic measurement, analysis and cleaning!



**Laser Particle Sizer ANALYSETTE 22
with dry and wet dispersion unit**



**Measurement design for the
lower particle size range**

With the new FRITSCH **Laser Particle Sizer ANALYSETTE 22** NanoTec particle measurement becomes a simple matter, for professionals as well as for any employee – in production and quality control or in research and development. No prior knowledge is required. Just start the programme, select a SOP and add the sample – the rest takes place completely automatic. **Fast. Reliable. Efficient.**

Your advantage: extremely simple operation, short analysis times and consistently reproducible and reliable results. And a convincing combination of price and performance.

New optical design

The very large measuring range from 0.01 µm to 2100 µm of the ANALYSETTE 22 NanoTec results from the combination of two lasers with two different measuring cell detector spacings: Large particles are detected using an infrared laser with a large distance to the measuring cell, for small particles a green laser with a small distance to the cell is used, which permits the detection of the forward scattered light up to a scattering angle of 65°. The measurement of smallest particles down into the nano range is performed by the green laser light for backward scattering. Specially arranged detectors ensure this. Especially convenient: The total measuring range of 0.01 – 2100 µm in the ANALYSETTE 22 NanoTec can be detected without converting the optical elements.

The result: perfect measurements with outstanding reliability, meaningful comparability and consistent reproducibility.

Intelligent modular design

The ANALYSETTE 22 NanoTec consists of a compact measuring unit that can be quickly and easily combined with different dispersion units for dry or wet measurement. Select the wet dispersion unit for wet measurements of solids and suspensions. For wet dispersion of very small quantities, the automatic small volume wet dispersion unit SVA with illuminated dispersion bath and the compact manual small volume wet dispersion unit SVM are available. The practical, fully automatic AutoSampler makes it easy to perform a series of measurements with the wet dispersion unit. For dry measurements of not too fine, free-flowing materials use the dry dispersion unit with efficient degradation of agglomerates. For dry measurement of agglomerates or free-flowing materials, choose the falling chute.

Your advantage: This allows you to buy only what you need for your applications.



Always the right dispersion module: The measuring cell is simply switched to change the dispersion



MaS control software for control, recording and evaluation of the measuring results

Practical fast-switch-system

The measuring cells of the ANALYSETTE 22 dispersion modules are located in practical cartridges that can be exchanged with a single motion when switching between wet and dry measurement – without changing any hoses or modifying the instrument! Your advantage: fast and easy change of the dispersion method.

So simple, but also very flexible!

The ANALYSETTE 22 NanoTec software contains completely predefined Standard Operating Procedures – SOPs for short – for nearly all typical measurement tasks, making operation especially easy. Via a well-arranged input mask, you are completely free and flexible in modifying these SOPs to perfectly suit your measurement requirements.

Perfect fully automatic evaluation

For the control, recording and perfect evaluation of your measuring results your ANALYSETTE 22 NanoTec is delivered with a computer on which the FRITSCH MaS control software is already fully installed. The software MaS control is easy to learn and guides you through the entire measurement process in a largely self-explanatory manner. In addition to integrated standard reports, the freely editable report generator allows you to organise your measurement reports exactly according to your needs.

Your advantage: Simple, secure, flexible.

Your advantages with the ANALYSETTE 22 NanoTec

- Measurement even of nano particles in an extremely wide measuring range of 0.01 - 2100 µm
- Fast, automatic particle size analysis
- Simple measurement with short measuring times
- Especially high measurement precision due to the analysis of 110 channels
- Consistent reproducibility - reliable comparability
- User-friendly operation
- Quick change between wet and dry measurement
- Fast and simple cleaning
- Short analysis times

SIEMENS

Explosion-proof Simotics XP 1MB1 motors certified for converter operation

- **Simotics XP 1MB1 motors – now approved for use with Sinamics converters in potentially explosive atmospheres**
- **Energy-efficient operation with 1MB1 motors possible in the 0.09 to 200 kilowatt output range**
- **Motor operating data determined using Sizer engineering tool for Siemens drives**

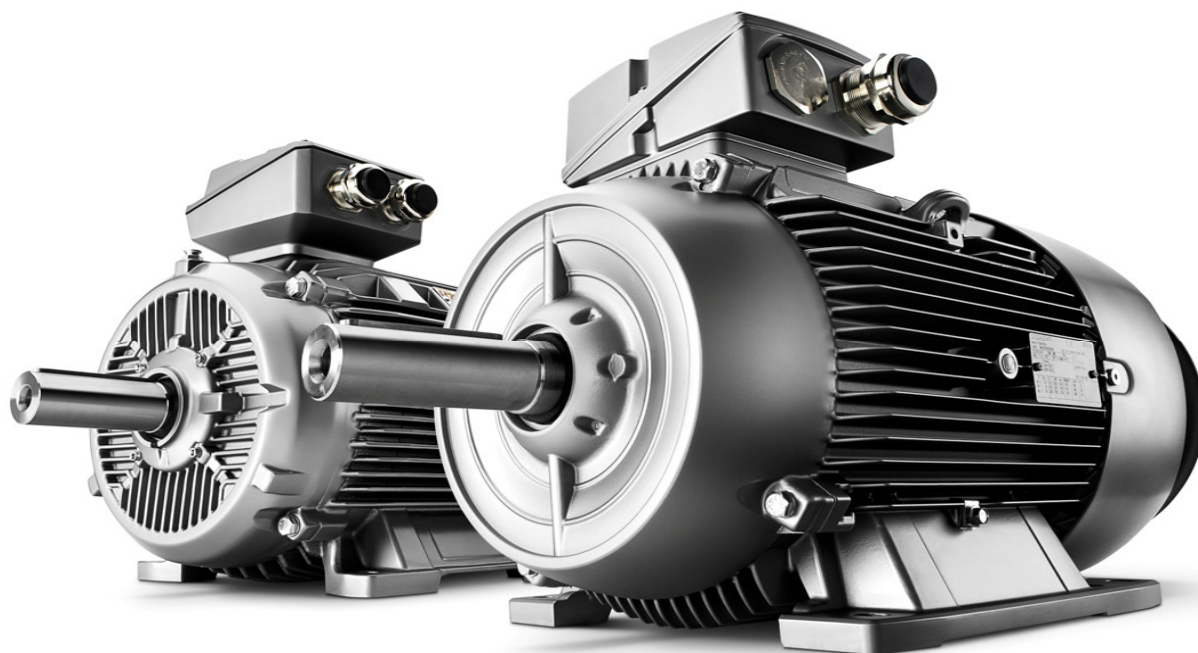
An extension to the EC Type Examination Certificate has opened up new scope for the 1MB1 motor series, which is now approved for both mains and converter-fed operation. The Sizer engineering tool for Siemens drives can be used to ascertain the operating data of Simotics XP 1MB1 motors used with the approved Sinamics converters. Energy-efficient, reliable converter-fed motor operation is possible in an output range of 0.09 to 200 kilowatts.

Motors used in potentially explosive environments such as those encountered in the chemical and petrochemical, oil and gas industries have to comply with IEC EN 60079 standards designed to protect human life, machines and the environment. With its Simotics XP motor series, Siemens offers a range of

explosion-proof motors for use in potentially explosive gas and dust-laden atmospheres. These motors are available in protection types Ex nA, Ex tb and Ex tc for use in zones 2, 21 and 22. Used in combination with Sinamics converters, the Simotics XP 1MB1 motors form a pre-tested and ideally coordinated Integrated Drive System (IDS). Benefits for the user include minimal installation costs, high availability and economical plant operation.

The explosion-proof Simotics XP motors are particularly suited for use in the chemical and petrochemical industry. They are also used in the oil and gas industry, the woodworking and plastics processing industries and in agriculture. The motors are certified in compliance with the European Directive 94 /9/EC (ATEX), IECEx (required for example in Australia) and EAC (Eurasia).

An extension to the EC Type Examination Certificate has opened up new scope for the 1MB1 motor series, which is now approved for both mains and converter-fed operation. Benefits for the user include minimal installation costs, high availability and economical plant operation.



SIEMENS

Intuitive data management for Process Analytical Technology

- **Simatic Sipat version 5.0 with new features**
- **New configuration concept reduces implementation time**
- **Dynamic Data Alignment for optimized data management in continuous manufacturing**

Siemens is innovating its data management software for Process Analytical Technology (PAT) with Simatic Sipat version 5.0, which allows users to monitor and control the quality of their products in real-time during manufacturing. The latest version features a new configuration concept that further increases user friendliness and shortens implementation time. Moreover, the new Dynamic Data Alignment (DDA) optimizes data management for continuous manufacturing. The main applications of Simatic Sipat 5.0 are in the pharmaceutical, food & beverage and fine chemicals industries.

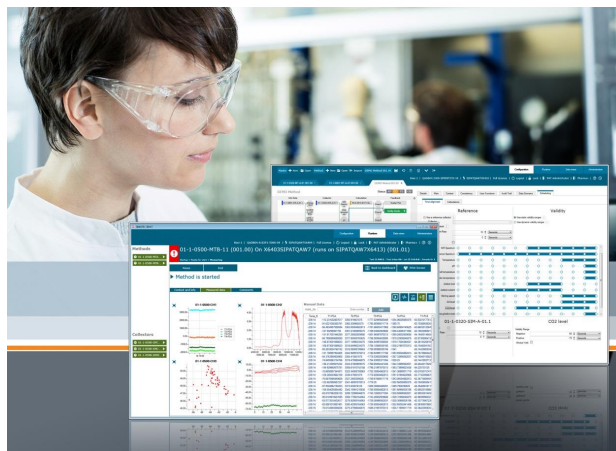
The new configuration concept offers an immediate graphical insight into the functionality of a Simatic Sipat method. On the instrument level, preconfigured PAT IDs can be applied. These can simply be selected during method creation, allowing fast and easy method setup. Configuring new methods is straightforward and can be done in just a few minutes. All linking processes (e.g. between collected data and calculations) can easily be performed using what are known as “wizards”. These new features allow the end users to work more quickly, reduce the training input required and speed up implementation within the organization.

For continuous manufacturing processes, the ability to combine the right pieces of information when making quality decisions is vital. This means that data collected Siemens AG Communications and Government Affairs from different locations along the production line at different time intervals must be combined with each other to arrive at the correct product quality. Simatic Sipat 5.0 enables this by using the Dynamic Data Alignment (DDA) concept. This allows users to make fast, data-driven decisions ensuring quality, right-first-time products. Moreover, it optimizes process control of

the production line in real-time during manufacturing. Furthermore Simatic Sipat 5.0 has integrated data security functionality for secure communication between the different components and protection of customer data integrity.

About Sipat

Simatic Sipat is a scalable and modular software solution that enables companies to extend their quality assurance activities on a step-by-step basis within the scope of the PAT initiative. With PAT, product development and production processes can be monitored, controlled and optimized by measuring the critical-to-quality attributes (CQA) of raw materials, process materials and procedures. This continuous monitoring of product quality can prevent deviations from specifications and therefore reduce production costs. In addition, it allows for Real Time Release Testing, so quality inspections on final products can be reduced or completely eliminated.



The latest version of Simatic Sipat 5.0 features a new configuration concept that further increases user friendliness and shortens implementation time. Moreover, the new Dynamic Data Alignment (DDA) optimizes data management for continuous manufacturing.

SIEMENS

Liquid cooling in Siemens converters reduces energy consumption

- Efficient heat dissipation in liquid-cooled Sinamics S120 Cabinet Modules makes air conditioning unnecessary
- High degrees of protection up to IP55 can easily be implemented
- Footprint smaller than with comparable air-cooled cabinets
- Simple ordering process, installation and implementing thanks to integration into commercially available engineering tools

The liquid-cooled Sinamics S120 Cabinet Modules frequency converter from Siemens is a converter for use in harsh ambient conditions. Efficient heat dissipation means there is no need for air conditioning, which markedly reduces energy consumption. Both optimized layout and effective cooling have helped to reduce the module's footprint. Since the liquid-cooled Sinamics S120 Cabinet Modules frequency converter is integrated into commercially available engineering tools it also makes ordering easier.

Sinamics S120 Cabinet Modules frequency converters are part of a modular cabinet system for multi-motor drives. Siemens has extended this portfolio with a view to using it in such specifically harsh environments as in mining or the steel industry, where it makes sense to use a sealed cabinet to protect against chemically aggressive atmospheres. The liquid-cooled Sinamics S120 Cabinet Modules provides a liquid cooling solution that is fully enclosed in order to protect the frequency converters against hostile ambient conditions. Here, a special cooling technology makes heat dissipation efficient and renders air conditioning unnecessary. Added to this, liquid cooling uses little energy which makes for leveraging additional energy savings potential.

Heat recovery principles can also be exploited by using the coolant heated up during the cooling process to provide low-cost process heat or room heating.

All individual liquid-cooled Sinamics S120 Cabinet Modules are perfectly compatible, modular, and can be flexibly combined. Additionally a wide range of options is available, allowing specific requirements to be accommodated with ease. Factory pre-configuration and integration into commercially available selection and

engineering tools, such as the Katalog, PMD and Sizer, make for simple ordering, installing, and commissioning of the system.

Sinamics S120 Cabinet Modules converters are mainly used in process, steel, and automotive industries and in the mining.



Thanks to the sealed cabinet system, the liquid-cooled Sinamics S120 Cabinet Modules frequency converter is ideally suited for use in harsh environments. Efficient heat dissipation means there is no need for air conditioning, which markedly reduces energy consumption.

SIEMENS

Portfolio expansion for Basic Controllers

- Simatic Basic Controllers expanded to include new modules and functions
- SM1238 Energy Meter module for entry into machine-related energy management
- New firmware version 4.2 for Basic Controllers with Media Redundancy Protocol and backup/restore function • Safety CPU 1212FC for safety-related applications

Siemens has added a range of new modules and functions to the Simatic S71200- Basic Controllers. One of the new products, the Energy Meter module SM1238, precisely records energy flows. In addition, the Basic Controllers have also been enhanced with the new CPU 1212FC for failsafe applications in the lower power range. What is more, the firmware for the Simatic S71200- Basic Controllers has been updated with the latest version of the TIA Portal V14 engineering framework, and expanded to include additional functions. The new release, version 4.2, now includes the Media Redundancy Protocol (MRP) and a backup/restore function for backing up project data for the 2-port CPUs 1215 and 1217. Another notable development is that failsafe CPU versions now also support the Profisafe protocol.

For operators looking to branch out into the field of machine-related energy management, the new SM1238 Energy Meter module for Simatic S71200-Basic Controllers is the ideal choice. The space-saving expansion module is just 45 millimeters wide, and can be used to record energy flows simply and precisely, directly on the machine. The measurements are processed directly in the CPU, and visualized with an HMI (Human Machine Interface) system, such as a Basic or Comfort Panel. The SM1238 Energy Meter module records measured electrical values, such as voltages up to 480 V AC, in a 1 or 3-phase network with a direct connection but without a transformer. The user can freely adjust the diagnostic parameters for over and undervoltage, overload, tolerance value and tolerance time. An external 1 or 5 ampere current transformer with a conversion factor of up to 10,000 is used to measure the current.

The firmware for Simatic S71200- Basic Controllers has been updated with the new version of the TIA Portal V14 engineering framework, and expanded to

include additional functions. Version 4.2 includes the Media Redundancy Protocol (MRP) for the 2-port CPUs 1215 and 1217, increases network availability, and offers greater flexibility when it comes to network configurations, for example in ring topologies. This is rounded off with the backup/restore function for backing up project data with up-to-date values to prevent data losses.

Like the more powerful CPU 1214FC and CPU 1215FC versions, the new Safety CPU 1212FC is able to handle standard and safety-related automation tasks, such as protective door monitoring, in a single device. This also reduces the wiring required in comparison to conventional solutions. Supporting Profisafe enables safety-related devices to be connected via Profinet - for example, the integrated safety functions of Sinamics drives can be used directly via Profinet. This also reduces wiring outlay, saves space in comparison to conventional safety solutions and allows more flexible safety concepts.



Siemens has added a range of new modules and functions to the Simatic S71200- Basic Controllers. One of the new products, the Energy Meter module SM1238, precisely records energy flows. In addition, the Basic Controllers have also been enhanced with the new CPU 1212FC for failsafe applications in the lower power range. What is more, the firmware for the Simatic S71200- Basic Controllers has been updated with the latest version of the TIA Portal V14 engineering framework, and expanded to include additional functions.

Argus Mediterranean Solid Fuels 2016

Date : 04 - 06 May 2016

Venue: Rome, Italy

For more information please contact:

Ms. Anita Agyeman, Conference Marketing Manager
– Europe & Africa

Email: anita.agyeman@argusmedia.com

3rd Global Cement EnviroCem Conference on Environmental Technology for Cement & Lime

Date : 10 - 11 May 2016

Venue: London, UK

For more information please contact:

Pro Global Media Ltd

Tel: +44 1372 743837

Fax: +44 1372 743838

For more information please visit:

www.globalcement.com

2016 China International Cement Industry Exhibition

Date : 12 - 14 May 2016

Venue: Nanjing, China

For more information please contact:

Miss Elaine JIN

Tel: 8610 88083329

Fax: 8610 88084171

Cell: 86 13520714365

Email: jinx@ccpitbm.org

For more information please visit:

www.cementtech.org

INTERCEM Africa

Date : 23 - 25 May 2016

Venue: Nairobi, Kenya

For more information please contact:

INTERCEM Conferences

Tel: +44 20 8669 5222

Email: info@intercem.co.uk

www.intercem.com

11th Global Slag Conference, Exhibition & Awards 2015

Date : 24 - 25 May 2016

Venue: the Radisson Blu Edwardian, London, UK

For more information please contact:

Pro Global Media Ltd

Tel: +44 1372 743837

Fax: +44 1372 743838

For more information please visit:

www.GlobalSlag.com

CEMENTURK 2016 Conference

Date : 30 May - 01 June 2016

Venue: Istanbul, Turkey

For more information please contact:

Özgür SELVİ

Email: o.selvi@ajansgn.com ,

konferans@ajansgn.com

Tel: 0212 217 47 29 31

27th International Conference and Exhibition, "BusinessCem Sochi 2016"

Date : 06 - 08 June 2016

Venue: Radisson Blu Paradise Resort & Spa, Sochi,
Russia

For more information please contact:

Mrs Irina VALYUKOVA, Deputy General Director
BusinessCem Media

Tel.: +7 499 977 4968

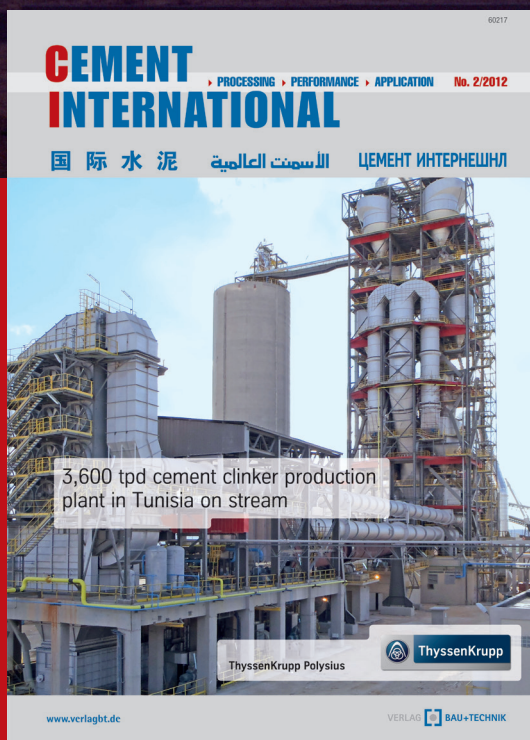
Fax: +7 499 977 4495

Email: valev@businesscem.msk.ru

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THE TECHNICAL JOURNAL FOR THE CEMENT INDUSTRY



PRACTICE-RELATED EXPERIENCE

Both reports on practical experience and up-to-date information from the areas of research and development are presented. Concomitant reports and short news items and announcement indicate to readers forthcoming trends in scientific-, product- and market developments.

INTERNATIONAL

CEMENT INTERNATIONAL with international orientation is bilingual (German/English). As the official organ of the German Cement Works Association (VDZ) and the Hungarian Cement Association, the journal can lay claim to the highest standards und superlative quality.

TARGET GROUP ORIENTED

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CEMENT

INTERCEM Shipping Americas

Date : 13 - 14 June 2016
 Venue: Charleston in South Carolina, USA
 For more information please contact:
 John Darke, Conference Executive
John.Darke@intercem.co.uk
+44 (0) 208 835 3584

CBCi 7th Cement Industry Congress

Date : 20 - 22 June 2016
 Venue: Sao Paulo, Brazil
 For more information please visit:
www.7cbci.com.br

VDZ- Annual Meeting

Date : 27 - 28 September 2016
 Venue: Dusseldorf, Germany
 For more information please visit:
www.vdz-online.de

3rd Alternative Fuel Symposium

Date : 12 - 13 October 2016
 Venue: Landschaftspark Nord, Germany
 For more information please contact:
 Mr Dirk Lechtenberg
Marketing@lechtenberg-partner.de /
sales@lechtenberg-partner.de
Http:// http://www.lechtenberg-partner.de

ICCCC 2016: 18th International Conference on Cement and Concrete Chemistry:

Date : 19 - 20 October 2016
 Venue: Istanbul, Turkey
 For more information please visit:
www.waset.org

Cement Business & Industry India 2016

Date : 17 - 18 November 2016
 Venue: Mumbai, India
 For more information please contact:
 Ms. Beatrice Ene, Client Development & Marketing Director (International)
Email: be@gmiforum.com
Mobile: +40 722 764 802
 Ms. Malika Arora, Head of Production (India)
Email: ma@gmiforum.com
Mobile: +91 98 19 401 959

Mr. Sriram Ganapathi, Sr. Conference and Events Executive (India)

Email: sg@gmiforum.com
Mobile: +91 99 69 297 536
GMI Global
Email: sales@gmiforum.com
www.gmiforum.com

Global CemProcess Conference and Exhibition Process optimisation, de-bottlenecking, production maximisation and troubleshooting

Date : November 2016
 Venue: London, UK
 For more information please contact:
 Pro Global Media Ltd
Tel: +44 1372 743837
Fax: +44 1372 743838
For more information please visit:
www.Global-CemProcess.com

CEMENT EXPO - 9th International Exhibition and Seminar

Date : 08 - 09 December 2016
 Venue: Mumbai, India
 For more information please contact:
 Ms. Vrushali Pawar, Asst. Conference Producer
Tel: +91 22 2419 3000
Mobile: +91 9619 197 636
Fax: +91 22 2417 5734
Email: vrushali.p@ASAPPinfoGLOBAL.com
www.ASAPPinfoGLOBAL.com

IV International Business Meeting

White Nights: Cement. Concrete. Dry Mixtures

Date : May 2017
 Venue: Grand Hotel Europe, St. Petersburg, Russia
 For more information please visit:
www.white-nights.info

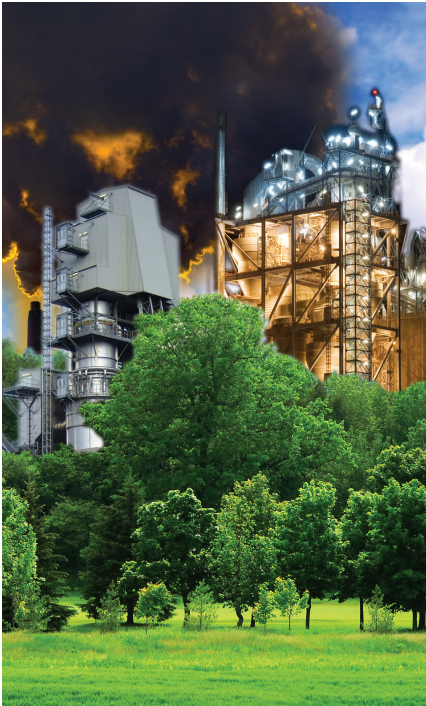
10-11 MAY 2016

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Following the success of the previous events, the 3rd EnviroCem conference will provide information on the state-of-the-art in environmental technology for cement and lime production, including case studies and information on how to fix cement plant environmental challenges.

Who should attend?

- Cement producers
- Lime producers
- Researchers and academics
- Equipment producers
- Service providers
- Consultants
- Legislators

- Main themes:**
- Regulation trends**
 - Mercury emission abatement**
 - Dust, NOx, CO2**
 - Emissions monitoring**
 - Air filtration & ESPs**
 - SNCR, SCR, TO**

Exhibition and sponsorship enquiries:
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24-25 MAY 2016

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- New applications**
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- Slag-related exhibition**



The 11th Global Slag Conference will take place in London for the first time and the event will include a session on 'Non-Ferrous Slags Day' and their use in the cement industry.

Who should attend?

- Slag producers
- Slag users
- Cement producers
- Cement users
- Equipment vendors
- Traders and shippers
- Academics

If your business is slag, make it your business to attend the 11th Global Slag Conference in London!

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Event partner



Organiser



CERAMIC

Glass & Aluminum Saudi Arabia 2016

Date: 01 - 04 May 2016

Venue: Riyadh, Saudi Arabia

Tel: +20 2 2270 35846/5/

Fax: +20 2 2270 3586

Email: aluglass@arabiangerman.com

For more information, please visit:

<http://www.glassalusaudi.com>

MIR STEKLA 2016

Date: 06 - 09 June 2016

Venue: Moscow, Russia

For more information, please visit:

<http://www.mirstekla-expo.ru/>

Glass South America 2016

Date: 08 - 11 June 2016

Venue: São Paulo, Brazil

Tel: +55 11 3205 5000

Fax: +55 11 3205 5070

For more information, please visit:

www.glassexpo.com

Glass Expo Africa 2016

Date: 17 - 20 August 2016

Venue: Johannesburg, South Africa

Tel: +27 11 835 1565

Fax: +27 11 496 1161

For more information, please visit:

<http://glassexpo.interbuild.co.za/>

6th International Congress on Ceramics

Date: 21 - 25 August 2016

Venue: Dresden, Germany

For more information, please visit:

<http://www.icc-6.com/>

China Glasstec Expo - CGE 2016

Date: 24 - 26 August 2016

Venue: Guangzhou, China

Tel: +86 189 2240 2195

For more information, please visit:

http://demo5.yiersan.cn/wgctq_1715/en/

CERANOR 2016

Date: 08 - 11 September 2016

Venue: Porto, Portugal

Tel: +351 22 998 14 00

Fax: +351 22 9957499

For more information, please visit:

<http://www.ceranor.exponor.pt/>

Sri Lanka Glass 2016

Date: 09 - 11 September 2016

Venue: Colombo, Sri Lanka

For more information, please visit:

<http://lankaglass.net/>

GLASSTEC 2016

Date: 20 - 23 September 2016

Venue: Dusseldorf, Germany

Tel: +49 211 4560 900

Fax: +49 211 4560 668

<http://www.glasstec.de/>

Tecnargilla 2016

Date: 26 - 30 September 2016

Venue: Rimini, Italy

Tel. +39 541 744111 / 744206

Fax +39 541 744200 / 744850

Email: infovisitatori@riminifiera.it

For more information please visit:

www.tecnargilla.it

Cersaie

International Exhibition of Ceramic Tile and Bathroom Furnishings

Date: 26 - 30 September 2016

Venue: Bologna, Italy

For more information please visit:

<http://www.cersaie.it/en/index.php>

GLASSTECH Asia 2016

Date: 01 - 30 November 2016

Venue: Kuala Lumpur, Malaysia

For more information, please contact:

CEMS (Conference & Exhibitions Management

Services Pte Ltd)

Singapore

Tel: +65 6278 8666

Fax: +65 6278 4077

For more information please visit:

<http://www.glasstechasia.com.sg/>

Cuba Glass 2016

Date: 06 - 07 December 2016

Venue: Havana, Cuba

For more information please visit:

<http://glassonline.com/site/cubaglass>

Glass Technology India 2016

Date: 09 - 11 December 2016

Venue: Mumbai, India

Tel: +91 44 4295 9595

Fax: +91 44 2820 2728

For more information please visit:

<http://www.zakglasstech.com/>

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Cemtech

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ASIA 2016

19-22 June 2016, Makati Shangri-La, Manila, Philippines



We are pleased to announce that the 7th Cemtech Asia conference and exhibition will take place at the Makati Shangri-La hotel, Manila, Philippines, on the 19-22 June 2016.

The Philippines is an exciting market for the cement industry at present with consumption growth outperforming southeast Asian peers thanks to increased government spending on public works and robust private sector activity. This strong volume growth and promising long-term prospects are encouraging many local producers to invest in new capacity with a host of new expansion and greenfield projects underway. Meanwhile the creation of LafargeHolcim has redefined the local corporate landscape, subsequently providing CRH with an opportunity to secure a foothold in this attractive emerging market.

Against this thriving industry backdrop, Cemtech Asia 2016 will provide up-to-date coverage of all aspects of the wider Asian and ASEAN cement sectors: from country profiles and regional market forecasts, to detailed case studies presented by leading technology experts and cement producers.

The Cemtech equipment exhibition will be held alongside the conference and will provide a forum for delegates to meet and interact with leading technology providers.

A plant tour and extended technical programme are also being arranged.

As 2016 marks Cemtech's 25th anniversary year, hospitality levels will be at their finest, including lunches, evening receptions and a spectacular Gala Dinner. Complimentary sightseeing tours of the historic and modern city of Manila will be provided for accompanying spouses and partners, who are also welcome to join all evening functions.

We look forward to welcoming you in the Philippine capital this June.

For more details, early-bird discounts, programme updates, etc, see:
www.Cemtech.com/Asia2016

Cemtech
25th
Anniversary

International conference and
exhibition organised by:

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Cementreview

GENERAL

5th American Drymix Mortar Conference (admmc five)

Date : 03 May 2016

Venue: Philadelphia, USA

For more information please visit:

www.drymix.info

The First Saudi Workshop on EIFS

Date : 09 or 10 May 2016

Venue: Riyadh, KSA

For more information please visit:

www.drymix.info

Effective Stakeholder Management and Engagement Strategies for the Public Sector Masterclass

Date : 17 May 2016

Venue: Singapore

For more information please contact:

Tel 1: +65 6633 5318

Tel 2: +65 6646 3917

Fax: +65 6399 3699

Email: register@crowleadership.com

www.crownleadership.com

Aerotropolis Asia

Date : 18 - 19 May 2016

Venue: Goodwood Park, Singapore

For more information please contact:

Trueventus

Casey Lee

Tel: +603 2775 0067

Fax: +603 2775 0055

Email: caseyl@trueventus.com

Added Value Facilities Management

Date : 18 - 19 May 2016

Venue: Dubai, UAE

For more information please contact:

LE Lim on (65) 6825 9609

Email: lelim@fdb.com.sg

Or:

Tel: +65 6825 9609

Email: grace@gf-intl.net

CBD Office Property Management and Leasing

Date : 18 - 19 May 2016

Venue: Goodwood Park Hotel, Singapore

For more information please contact:

Trueventus

Casey Lee

Tel: +603 2775 0067

Fax: +603 2775 0055

Email: caseyl@trueventus.com

5th Annual Modular & Precast Conference

Date : 25 - 26 May 2016

Venue: Bangkok, Thailand

For more information please contact:

Trueventus

Mr. John Karras

Tel: +603 2775 0001

Fax: +603 2775 0005

Email: johnk@trueventus.com

3rd Global EnviroCem Conference & Exhibition

Date : 10 - 11 May 2016

Venue: London, UK

For more information please visit: www.environmental-technology.com

39th YAPI - TURKEYBUILD ISTANBUL

Date : 10 - 14 May 2016

Venue: Istanbul, Turkey

For more information please visit:

www.yapifuari.com.tr/eng

58th IEEE-IAS/PCA

Date : 15 - 19 May 2016

Venue: Dallas, USA

Venue: Erbil, Iraq

For more information please visit:

www.cementconference.org

The First European and Mediterranean Structural Engineering and Construction Conference

Date : 24 - 29 May 2016

Venue: Istanbul, Turkey

For more information please contact:

ISEC Secretariat

Email: euro.med.sec@gmail.com

www.isec-society.org/EURO_MED_SEC_01/

CeMAT World Leading Trade Fair for Intralogistics and Supply Chain Management

Date : 31 May - 03 June 2016

Venue: Hannover, Germany

For more information please visit:

www.cemat.de

Advanced Predictive Maintenance

Date : 01 - 02 June 2016

Venue: Makati, Philippines

For more information please contact:

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Brief

International Company for Construction and Special Maintenance (INTERMAINT)

was established in 2003 by the best referenced expertise of 18 years

Working with Japanese ideology which proved a great success in the Egyptian market.

That's why we manage through different valuable clients and meet their needs.

Intermaint/Alfran partnership was formed to add **alfran** history of success

Total Refractory Solution's

in the total refractory systems all over the world to our different services inside Egypt.



01



02

03

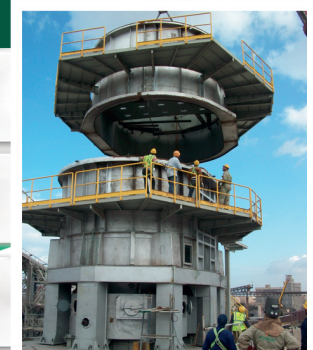


04

05



06



Fabrication :

- Our Fabrication Experience Covers All The needs of Your Plant's Production Equipment.
- All Of Our Process Quality Controlled and quality assured
- We ensure the best quality in the shortest duration possible.
- Our Yearly Capacity Is About 7000 Tons Mixed, As Technological Steel Structure Plate Works And Built Up Sections , Spare Parts Etc.

Erection :

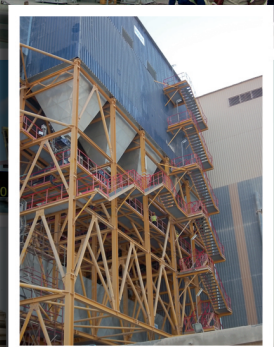
Our way to success is short time and high quality performance.

for new or existing project we can do :-

- Installation of Electromechanical Equipments and Piping as a total services.
- Installation of insulation works.
- Refractory services.

Maintenance :

- Quick intervention
- Planning of shutdowns
- Good preparation
- Very short time execution period



Contact Information

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Web site : www.intermaint.net

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Phone : +966 11 4762230

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THINKING FOR TOMORROW

GENERAL

Trueventus
Mr. John Karras
Tel: +603 2775 0001
Fax: +603 2775 0005
Email: johnk@trueventus.com

Switchgear and Circuit Breaker Ops and Maintenance

Date : 01 - 02 June 2016
Venue: Makati, Philippines
For more information please contact:
Trueventus
Mr. John Karras
Tel: +603 2775 0001
Fax: +603 2775 0005
Email: johnk@trueventus.com

Road Safety Audit

Date : 01 - 02 June 2016
Venue: Kuala Lumpur, Malaysia
For more information please contact:
Trueventus
Mr. John Karras
Tel: +603 2775 0001
Fax: +603 2775 0005
Email: johnk@trueventus.com

Ugol Rossii & Mining 2016

Date : 07 - 10 June 2016
Venue: Novokuznetsk, Russia
Tel: +7 (3843) 3295-11-
Fax: +7 (3843) 3230-24-
For more information please contact:
Kuzbass Fair Exhibition Center (Novokuznetsk)
E-mail: info@kuzbass-fair.ru
www.kuzbass-fair.ru

2nd ICC Asia Conference on International Arbitration

Date : 28 - 30 June 2016
Venue: Hong Kong, China
For more information please visit:
www.iccwbo.org

Argentina Drymix Mortar Meeting

Date : 30 June 2016
Venue: Buenos Aires, Argentina
For more information please visit:
www.drymix.info

Tenancies Management: Landlord & Tenant Law

Date : 12 July 2016
Venue: Singapore

Tel 1: +65 6633 5318
Tel 2: +65 6646 3917
Email: register@crowleadership.com
www.crownleadership.com

The 4th International Exhibition of Mine, Mineral Industries and Mineral Processing & The 2nd International Exhibition of Mining and Construction Machineries

Date : 12 - 15 July 2016
Venue: Kerman, Iran
For more information please contact:
Rastak Pad Vision Co.
Tel: +98 21 88346455 7
Fax: +98 21 88346457
Email: int@rastak-expo.com
Info@rastak-expo.com
expo.rastak@gmail.com
Web site: www.rastak-expo.com

Added Value Facilities Management

Date : 14 - 15 July 2016
Venue: Singapore
For more information please contact:
LE Lim on 65 6825 9609
Email: lelim@fdb.com.sg
Or:
Tel: +65 6825 9609
Email: grace@gf-intl.net

Anti-Counterfeiting and Brand Protection

Date : 27 - 28 July 2016
Venue: Kuala Lumpur, Malaysia For more information please contact:
Mr John Karras
Tel: +603 2775 0001
Fax: +603 2775 0005
Email: johnk@trueventus.com

Rostering and Shiftwork for Plants

Date : 27 - 28 July 2016
Venue: Kuala Lumpur, Malaysia
For more information please contact:
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Tel: +603 2775 0001
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Email: johnk@trueventus.com

Cameroon BUILDEXPO

Date : 10 - 13 August 2016
Venue: Yaounde, Cameroon
Tel: +90 212 272 18 50

PetroCem

NINTH INTERNATIONAL CEMENT CONFERENCE



24-26
APRIL 2016
St. Petersburg
Astoria Hotel

PetroCem 2000 – over 170 participants from 21 countries • 2002 • 2004 • 2006 • 2008 • 2010 • 2012 • PetroCem 2014 – over 520 participants from 34 countries

Journal Cement and its Applications yet again gathers cement industry specialists in St. Petersburg. The meeting of representatives of cement plants, holdings, associations, equipment and services suppliers, analysts, consultants and financiers will traditionally take place at the Astoria hotel.

■ Petrocem-2014 attracted over 520 professionals from 335 firms in 34 countries with 90 cement producing companies among them.

■ As always, this event guarantees a high level of organisation, variety of opportunities for business meetings and establishment of new contacts, simultaneous translation support and comfortable atmosphere for dialogue and

exchange of experience. Conference presentations will address **the most topical issues and advanced process solutions**. A generous exhibition space will showcase companies' achievements.

■ A memorable cultural programme will satisfy the most exacting taste of participants and their spouses.

See you at Petrocem-2016!

Organiser:

journal
ЦЕМЕНТ
и его применение

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+7 812 764 5612
+7 812 712 3683
info@jcement.ru
www.jcement.ru

www.petrocem.ru

GENERAL

Fax: +90 212 272 18 53
Email: info@icffair.com
www.icffair.com

TECNO FACHADAS 2016

Date : 21 - 24 September 2016
 Venue: São Paulo, Brazil
 For more information please visit:
www.fesqua.com.br

Mediterranean Coal Markets 2016

Date : 22 - 23 September 2016
 Venue: Istanbul, Turkey
 For more information, please contact:
 Ms Anna Sydorenko, Conference Director – Coal,
 Power, Freight
 Business-Forum
Tel/fax: +380 562 313 919
Email: A.Sidorenko@b-forum.ru
www.b-forum.com

10th Erbil International Building-Construction, Municipality Equipment, Machinery & Natural Stone Exhibition

Date : 22 - 25 September 2016
 Venue: Erbil, Iraq
 For more information please contact:
 Mr. Tarek ALAMER / Int'l Marketing Executive
Tel: +90 216 575 28 28 ext. 223
Email: tarek.alamer@pyramidsfair.com

MSE 2016 – Materials Science and Engineering

Date : 27 - 29 September 2016
 Venue: Darmstadt, Germany
 For more information please visit:
www.mse-congress.de

ILA General Assembly: international lime association

Date : 12 - 14 October 2016
 Venue: Washington, USA
 Email: ILA2016@icsevents.com
 For more information please visit:
www.icsevents.com

ADDIS BUILD EXPO'2016

7th International Trade Exhibition on Building - Construction, Safety - Security and Infrastructure
 Date : 14 - 17 October 2016
 Venue: Addis Ababa, Ethiopia
 For more information please contact:
 Ms. Sophia David, Marketing co-ordinator,
 ITP, India
Mobile : + 91 8551918436
Email: intltradepromoters@gmail.com

Iran Drymix Mortar Meeting

Date : 25 October 2016
 Venue: Teheran, Iran
 For more information please visit:
www.drymix.info

Erbil International Real Estate & Investment Exhibition

Date : 26 - 29 October 2016
 Venue: Erbil, Iraq
 For more information please contact:
 Mr. Tarek ALAMER, Int'l Marketing Executive
Tel: +90 216 575 28 28 ext. 223
Email: tarek.alamer@pyramidsfair.com

Gulf Safety Forum 2016

Date : 30 - 31 October 2016
 Venue: Doha, Qatar
 For more information please contact:
 Euro Petroleum Consultants DMCC
Tel: +971 0 4 421 4642
Email: office@europetro-me.com
www.gulfsafetyforum.com

4th Latin American Drymix Mortar Conference

Date : 6 November 2016
 Venue: Sao Paulo, Brazil
 For more information, please contact:
 Mr. Ferdinand Leopolder
Email: drymix-news@drymix.info

Bauma 2016

Date : 11 - 17 November 2016
 Venue: Shanghai, China
 For more information, please visit:
www.bauma-china.com

Global Clean Energy and Sustainability Summit & Exhibition

Date : 14 - 15 November 2016
 Venue: Doha, Qatar
Email: shafai@goic.org.qa

6th International Drymix Mortar Conference IDMMC Six

Date : 03- 04 April 2017
 Venue: Nuremberg, Germany
 For more information, please visit:
www.drymix.info

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