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CONCRETE SOCIETY OF SOUTHERN AFRICA

CONCRETEBETON

Fairscape Precinct Botswana

Revisiting the C_3A content and fineness of cement

Concrete Boat Race Day report back

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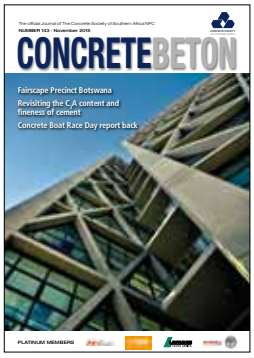

COVER: The Fairscape Precinct office tower project in Gaborone, Botswana was proclaimed the winner in the Building Structures Category (over R100 million) in the 2015 Fulton Awards. The judges commended the design approach applied in conceptualizing the project and were impressed by the effective use of hybrid concrete technology, as well as the innovative method of construction which significantly reduced the amount of staging and scaffolding, and therefore the amount of 'working at height'. The project also received a judges' technical commendation in the Innovation in Concrete Category.

Editor's comment

It's that time of year again when we all think about the summer break to come, and what the next year might hold for us all. The Society has enjoyed a very active and successful time this year in the tough times we find ourselves. I think 2016 will be equally challenging but we intend rising to the situation and meeting those challenges head on.

Membership renewals for 2016 have been sent to all members and I hope that you feel that you have received good value for money from the Society over the past year, and that you would therefore wish to continue being part of our concrete community.

I implore you not to delay paying your 2016 fees - this has a tremendous effect on our cash flow and we cannot be as kind to those late payers as we were this year, when waiting up to 6 months for settlement!

Remember the benefits that the Concrete Society offers:

- Networking with colleagues and clients – exchanging ideas, experiences etc.
- Own regional programme of events
- Opportunities to sit on local committees
- Knowledge growth through seminars; technical meetings and publications
- Voting rights
- Discounts on American Concrete Institute publications
- Earn CPD points
- Discounts on ECSA fees (Engineers)
- Be part of a community that will remain throughout professional career

Recognising that some of our individual members were not able to enjoy maximum benefits from the activities that we offer, due to their distant location from the branch centres, we have now decided to introduce a new category of membership. This will be known as 'Country Member' and the definition is "a person who accepts membership of the Society in his or her personal capacity, and who works and/or resides at least 200 km away from the relevant Concrete Society regional centre'.

Finally, as this is the last issue of Concrete Beton for this year, I would like to thank our Board of Directors for their invaluable support during sometimes very trying circumstances, and Natasja Pols and Marike van Wyk for their loyal support and hard work at Head office, particularly over the Fulton Awards period.

To our advertisers, members and designer, thank you for making this journal the success it is today, because without you, it would not exist.

For the love of concrete!

John Sheath
Editor

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President's message

The end of 2015 is around the corner and what a year it has been!!! This year will certainly hold a special place in my memories

As the year draws to a close, and we reflect, we can safely say this was a good year for the Concrete Society of Southern Africa with a jam-packed schedule of activities. We arranged two successful roadshow seminars, held in various venues around the country, the RepSem earlier in the year and the HybriSem in September. These seminars brought together industry experts to share their knowledge and latest developments in these two industry "hot" topics.

The highlight of the year was no doubt, the successful hosting of the prestigious Fulton Awards 2015 gala event at the Champagne Sports Resort in June, followed by the regional events in Durban, Port Elizabeth, Cape Town and Johannesburg. This is where "excellence and innovation" in the use of concrete was recognized at the highest level. I once again urge you to start thinking of about project entries for the 2017 Fulton Awards, as planning for these awards is well underway and the call for entries will be going out early in 2016.

Yet another highlight for me! I had the privilege of attending the Annual CSSA Inland Branch Concrete Boat Race, definitely an event worth diarizing every year. I marveled at not only the success of the event in terms of the numbers of people who attended, but at the success of bringing industry and academia, especially university students, together in a fun yet very technical competition. The innovation in design, construction and use of concrete as a material shows that our industry is well and in good hands looking into the future.

This is my penultimate edition of the Concrete Beton as the President and Chairman of the Board of the CSSA. Our Vice President Hanlie Turner will be taking over in March 2016 when I step down as President. And I would like to take this opportunity to congratulate Francois le Roux from Nyeleti Consulting who was recently elected as our future Vice President - welcome aboard!

Finally, a big thank you to the board of the CSSA and our Head Office staff for their time and hard work throughout the year ensuring that the CSSA continues to achieve new heights for the benefit of its members and the industry at large.

I wish you all a restful and blessed holiday season. Enjoy the read and God Bless!

Yours Sincerely
Tseli Maliehe
President – Concrete Society of Southern Africa

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View of the Fairscape Precinct from the North East

Night view of the Fairscape Precinct

Fairscape Precinct – Botswana

The use of precast concrete diagrid elements as a structural veil for this global iconic office tower is a first in Africa. The unique use of the diagrid reminds one of the facets on diamonds, a major source of income in Botswana.

Owner's brief and how it was resolved

The owner was desirous of developing a mixed-used precinct with a global iconic presence. The unique use of a triangular precast diagrid structure offered this opportunity, since diagrids have never been applied in this format on any building globally..

Concrete was chosen as it was the most cost effective option which provided economy and practicality as well as the desired aesthetic appeal. Normally steel would be used, but in the African context concrete is simply more economical. The availability of local specialist steel contractors was also limited.

Diagrids are multipurpose in nature and apart from supporting the building also provide stability and resolve the requirements of the façade rather sensibly, by providing shading exactly where it is required. The diagonal frame resulting from the diagrid braces the building and creates incredible stability that can securely withstand the vagaries of Mother Nature.

Description of the works and construction procedure

Serious consideration was given to manufacture the diagrids in South Africa and have them transported to Gaborone, but programme constraints and logistical challenges in transporting the diagrids by road, prohibited this option.

The diagrids were ultimately manufactured in Gaborone, transported to site on specially built trailers and stockpiled on site. Careful labelling of the diagrids was very important since each diagrid had different loading characteristics and had to be correctly placed on the façade.

The core of the building was traditionally constructed ahead of the floor slabs. Pull out bars were provided in the core to anchor the slab to the core. On the slab edge the diagrids were placed in position and the slabs were cast against the diagrids, held in position with special anchors.

Unique, robust shutters were designed and manufactured for the pouring of the trapezoidal shaped raking columns. The building

Transportation of diagrid units each weighing 6 tons.

First completed diagrid in the yard at Phakalane, Gaborone.

First two diagrid units being erected on site.

comprises four quadrants and the slabs and diagrids were constructed in a cascading, spiral fashion to the top.

Design approaches and construction techniques

Due to the structural integrity required in the diagrid design, the profile had to be 600 mm deep.

The profile was shaped in a tapered form to make it look elegant, and the resultant benefit of the tapered shape was to give rainwater run-off in all instances. The 600 mm depth offered sufficient sun screening to the north, east and west façades, thus reducing the mechanical loads within the building.

Moulds

The diagrid elements form the permanent façades of the building and were required to have a high quality finish. The moulds were designed to be complete 'drop out' moulds. The first completed moulds were produced in the engineering workshop in Pretoria North, and were designed and made with no external removable parts to accommodate de-moulding of the concrete elements. The advantage was that there were no unsightly 'bleed lines' on the concrete elements.

However, it was really a challenge to strip the elements out of the mould, without damaging or destroying it. Purpose made hydraulic jacks were successfully utilised to force the 6.5 ton elements free from the moulds without breakages or damage to the elements. All the 420 elements with about 50% variations were produced out of the same set of moulds, helping to make the precast sub-contract economically viable.

Concrete Strength

An average of four elements had to be produced per day at the peak production rate. Due to the prohibitive cost of the moulds, it was decided to use only four moulds and to design a high early-strength concrete mix with a strength accelerator, to allow stripping of the diagrids within 14 hours at a strength of 16,5 to 20 MPa. This allowed all the moulds to be utilised every day.

De-moulding of the diagrids out of the moulds was successfully accomplished with the help of the jacks previously mentioned. The early-strength concrete gave 28-day strength of more than 50 MPa, which was substantially higher than the 30 MPa specified for the project, but this helped a lot in minimising handling damage of the elements.

Erection

The diagrids had to be aligned and kept in position before 'stitched' to the structure. This was done with four specially designed, purpose-made, push-pull props

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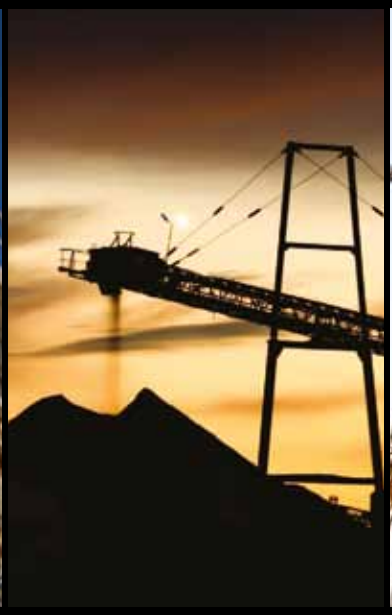
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View of the iconic Fairscape Tower facing the Piazza

per panel, allowing all the required adjustments to be done to properly position & align the panels.

All the connections between the push-pull props and diagrids were formed with cast-in sockets in the diagrid used to structurally connect the props to the diagrid. The cast-in sockets were afterwards filled in to be invisible.

Load-Bearing Waterproofing Grout

As the diagrids were required to be load bearing, great care was taken to select a structural grout and to ensure that all voids were fully filled between the diagrids.

A tolerance of only 15 mm was allowed between the diagrids, to be filled in with the structural grout. Specialist Precast Elements (SPE) had to guarantee the water-tightness of the final structure, so the grout was further successfully used as a water-tight barrier, preventing any ingress of water into the building.

Lost Shutter Raking Beams

A special challenge was the raking beams at the top of the building, connecting the diagrids to the structure. SPE designed precast concrete 'lost shutters' to be erected in position and filled with concrete, to form part of the structure.

Programme challenges and compliance

The primary concern in terms of the programme was to maintain the speed of production and delivery to site of the diagrids. This activity remained on the critical path until the building topped out and fortunately, the production of the diagrids was maintained and no delays were experienced. Sufficient tower cranes were imported to maintain the production of the in-situ concrete and the erection of the diagrid elements.

Impact on social upliftment and the environment

During the construction of the project a large number of local artisans and labourers of both genders were employed. These artisans and labourers were then able to support their dependants and through this, the local economy received a substantial cash injection. Furthermore, due to the on the job training programme followed by the contractor, a number of workers left the project with new skills which made them more marketable for future employment.

Purpose-designed and fabricated scaffolding had to be erected around the slanted columns and 12 special scaffold erectors were trained for this specific operation. Seven Rope Access Technicians were also trained by Height Safety RSA in working on heights Level Two as well as rope access level One (basic rope access) & Two (rigging and rescue) to facilitate in the process of concrete patching, glass replacement / repair

and also general cleaning of façades and curtain walls after the construction work were completed.

Besides the key experienced rebar fixers, at least 55 local people were trained to do the reinforcing installation and fixing. The key concrete hands trained a further 35 people to work and handle the various placing/pumping of the 53 000 m^3 of concrete on the project.

The formwork requirement on the project required a huge amount of hands and over 12 teams of shutter hands and formwork labour were trained on the site by our key experienced teams. All the other relevant sub-contractors employed and trained local people in their field of expertise to work on the site.

At peak there were over 850 people on site. Precast concrete technology has also been further developed and expanded in Botswana.

First completed mould in the engineering workshop in Pretoria North.

Health and safety issues

When the project commenced, Botswana did not have any formal laws that determined the health and safety on a building site. However, the main contractor, Stefanutti Stocks Botswana had a very strict health and safety policy which they enforced on site. This made each and every person on site through the induction process, aware of these requirements and should hopefully, also be part of the acquired skill set that they will take with them when working on other building sites. ▲

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Back to the Future

The concrete industry's use of very efficient admixtures prompts the revisiting of C_3A content and fineness in portland cement.

by Pierre-Claude Aïtcin and Sidney Mindess

Up to the end of the 1960s, the maximum compressive strength that could readily be achieved for a 100 mm (4 in.) slump concrete was about 30 MPa (4400 psi), due to the limitations in the dispersing properties of the water-reducing admixtures then available. These early water-reducing admixtures were based on lignosulfonates, a waste product from pulp and paper mills using the so-called bisulfite process. In this process, the lignite that "glues" the cellulose fibers together is dissolved by sodium bisulfite at a temperature of about 100°C (212°F). The paper mill recovers the fibers to make paper and discharges the lignosulfonate liquor that also contains all of the other chemicals present in the wood (sugars, surfactants, and so on).

The chemical composition of the lignosulfonate liquors is quite variable, depending on the types of trees, and even on the time of year at which these trees were felled. Further, the production of certain types of paper requires the exclusive use of softwoods, while other types of paper need hardwoods, and still others are made from a combination of these tree types. This explains the great variability in commercial lignosulfonate- based water-reducing admixtures that are commercially available, even though they are beneficiated to eliminate most of the sugars or surfactants.

Superplasticizers

At the end of the 1970s, two revolutionary synthetic molecules developed specifically for the concrete industry were introduced into the market.[1,2] These synthetic molecules were much more efficient than lignosulfonates at dispersing cement particles.[3] These molecules were quickly commercialized as superplasticizers (also known as high-range water-reducing admixtures); with their use, it became possible to significantly increase concrete slump without adding extra water.[4] It was also quickly realized that it was now possible to simultaneously increase the slump of concrete while decreasing the water dosage. Consequently, in accordance with Féret's[5] and Abrams'[6] laws, the compressive strength of the cement paste and the concrete could be increased dramatically, even when there was not enough water to fully hydrate all of the cement particles. It became possible to produce high-strength concretes (HSCs) with strengths of 75 to 150 MPa (11,000 to 22,000 psi) with a slump of 200 mm (8 in.), as long as the coarse aggregates were strong enough.[7-10]

It was also observed that HSCs had more than just a high strength – the modulus of elasticity and the modulus of rupture were somewhat higher[11] and the resistance to abrasion was greater.[12] HSCs were also more impermeable and hence more durable.[13] As a result, the name for these concretes was changed to high-performance concrete (HPC), even though this was quite a vague designation and, as pointed out by Bryant Mather in many ACI committee meetings, there were no tests with which to measure the performance of such concretes. Nonetheless, HPCs are used on a daily basis worldwide. A few years later, even higher strengths and higher performance were obtained with the development of ultra-high-strength concrete (UHSC) and ultra-high-performance concrete (UHPC). While most of these UHPCs are produced using ordinary portland cements, Type H oil well cement has also been used to produce UHPC.[14] Such concretes are really mortars having very low water-cement ratio (*w/c*) values from which the usual coarse aggregates have been eliminated. The coarse aggregates are eliminated because at these very low *w/c* values, the strength of the coarse aggregate can become the weakest link of the concrete.[15,16] In fact, most of the coarse aggregates used to make concrete are obtained by crushing rocks with compressive strengths in the range of 75 to 150 MPa (11,000 to 22,000 psi) – stronger rocks are too difficult and costly to be crushed.

Compatibility and Robustness

When superplasticizers came into general use, it was soon observed that two cements complying with the same acceptance standards might exhibit very different rheological behaviors when high dosages of superplasticizer were used to make low *w/c* concretes. In some cases, it was relatively easy to maintain the initial slump for 90 minutes, while in other cases the initial slump was completely lost after 15 minutes. To describe this unusual and unexpected behavior, the expressions "cement-superplasticizer compatibility" and "the robustness of cement-superplasticizer combinations" were coined.

Because control of the rheology of low *w/c* concretes was essential if they were to come into general use, a great deal of research was devoted to understanding this strange behavior. A systematic study of this phenomenon was carried out, with a particular focus on polynaphthalene (PNS) superplasticizers, because in the 1990s these were the most commonly used superplasticizers. It was eventually discovered that the cement's C_3A and C_3S contents, specific surface area, and sulfate content, as well as the nature and solubility of the cement's sulfates, were the key factors controlling the rheology of low *w/c* concretes, and, of course, the efficiency of the superplasticizer itself. In particular, study showed that if the C_3A content is greater than about 6% and if the various sulfates present in the mixture cannot dissolve rapidly, the sulfonate groups in the PNS can react with the C_3A, thus reducing the effectiveness of the PNS superplasticizer.[17] It was also found that, from a rheological point of view, the best cements for HPC and UHPC were those having the lowest possible C_3A content, not too high a C_3S content, and a fineness less than 400 m^2/kg. These findings raised the following question: *Why did these parameters not have much of an effect on the results of the acceptance standard tests for cement?*

Acceptance Standard Tests

Cement acceptance standards are typically based on the results of tests carried out on cement pastes or mortars prepared with the high *w/c* of 0.485 or 0.50. In these systems, the cement particles are not fully dispersed, but rather occur in flocs that are quite separated from each

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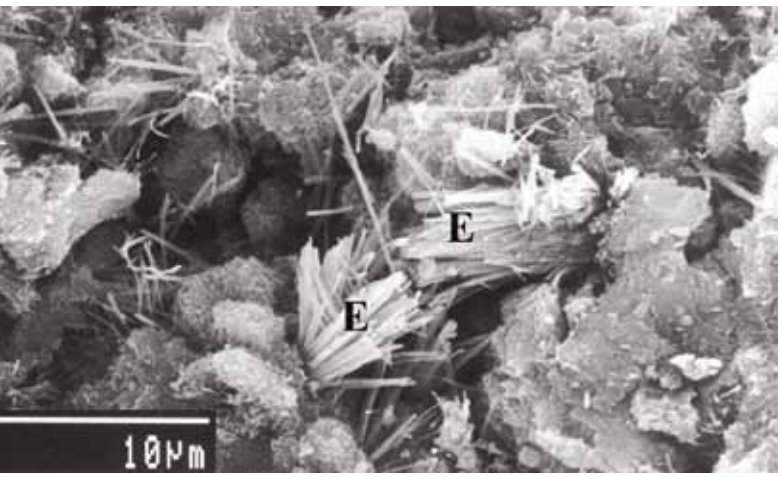


Fig. 1: Ettringite crystals (needles) formed around C3A hydrates.

other.[3] When such a system begins to hydrate, the hydration products formed on the surface of the cement particles by reaction with the various ionic species dissolved in the interstitial solution, have to travel a considerable distance before they can interact with the hydrates growing from adjacent cement particles. Thus, the rheology of the system develops rather slowly.

The role of the cement chemists at each cement plant is to adjust the C_3S, C_3A, and gypsum contents as well as the fineness of the cement to fulfill the following goals:

- Fulfilling the acceptance requirements in terms of initial flow, initial setting time, and final setting time; and
- Obtaining the highest early compressive strength that they can.

Portland Cement Production

Producing portland cement with C_3A and C_4AF contents of about 8% each is significant for cement producers from an economical point of view, because at these C_3A and C_4AF contents the clinker output of the kiln is maximized. In addition, under these conditions, the kiln should be running smoothly, requiring relatively little attention from the kiln operator because in the burning zone the raw meal is easily transformed into clinker. This is due to the good balance between the silicate phase and the interstitial phase. However, if the C_3A content of the clinker is reduced while the C_4AF content is increased, the operation of the kiln is somewhat compromised. This is because in the burning zone the interstitial phase becomes too fluid, requiring a reduction in the speed of rotation of the kiln, leading to a reduced output. Moreover, the control of the burning process becomes more difficult, and the risk of ring formation increases. Thus, producing a low C_3A clinker requires constant attention by the kiln operator. Therefore, producing a clinker with a C_3A content of about 8% is advantageous for the cement manufacturer because:

- It facilitates the clinker production;
- It increases the kiln output; and
- It increases the initial strength of the cubes used to check the compliance with the acceptance standards.

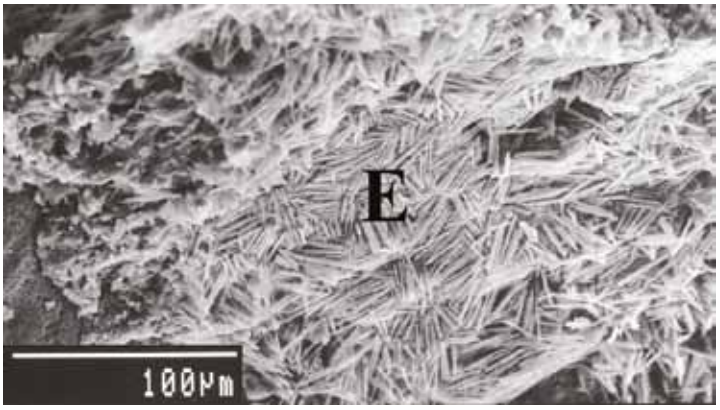
The Perverse Role of C3A

On concrete rheology

For a concrete producer, C_3A is not very desirable because it is "poison" for the rheology and durability of concrete. C_3A is the most reactive of the portland cement minerals, and to avoid its almost instantaneous hydration to form hydrogarnet, calcium sulfate (gypsum) must be added during the final grinding of the cement. In the presence of this calcium sulfate, C_3A hydrates to form a thin shell of ettringite ($6CaO \bullet Al_2O_3 \bullet 3SO_3 \bullet 32H_2O$) that slows down further C_3A hydration (Fig. 1).

Ettringite needles generated during the rapid hydration of C_3A increase the yield stress of the concrete, so that workability and slump decrease. The higher the C_3A content of the cement, and the higher the cement fineness, the greater the amount of ettringite formed, and the greater the workability and slump losses. Further, when the C_3A hydration occurs in the presence of a polysulfonate superplasticizer (as in low *w/c* concretes), if the calcium sulfate in the cement does not go into solution quickly enough, some of the superplasticizer molecules can react with the C_3A. Thus, some of the superplasticizer is no longer available to disperse the cement particles, resulting in a rapid slump loss. In such a case, the cement and superplasticizer are said to be incompatible.[18,19] On the other hand, when making "ordinary" concrete, the C_3A content of the cement is not so critical. However, the market for low *w/c* concretes is now steadily increasing, and will continue to increase in the future because low *w/c* concretes are more sustainable. It may therefore become necessary for Fig. 1: Ettringite crystals

(a)



(b)

Fig. 2: Clusters of ettringite needles (E) that were found in a concrete that had been damaged by freezing-and-thawing cycles in Quebec, Canada: (a) at the paste aggregate interface or in fissures; (b) almost filling an air-entrained bubble; and (c) lining an air-entrained bubble (A) (photos courtesy of Guanshu Li)

(needles) formed around C_3A hydrates cement producers to manufacture two different types of clinker: one with a relatively high C_3A content of about 8% (but not more, for reasons of durability) for ordinary concrete, and one with a relatively low C_3A content of about 6% (for reasons of rheology) for the high-strength and ultra-highstrength applications. The latter clinker would be essentially the good old Type I/II clinker that has served the American concrete industry so well for many years.

The cements with an 8% C_3A could be ground more finely (400 to 450 m^2/kg) because they will be used in high *w/c* concretes (*w/c* > 0.50), while the 6% C_3A cements will not need to be ground so finely (350 to 400 m^2/kg) because, in the low *w/c* concretes in which these cements will be used, the rapid development of ettringite needles is not necessary for early strength development. Instead, it is the close spacing of the cement particles deflocculated by the superplasticizer that will create the first bonds responsible for initial strength.

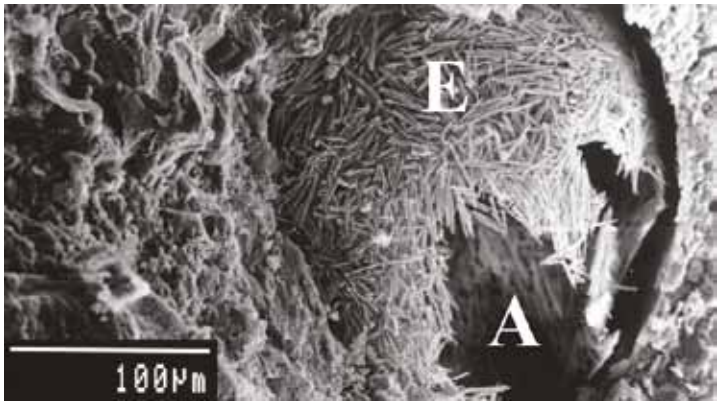
On concrete durability

A high C_3A content is not good for durability of concrete because ettringite is not stable in the high pH of the interstitial water existing in the capillaries of the hardened concrete. A few hours after the onset of hydration, when all of the calcium sulfate introduced into the ball mill during the final grinding of the clinker is exhausted, some of the initially formed ettringite is transformed into monosulfoaluminate ($3CaO \bullet Al_2O_3 \bullet CaSO_4 \bullet 12H_2O$). During this transformation the ettringite releases some calcium sulfate that then reacts with the remaining C_3A to form more monosulfoaluminate. Also, if for any reason additional calcium sulfate penetrates into hardened concrete, the monosulfoaluminate is transformed into ettringite, which is an expansive reaction that causes disruption to the concrete.[20,21] Thus, in the high-pH environment of concrete made with "pure" portland cement and later exposed to sulfates, both ettringite and monosulfoaluminate are not stable; this instability can cause durability problems such as delayed ettringite formation, sulfate attack, and reduction in resistance to freezing and thawing (Fig. 2).

Blended Cements

To increase the sustainability of concrete, cement producers are increasingly producing blended cements, in which some of the portland cement clinker is replaced by substantial amounts of supplementary cementitious materials (SCMs) or fillers. Of course, these blended cements are less reactive than pure portland cements in the short term, unless something is done to the portland cement characteristics or to the *w/c* of the concrete to increase the early strength. Currently, the response of the cement industry is to increase the C_3A and C_3S contents of the clinker, to grind it more finely, and to adjust the amount of added gypsum to meet the acceptance standards. Cement fineness has steadily increased for the past 50 years.[22] However, these measures serve to create rheological problems when producing low *w/c* concretes; it would be better simply to reduce the water-binder ratio (*w/b*) of the blended cement concrete.

(c)



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Due to the excellent dispersing properties of modern superplasticizers, it is possible to reduce the *w/c* or *w/b* down to 0.30 or even down to 0.20 for UHSCs. Of course, at these low ratios, the cement particles cannot reach 100% hydration because there is not enough water. Only the outer parts of the cement grains will be hydrated, but experience has shown that it is not the degree of hydration but rather the closeness of the cement grains to each other that governs the compressive strength. Further, in low *w/c* or *w/b* cement pastes, the unhydrated cores of the cement particles have a strengthening effect on the paste. Therefore, decreasing the *w/c* or *w/b* of concrete made with blended cements represents the most sustainable way of reducing the carbon footprint of concrete structures. However, to facilitate the placement of such concretes, it is necessary to use cements made from clinkers having low C_3A contents, and to maintain the fineness at between 350 and 400 m^2/kg. When such cements are used to produce low *w/c* concretes, a reduced fraction of the C_3A will be transformed into ettringite, and this will improve the durability.

Conclusions

The recent technological progress in the concrete industry due to the use of very efficient admixtures developed specifically for the industry provides two good reasons to look to the past. First, because HSCs are more sustainable than ordinary concretes, the acronym HSC should be used to identify them as "Highly Sustainable Concretes." Second, to make low *w/c* concretes easy to transport and place, the North American cement industry should continue to produce the good old Type I/II clinker, as has long been the "battle cry" of R.W. Burrows (for example, Brewer and Burrows[23] and Mehta and Burrows[24]). ▲

ACI Honorary Member **PIERRE-CLAUDE AÏTCIN** is Professor Emeritus at the Université de Sherbrooke, Sherbrooke, QC, Canada. He was the Scientific Director of Concrete Canada, the Network of Centers of Excellence on High Performance Concrete for 8 years. He also had an Industrial Chair on Concrete Technology for 9 years in collaboration with 13 industrial partners.

SIDNEY MINDESS, FACI, is a Professor Emeritus in the Department of Civil Engineering at the University of British Columbia, Vancouver, BC, Canada, where he has taught since 1969. His teaching and research interests have been primarily focused on cement and concrete technology. He is now occasionally engaged in consulting on concrete construction problems.

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An artist's impression of the new look Menlyn Mall currently being constructed.

Work begins on challenging Menlyn Park Phase 2 project

Murray & Roberts Buildings has commenced work on the Menlyn Park Reconfiguration Phase 2 project in Pretoria. Originally opened in 1979, the Menlyn Park Shopping Centre is undergoing a major redevelopment that includes a massive expansion and refurbishment, adding approximately 45 500 m^2 to bring its retail space to approximately 170 000 m^2.

Rui Santos, operations director at Murray & Roberts Buildings, says that the company recently completed the work on the first phase Food Court portion, which included the construction of an enclosed area over two levels (previously the Events Arena) which houses recreational and fast food outlets. This spanned over a seven month period and was completed in December 2014. The construction of the new retail portion of Phase 1 spanned over a 12 month construction and anchor tenants Checkers Hyper, Pick 'n Pay, Food Lover's Market, House and Home, New World, two restaurants and a number of smaller line shops commenced trading on 12 June 2015. Additional structured parking was also constructed during this phase.

Phase 2, which started at the beginning of June 2015 and is scheduled for handover at the end of November 2016 calls for the demolition of 35 000 m^2 of an existing area of the shopping centre, followed by the construction of a new two level retail section of 57 000 m^2. In addition to this, the contractor will also be responsible for the refurbishment of existing malls, ablutions and the existing seven level parkade within the centre. This will include replacing ceilings, floor tiles, balustrades and the cladding of demising columns as well as the redecoration of existing external facades, new landscaping and boundary wall construction on the perimeter of the centre.

Tenants in the section to be demolished during Phase 2 were relocated to the new retail section of Phase 1 and to the temporary The Village Mall in the existing P5 Parkade. Demolition work has been implemented in a phased approach to accommodate this relocation of existing tenants. It was also necessary to isolate existing services in phases for the complete centre to enable the demolition works to commence. Work is scheduled to progress from the western side of the newly completed Phase 1 mall towards the remainder of the existing centre to the east.

Santos says one of the biggest challenges on this project will be logistics. "With the mall being fully operational at all times, we will need to undertake the demolition and construction work with as little disruption to the centre as possible. This will require careful planning and great attention to the safety of not only our and sub-contractors' teams but also the general public.

"Extreme care has been taken to ensure the safety of all shoppers and other stakeholders, with work areas hoarded off and communicative signage clearly demarcating construction areas. Demolition will take about three months and thereafter piling will begin, followed by the construction work," says Santos.

The exceptionally fast track nature of the contract programme will be challenging, coupled with the complex logistics of moving materials in and out of the site to achieve the critical milestone dates. Environmental stewardship is important to all involved in the project and the waste material from the demolished site will be sorted, prior to removal off site.

"To accommodate the tight construction programme and to meet the targeted handover date, a major portion of after-hours work will be undertaken, including majority of the finishing trades," Santos says. ▲

For more information contact: +27 011 590 5605, www.construction.murrob.com

Greening up hospital grounds with permeable pavers

Since June this year, residents of Strand and Somerset West will have access to wide selection of health services, following the opening of a new private hospital in the region. The R400 million, 100-bed Busamed Paardevlei Private Hospital in Strand is the first of four hospitals to open in the country.

Launched by the black-owned Busamed hospital group, it boasts state-of-the-art medical wards, including maternity and neonatal wards, high care, and an intensive care unit (ICU) among its specialist units. Says Dr Diliza Mji, whose company Goldenwood has a 60 percent stake in the Busamed: "Even though there is a presence of some private hospitals in the area, these didn't cater for everyone.

"Patients who needed vascular surgery, rheumatology and orthopaedic oncology services, for instance, had to venture out of Somerset and Strand and travel to areas such as Stellenbosch or Cape Town if they wanted access to these services.

"The new hospital is now bringing services to the people…right on their doorstep."

To accommodate patients and staff on arrival, the parking area on hospital grounds needed structurally functional and aesthetically pleasing hard landscaped surfaces for parking, roads and various pedestrian areas. Based on a Council directive that the parking on Beach road edges should be soft and green, this included creating parking areas paved with permeable pavers that would allow groundwater to return to the aquifer in the area.

Both Jon Whiting, paving contractor and Tanya de Villiers, CNdV Africa, approved a locally designed hard lawn paver. Says Whiting: "We chose the Terracrete interlocking grass paver, designed by Terraforce and manufactured by Cape Retaining Systems, because of its unique aesthetics and ability to return storm water to the ground via its permeable characteristics and sand substrate. In total, we installed 1,700 m² of Terracrete blocks."

Richard Hartsuiker, of Vula Environmental Services, describes the final planting process of the pavers: "All the blocks were brush filled with a topsoil and organic fertilizer mix of a high compost fraction (40/60). The soil was then lightly compacted and watered, and finally seeded with 40 g per m² of warm season grass (Cynodon dactylon). Once the grass started germinating after five to ten days, the parking lots were transformed into attractive green zones along the length of the hospitals exterior grounds."

De Villiers is also very pleased with the resulting appearance of the grassed Terracrete pavers: "I think they worked out rather well!" ▲

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BASF opens construction chemicals production facility in Lagos, Nigeria

BASF recently inaugurated its new production plant for concrete admixtures in Lagos, Nigeria. The production site is BASF's answer to the increasing demand for construction chemicals in western Africa.

BASF produces standard and custom-made performance concrete additives, or 'admixtures', from the company's comprehensive Master Builders® Solutions portfolio. "We are now able to rapidly supply our customers with admixtures for all cement and aggregate types, whether their construction projects are located in the urban areas of western Africa or in more remote sites," said Nair Narayanan, Country Manager for BASF Construction Chemicals, West Africa. "We as experts in construction chemistry are where our customers need us with the foremost aim to fulfil the many needs and requirements of the industry in Nigeria. Then to further expand the business to export to neighboring west African countries such as Ghana, Liberia, Benin, Togo, Burkina Faso and the Ivory Coast", added Mr. Narayanan.

L to R: Peter van den Hoek, Vice President, Market Development, Africa; Andrew Bailey, Managing Director BASF West Africa; Laurent Tainturier, BASF Senior Vice President EUE - CIS, Middle East & Africa; Joan Maria Garcia Girona, Vice President and Head of Business Center South Africa and Sub-Sahara.

BASF's admixtures enable the production of concrete that is stronger and more durable while also increasing its workability retention. This leads to faster setting and hardening and thus accelerating the construction progress. This helps to reduce the total costs. The new facility also allows for tailor-made products for local customers in order to meet their specific needs. "Fast and flexible solutions based on the daily and future needs of the construction industry in Western Africa are our contribution to the region's economic progress", said Christian Geierhaas, regional head of BASF's Construction Chemicals division. "Our clear aim is to support the local industry by reducing imports, thereby minimizing the long lead times for supplies and other transport related issues, while supporting the economic growth of the region by creating employment opportunities", he said.

Africa – a vivid role in growth strategy

Nigeria is a particularly dynamic growing market for construction chemicals in West Africa. "Growth in emerging markets is an integral component of BASF's 'We create chemistry' strategy," said Laurent Tainturier, BASF Senior Vice President Europe East, CIS, Middle East and Africa. "This new production facility will strengthen the product portfolio in the region, and, while meeting the demands for the broader construction industry, it will also introduce the company's expertise in world leading technology into the region such as energy efficiency in construction techniques," he said.

The new production site in Lagos is a further step to strengthen the global network of the Master Builders Solutions brand. The solutions offered by the brand will also strongly benefit contractors from other regions doing construction projects in West Africa, as they may already know the product portfolio and technologies. Solutions from BASF also help to comply with energy efficiency certifications for buildings such as LEED (Leadership in Energy and Environmental Design) by the U.S. Green Building Council.

BASF has been actively selling construction chemicals to the western African market for more than 20 years. Other production sites in Africa are located in Westonaria, South Africa; Algiers, Algeria; Sadat City, Egypt, Casablanca, Morocco, and Nairobi, Kenya. Among the rich history of successful construction projects in Africa in which solutions and expertise of Master Builders Solutions were included, are the Lekki-Ikoyi-Bridge in Lagos, Nigeria, the East-West Highway in Algeria and the De Hoop Dam in South Africa.

About the Construction Chemicals division

BASF's Construction Chemicals division offers advanced chemicals solutions for new construction, maintenance, repair and renovation of structures: Our comprehensive portfolio encompasses concrete admixtures, cement additives, chemical solutions for underground construction, waterproofing systems, sealants, concrete repair & protection systems, performance grouts, performance flooring systems, tile fixing systems, expansion control systems and wood protection solutions.

The Construction Chemicals division's 5,400 employees form a global community of construction experts. To solve our customers' specific construction challenges from conception through to completion of a project, we combine our know-how across areas of expertise and regions and draw on the experience gained in countless construction projects worldwide. We leverage global BASF technologies, as well as our in-depth knowledge of local building needs, to develop innovations that help make our customers more successful and drive sustainable construction.

The division operates production sites and sales centers in more than 50 countries and achieved sales of about €2.1 billion in 2014. ▲

The move from jointed floors to seamless floors

The fast moving and dynamically changing supply chain, product distribution and logistics industry has dramatically altered the landscape when it comes to the design of warehouses, distribution centres and storage facilities.

There is an ever increasing demand for more space, faster distribution and improved overall operational efficiency in order to meet the constantly expanding needs of constantly growing markets. The design of facilities required in this industry has changed dramatically because of this growing demand and probably the most critical element of the design to meet this requirement is the concrete floor, essentially it is the working surface of the entire operation. The floor is ultimately the foundation of the future operational success of any facility. It carries the traffic of Materials Handling Vehicles which move the goods in and out of the facility.

In the past, traditional "jointed" floors have coped with the demand, but with the exponential growth experienced over the last 3 decades, these traditional "jointed" floors have taken an immense amount of pressure simply because of the hugely increased traffic and quantity (weight) of goods being moved. In particular the joints become badly damaged resulting in major direct and hidden costs being incurred by the facility owner/tenant as follows:

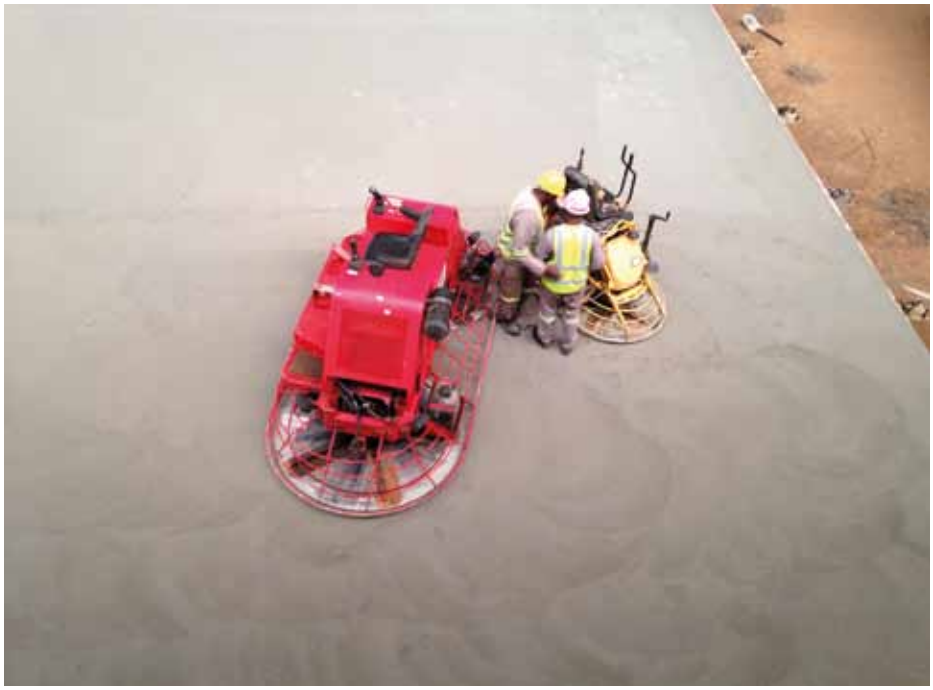
- the floor joints require ongoing costly maintenance,
- the vehicles' wheels, bearings and computer equipment get damaged
- the speed of operation is significantly reduced
- driver health and safety is impaired
- stock losses occur due to load tippage and breakages
- the overall value of the building decreases

Due to these and other factors, such as the requirement for higher racking and narrower aisles, engineers and architects have had to rethink the design of the facilities, particularly with regard to the concrete floor. Their thinking has been driven by the resultant requirement for flatter, more durable and lower maintenance flooring. This has led to many improved concepts being developed.

One of these concepts is the introduction of "seamless" floors – in other words floors without traditional "saw cuts" or joints. Seamless concrete floors are placed using a high saturation of tensile steel fibres and shrinkage compensating admixtures, which together with a unique concrete mix design, achieve a tough composite concrete surface. This allows the floor to be placed thinner, in much larger panels and in far less time which takes immense pressure off the main contractors' project programme. Seamless floors eliminate curling and because they use less cement (being thinner) the result is lower CO_2 emissions making it an environmentally friendly "green" alternative.

Ultimately the elimination of joints in the floor is the most significant benefit in that it reduces the costs of floor and vehicle maintenance for the owner/tenant across the board and offers a more user-friendly and risk (health and safety) compliant flooring solution. In addition, the overall value of the investment in the building is not compromised by a non-compliant floor. ▲

Enquiries: Brian Norton 011 704 5557 / 082 600 5618



Topfloor supplies concrete elements for Western Cape's first multi-storey, load-bearing reinforced concrete block masonry development

Echo Group company, Topfloor, has supplied over 16 000 m² of prestressed hollow-core concrete flooring slabs for the construction of Lange Formal Township, the Western Cape's first multi-storey, loadbearing reinforced concrete block-masonry development. Eighteen low-income rental apartment blocks are being built by main contractor, the Power Construction Group, which formed an integral part of the project's architectural and engineering development teams.

Built for the City of Cape Town and situated on the Cape Flats off the N2, the development's anticipated completion date is November 2015.

Each block houses twenty five 35 m² apartments comprising two bedrooms, kitchen/lounge, bathroom and balcony. Moreover, insulated roofing and solar heating are included to meet conservation requirements and reduce the cost of living for the occupants.

In addition to the hollow-core concrete flooring slabs, Topfloor also provided the Power Group with precast staircases. Other precast concrete elements included high-strength concrete blocks, modular precast concrete doorframes and windows, as well as poly-fibre balcony railings.

According to Power Group, director Johnny Moore, precast hollow-core slabs were an integral part of the structural design criteria and saved months in construction time.

"No shuttering was required nor curing time for wet concrete which meant that other services could begin work as soon as the slabs were installed. Further time-savers were the smooth soffits and rough finishes on the upper sides of the slabs. This enabled the soffits to be painted without the need for skimming and made screed bonding on the top sides hassle-free. All of these time-saving advantages meant substantial cost savings for the client.

A close up of hollow-core slabs used at Lange.

"Topfloor was involved in the primary as well as secondary planning stages and helped resolve details such as the staircase/slab interfaces and pull-up bars for the reinforcing of the walkway balustrades," said Moore.

The Lange buildings have been designed to comply with seismic codes and this meant that Topfloor had to provide pre-cut openings for seismic-stress connections. In addition, they supplied cut-outs for plumbing ducts.

Topfloor general manager, Wessel Prinsloo, says another advantage of using hollow-core flooring is its superior thermal and sound insulation properties.

"Moreover, hollow-core slabs are produced in a well-managed factory environment which ensures high and consistent quality levels."

The professional team which initiated Lange's design concept was led by Dieter Boessow of Architect Associates. Together with Power Construction's project engineers and consulting engineers, Aurecon, and independent construction consultant, Günter Koch, they succeeded in setting a new standard and establishing a new trend in cost-effective economic housing delivery in the Western Cape.

Moore concluded by saying that the fiscal benefits gained with this project points the way forward in labour-intensive skills development and job- creation potential. ▲

Aerial view of the Lange Formal Township housing development.

For more information on Topfloor contact
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Wessel Prinsloo, Topfloor, 021 951 7700
David Beer (011) 478 0239 or 082 880 6726.

SIKA expands footprint in Africa

Sika is opening its first concrete admixture and mortar production facilities in Nigeria and Ivory Coast. The global speciality chemicals company has established new subsidiaries in Ethiopia and Tanzania to participate in the growing markets in the Sub-Saharan region. Thus Sika continues its dedicated and successful expansion strategy and is enlarging its presence to sixteen countries on the African continent.

Sika established the subsidiary in Nigeria and Ivory Coast in 2014 and is now in Lagos and Abidjan, investing in local production facilities for high-quality concrete admixtures and mortars to supply the booming construction, refurbishment and maintenance markets in both countries. Many international and medium-sized local contractors working on big oil & gas, infrastructure, commercial and residential projects represent a large customer potential.

Paul Schuler, Sika Regional Manager EMEA, emphasizes the importance of Sika's expansion in Sub-Saharan Africa: "Our new production facilities in Nigeria and Ivory Coast and our new subsidiaries in Tanzania and Ethiopia represent another milestone in the consequent execution of Sika's Strategy 2018. With the latest investments we will further accelerate our growth in Sub-Saharan Africa and increase Sika's market share. It demonstrates our strong belief in the potential and the prosperous future of the continent."

MAJOR GROWTH POTENTIAL

Nigeria is the biggest economy in Africa in terms of population and GDP. With roughly 180 million inhabitants and an expected annual growth rate of approximately 5%, the country will have major requirements in the construction sector. With 23 million inhabitants Ivory Coast represents one of the smaller African countries, but offers also a promising growth potential for Sika. Cement consumption in both countries is expected to grow by 9% in 2015.

SIKA'S GROWTH MOMENTUM

One pillar of Sika's Strategy 2018 is the accelerated build-up of emerging markets and the expansion of the supply chain. The overall objective is to increase sales generated in emerging markets from currently 37% of total sales to 42-45% by 2018. Africa is one of the focus regions for the company. In the first six months of 2015, Sika's sales in the region were up 18%. Currently the company maintains 16 local subsidiaries and 13 manufacturing sites on the African continent. ▲

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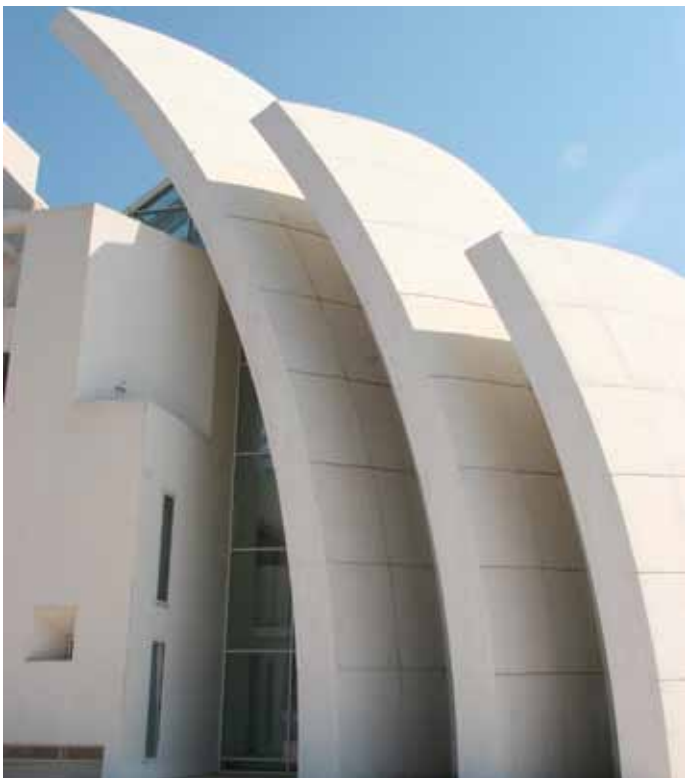
In pursuit of sustainable infrastructure development

Concrete continues to play a pivotal role in economic growth both locally and globally. As infrastructure investment and development across Africa take on a new sense of urgency, the construction industry is recognising that a different approach is required on and for the continent. We can't simply take textbook-type economic models and apply them across this diverse space if we're committed to taking a long term view of sustainability.

Africa's context demands that we innovate across the full value chain – from planning right through to design, construction and building management. As such, much of this sustainable innovation will have to do with the use of concrete as a building material. In order to improve the sustainability of concrete structures, one has to understand the interdependencies from "cradle to grave" in the design phase, during construction and at end-of-life and, most importantly, how these influence the eco-impact and the carbon footprint of structure during its life cycle. "While the industry has worked to quantify the 'embodied-energy' impact of materials used in infrastructure development, effectively measuring the 'whole-life' impact and full effects of the infrastructure's existence during its usage phase continues to challenge the industry," notes Daniel van der Merwe, Architect: PPC Ltd. "This type of measurement is however, critical if we're to meet future targets of 'zero net-energy' buildings. Understanding the life-cycle impact of concrete is therefore central to this equation."

Due to its flexibility and durability, concrete is the most widely consumed substance on earth after water, with approximately 12 billion tons being created globally each year. Cement is a constituent of concrete (approximately 10 – 15% by volume). "The energy used in cement production is a key component of the environmental impact of cement manufacture due to the high kiln temperature involved in production," explains Alta Schoultz, Head of Innovation: PPC Ltd. "This must be viewed in context however."

Globally, cement manufacture accounts for approximately 5% of greenhouse gas emissions. "The industry has already reduced its carbon footprint by reducing the use of non-renewable fossil fuels, by introducing more modern technology and equipment and introducing alternative cementitious materials," says Schoultz. "This includes the use of alternative fuels and resources in kilns, including waste tyre-burning."



Cararra Marble as aggregate

"To effectively reduce the carbon impact of the built environment at the lowest cost, the industry will have to innovate together if we are to positively redefine the continent's future and root its development in sustainability," says Schoultz. "This makes it important for each user group to understand specific concrete benefits for them."

From an ownership perspective, concrete offers technical advantages, aesthetic appeal and cost effectiveness. Its strength, durability and natural thermal mass can assist in developing buildings that are low maintenance, durable and have high operating energy efficiency. "Developers on the other hand can make use of concrete as a competitive building solution. This is based on first cost, long term economic benefits, energy efficiency, lower maintenance, and overall operating costs, as well as opportunities for future reuse should the occupancy of the building change," notes van der Merwe.

He adds that concrete is an ideal medium for designers – offering a range of colours, finishes and unlimited design possibilities, difficult to match in other materials. "The resultant structure also provides superior environmental and energy performance. The benefits of designing with concrete to leverage its thermal mass and structural integrity can be seen in many award-winning projects throughout the world."

Connecting user groups to leverage technical expertise and insights from the outset can however prove a challenge, explains Schoultz – which is why PPC developed an industry collaboration platform just over a year ago. "The Cement and Concrete Cube or C3 is the first non-commercial, open, information sharing platform in the cement and concrete industry in South Africa. It facilitates communication among industry players, including industry news and trends, research, studies and findings, and sources of inspiration. In this way, it enables more effective collaboration across the value chain."

The development of sustainable infrastructure in the country and on the continent came under the spotlight at the Green Building Council of South Africa's (GBCSA) annual convention in November, and Schoultz says it was an ideal time for players in the construction space to rethink a strategy for future projects. "Sustainability is about far more than singular aspects of materials only. It involves taking a long term view of any development such that one considers both the best interests of people and the planet. Finding this balance will require far more conscious and responsible choices from all of us" ▲

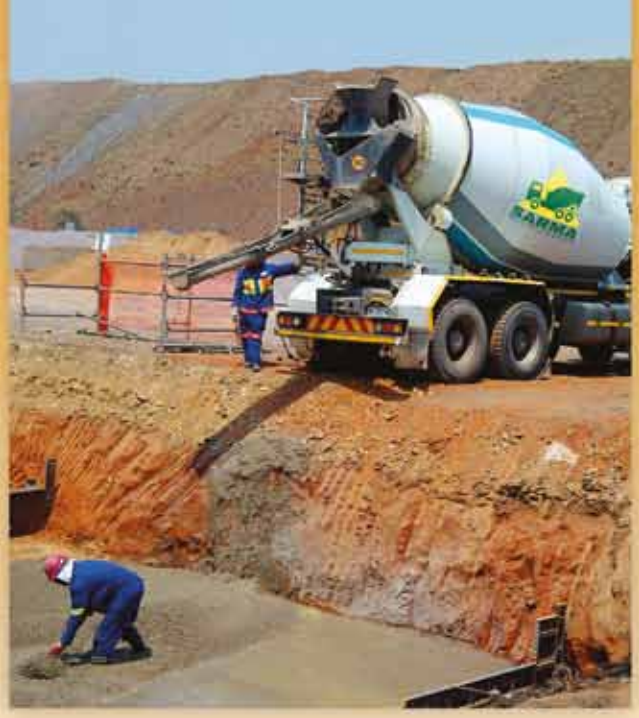
Key facts to note:

Almost half of the continent's population is now urban – resulting in increased consumer spending and a desperate need for accommodation and associated infrastructure.

Africa has the fastest urbanisation rate in the world and there are now more than 1 000 cities in sub-Saharan Africa that are playing a critical role in driving the economic growth of their respective countries. Lagos and Cairo, for instance, are in the ranks of the world's megacities, while Kinshasa is also rapidly approaching megacity status.

By 2050, the absolute number of people living in cities will increase to one billion — equivalent to the continent's total population in 2010.

(Source: RMB's latest "Where to do business in Africa" report)



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The Lafarge Artevia™ solution for a beautiful, durable concrete floor

CMC Auto Panel in Brackenfell, Cape Town, wanted the floor in their panel beating business to reflect their reputation for beautiful finishes.

They commissioned Quickslab Concrete Grinding & Polishing to produce a 1 000 m² white concrete floor with a specified blend of stone. "White concrete work is a special challenge," comments Johan Coetzee of Quickslab Concrete Grinding & Polishing. "However, we have a good relationship with Lafarge South Africa and have partnered with them many times, often on difficult jobs. We were confident they could provide the concrete solution."

For the large floor of CMC Auto Panel's business, it was critical to ensure absolute consistency in the concrete mix. This meant Lafarge Readymix had to lay down stock of the special aggregates and white cement, and ensure there was no risk of contamination with standard materials in the production process or supply chain. To design the ideal mix, laboratory trials were conducted and test samples approved by the client. The contamination risk was not only faced by Lafarge Readymix: without the necessary experience, the action of grinding and polishing tends to make white concrete creamy in colour!

"This is where it is so important to have a sound working partnership with Lafarge – they are unquestionably our preferred concrete supply partner," says Coetzee. "Combining their technical experience with its unique backup from the international Lafarge group, and our extensive experience with polishing is the guarantee of a successful outcome. One of the highlights of our company's impressive track record was the 63 000 m² contract for eThekweni's Moses Mabhida Stadium using Lafarge Artevia™ Polish – it was believed to be the largest single polishing contract in the world at the time."

Quickslab Concrete Grinding & Polishing used Lafarge Artevia™ Polish to create a beautiful, strong, durable floor.
(Photograph courtesy of Quickslab Concrete Grinding & Polishing)

Setting a high standard for quality, low maintenance finishes: the striking white concrete floor created at CMC Auto Panel in Brackenfell, Cape Town, using Lafarge Artevia™ Polish.
(Photograph courtesy of Quickslab Concrete Grinding & Polishing)

"CMC, the client of Quickslab Concrete Grinding & Polishing, is very happy with their new floor, which is aesthetically striking and yet will be easy to maintain," comments Unathi Batyashe-Fillis, Country Communications Manager for Lafarge South Africa. "Artevia™ is an extremely versatile decorative concrete but it is also a strong, durable structural concrete that will cope with the rough treatment you can expect in a panel beating shop."

The highly successful CMC Auto Panel floor is proving to be a good advertisement for Quickslab Concrete Grinding & Polishing and Lafarge Artevia™. The same specification floor will be used in the Shoprite Checkers' store at Noordhoek and there is strong interest from a well-known wine farm in the Stellenbosch area. The almost limitless textures and colours offered by Lafarge Artevia™ has been stimulating a trend in modern concrete design and setting higher standards for quality, low maintenance finishes for interior and exterior flooring projects in commercial and residential properties. ▲

ABOUT LAFARGE SOUTH AFRICA

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Precast concrete elements can be transported to a construction site and then lifted into place.

"Precast concrete has many advantages", says The Concrete Institute

Concrete is one of the most versatile of all construction materials and can be designed and proportioned to meet a wide range of requirements, according to Bryan Perrie, managing director of The Concrete Institute.

He says there are two methods of fabricating reinforced concrete. The first is to pour the liquid material into forms at a building site; this is so-called in-situ concrete. The other method is precast concrete, in which building components are manufactured in a central plant and then brought to the building site for assembly.

Perrie says by producing precast concrete in a controlled environment - such as at a precast yard or factory - it is possible to monitor and control all stages of production to ensure aspects such as adequate curing, and ensure that the products fully comply with the prescribed strength requirements.

"A precast yard may be an established factory or it may be located on a building site. Precast concrete is generally cast at ground level which helps with safety and productivity throughout a project. There is greater control of the quality of both materials and workmanship in a precast plant than when concrete is cast in-situ. This increased control can boost durability and lead to savings in maintenance costs, inconvenience, materials and energy. The moulds or forms used in a precast plant may also be reused hundred to thousands of times before they have to be replaced which means the cost of formwork for precast is lower than for in-situ construction unless they have very unique shapes.

"Often, if the structure has been appropriately designed, precast products can be removed and reused after the structure has reached the end of its life and is to be replaced," Perrie states.

He says there are many different types of precast concrete products. Precast architectural panels are used to clad all or part of a building façade. Storm water drainage, water and sewage reticulation make use of precast concrete units such as pipes, culverts, manholes, sumps, and tunnels. Precast building components are used architecturally as cladding, accessories and curtain walls. Structural applications of precast concrete include bricks, blocks, foundations, beams, floors, walls.

"Precast concrete products are also used in the construction of various transportation systems such as culverts, bridge beams and segments, railway sleepers, sound walls or barriers, safety barriers and kerbs. A significant amount of precast concrete was used in the construction of the Gautrain system and the soccer stadia built for the 2010 Soccer World Cup," Perrie adds. ▲

Further info: Bryan Perrie, tel 011 315 0300 / www.theconcreteinstitute.org.za

L13, L18, L22

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L11, L12, L15, L16

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Post-fixed RC anchors – erroneous assumptions leading to unsafe design

In this regular section of Concrete Beton, we feature concrete-related, confidential reports emanating from the Structural Safety organisation* in the UK, represented in South Africa by the joint Structural Division of SAICE.

Structural engineering consultants on a recent UK project have reported that a number of steel to RC moment resisting connections were required. The steel fabricator proposed forming these connections using post-fixed anchors and the design was undertaken by their engineer.

The reporter's firm reviewed the connection calculations which gave reduction factors for the capacity of the anchors and, when queried, the fabricator's engineer confirmed that this factor accounted for both anchor spacing and concrete edge distance in accordance with the fixing manufacturer's design guidance. During construction the reporter became concerned about one of the fabricator's designs and undertook a check using the fixing manufacturer's proprietary design software. In doing this it was realised that several of the proposed fixings did not have the minimum concrete edge distance required, and when these fixings were disregarded the software calculated that the design had only a small fraction of the required capacity.

The issue was raised with the fabricator's engineer who explained that they had specified an adhesive type of grout and that this adhesion between the steel and the concrete meant that concrete edge distances could be ignored when calculating anchor capacity. There was no reference or mention of this assumption in any of the connection design calculations or on drawings. The fixing manufacturer said that those anchors without the required edge distance would only have a small but unpredictable capacity and that there was no established design method for accounting for adhesion between the steel and concrete.

Several of these connections had already been installed on site but fortunately had only had a small proportion of the full design loading applied. Extensive strengthening works were required to achieve the required capacity in accordance with the manufacturer's guidance. Had these issues not been identified then there was very real danger that part of the structure would have collapsed and the reporter is concerned that engineers may be using post-fixed anchors without complying with the manufacturer's guidance or ensuring that their design assumptions are applicable. It was also very worrying to learn that such an important design assumption had not been communicated in calculations or on drawings.

COMMENTS

Fixing problems make up 10% of all reports to CROSS and of these many have related to post-drilled fixings. There have been several cases of failure and advice on inspecting existing installations and installing new fixings. The importance of following manufacturer's instructions is stressed. A review of the design process for many proprietary fixing items will reveal the complexities of differing design processes.

It is course very important not to assume that recommendations for one product will suit another. Many failure studies highlight that they result from errors in apparently small items or that what one party thought was being built was not actually so. A lesson might be that where these are key components, part of the QA procedure should be site testing to ensure their strength capacity. ▲

** If you found value in this material, please consider submitting issues that you have come across, such that others may, in turn, benefit from your experience. This is done through Confidential Reporting on Safety (CROSS) at www.structural-safety.co.za*

Banner Competition winners enjoy their prize

We hear from the winners of the Fulton Awards banner competition, Ray and Shan Thomson, about their experiences with their prize - a trip to Old MacDaddy Trailer Park, set on the pine-whispering slopes of the Elgin Valley, in the Western Cape, and featuring a collection of nostalgic fifties vintage 'Airstream' trailers.

Shan at Mofam River Lodge

A 'whale' of a time

Spioenkop Wine Farm

"After arriving in Cape Town, we collected our rented car and proceeded to Old MacDaddy Trailer Park, which became our home from home for the following 4 days. We checked in to the very unique "Trailer Park", where ach Trailer/Caravan has its own unique interior design. That evening we travelled a short distance to the Mofam River Lodge for dinner at their restaurant.

The following morning we travelled to Hermanus for a boat trip to view the Southern Right Whales, which make their annual pilgrimage to the waters of the southern Cape. This was the highlight of our trip. We have seen whales from a distance before, but never from close up as was experienced from the boat.

The day only got better and better for us - after our boat trip, we proceeded to the Bienteng Cave Restaurant which, as the name implies, is inside a cave on the rocks in Hermanus. The cave was the residence of a legendry Strandloper many years ago. Legend has it that she was the one that had the mystical powers to call the whales back to this bay every year. We spent the afternoon drinking wine, eating oysters and watching more whales breaching very close to the shore where we were dining.

The following morning we went to the Spioenkop wine estate for a personal tour and tasting. The Spioenkop wine farm is on top of a hill in the middle of the Elgin Valley. The name is derived from the Spioenkop Battle in KZN, where there was a 360 degree view of any approaching enemy.

That evening we went off to a dinner and dance at the very old, but very famous, Houwhoek Inn. Sunday morning consisted of a breakfast, check out of the Trailer Park and a slow scenic drive through Kleinmond, Bettys Bay and Gordons Bay and finishing off with lunch at the Brass Bell in Kalk Bay, before heading off to the airport for our flight back to Durban.

It was truly an awesome trip. A huge thank you to the sponsors of the prize, the Concrete Society, and especially Marike van Wyk for all the organisation, the bookings and setting up the itinerary. It was an experience never to be forgotten. ▲

Blenteng Cave

Inland Branch – Annual Concrete Boat Race Day 2015

A very cool and windy early morning greeted the hundreds of students, members and their guests at this year's Annual Concrete Boat Race Day. Benoni Sailing Club at Homestead Lake, was once again selected for the event because of its prime location, generous size and it amenities – all of which easily accommodated this growing event in the Inland Branch calendar of activities.

The day started with the judging of the boats that had been constructed by the university students from UJ and Tukkies. The 47 concrete boats were lined up along the lakeside, having been carefully and enthusiastically constructed by university students to prescribed rules in terms of design, dimensions, weight and materials. This year the design theme of the boats was set at 'Red Indian' canoes, which brought forth some 'new ideas' on how the American Indian designed his craft!

The judges this year were:

- Retselisitsoe Maliehe – President of the Concrete Society
- Marius Grassman – Concrete Testing Equipment
- Andre Jooste – Royal HaskoningDHV
- George Evans – PPC Cement

The construction of the boats was carried out to this very strict criteria, the most important of which was that they must float! The boats had to be made from a freely available, commonly-used cement, mortar or concrete. Lightweight aggregate could be used, and the binding agent had to be predominantly cementitious in composition.

Limited quantities of other materials were allowed, provided that they did not replace the binding action of the cement. The strength and stiffness of the boat had to be entirely due to the cementing action between hardened concrete or mortar and its reinforcement. Non-concrete parts were not allowed to contribute to the strength or structural integrity of the boat and could be removed at the judges' discretion.

The prize winners in the construction category were as follows:

Position	Boat name	Academic Institution	Sponsors
1st	Die Wit Olifant	University of Pretoria	SARMA
2nd	Aquatic Engineers	University of Johannesburg	AfriSam
3rd	Le Marlin Noir	University of Johannesburg	SAICE

Once the judging was over, the racing began, facilitated by Johan van Wyk, Vice-Chairman of the Inland Branch and MC for the day, who ably steered the various heats to reach the stage where 3 'final' races decided the winners in the Student, Industry and Ladies categories. The racing was very competitive, and different shapes and buoyancies of the boats soon sorted fast-moving craft from the slow. Races took the form of relays where a 4-person relay team paddled 4 legs across a pre-determined course on the lake. Whether it was the change of design, or some other technical reason, is not yet known, but there was a huge increase in the number of craft that capsized this year, much to the consternation of the paddlers, who often fought bravely to up-turn their boats in the middle of the lake.

The racing concluded with an 'Anything that Floats' open race, and the paddles were 'flying'.

Winning Team and Boat – Construction Category

Runner-Up Team and Boat – Construction Category

3rd Place Team and Boat – Construction Category

After all the heats and the finals had been held, the winners in each category were as follows:

Student Race	Boat Name	Academic Institution
1st	Die Wit Olifant	University of Pretoria
2nd	Lakota	University of Pretoria
3rd	Hayaku	University of Johannesburg
Industry Race	**Boat Name**	**Organisation**
1st	Matla Ash	Ash Resources (Pty) Ltd
2nd	Poseidon	BASF/Go Consult
3rd	Pride Watercraft	BASF
Ladies Race	**Boat Name**	**Organisation**
1st	Lakota	University of Pretoria
2nd	Red Dragon	Chryso-abe
3rd	Amazing Racer	AfriSam
'Anything that Floats' Race	**Boat Name**	**Organisation**
1st	Hydrobath	University of Johannesburg
2nd	Le Marlin Noir	SAICE
3rd	Aquatic Engineers	AfriSam
Quickest Sinker	**Boat Name**	**Organisation**
17 seconds	Storm Rider	AECOM

Winners – Student Race

Monetary prizes for the top 3 students' construction projects, and the students' race were donated by PPC Cement, and presented to the winners by Zelna Klaaste from PPC.

A special award, also donated by PPC, was presented to Deon Kruger from the University of Johannesburg for being the lecturer that registered the greatest number of students and boats. Medals were awarded to the first three teams in the other boat race categories.

The Inland Branch of the Concrete Society would like to thank all the Sponsors for their generous contribution to, and continuing support of, the Annual Concrete Boat Race Day!

Thanks also to the Benoni Sailing Club for the use of their facilities; National Paramedics for their usual excellent support on the day; ASM Safety Consultants, Easterns Life Savers; Francois Bain and his Diving team and John Sheath for the photographs. ▲

Winners – Ladies Race

Winners – Industry Race

Winners – Anything that Floats Race

Quickest Sinkers

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Inland Branch Expands its Footprint

For the first time, the Inland Branch of the Concrete Society presented one of its technical seminars to members and visitors in Nelspruit, Mpumalanga. This proved to be a very popular initiative with almost 60 people gathering to listen to the latest developments in concrete technology, concrete testing and standards and specifications.

Roelof Jacobs, Chairman of the Inland Branch welcomed the delegates to the meeting and confirmed that the visit by the Society to Nelspruit was part of a new strategy to reach out to the professions in areas outside of the main metropolitan centres. In this way, he said, we hope to grow our membership and at the same time contribute to our overall objective of promoting excellence in the design and use of concrete.

Proceedings began with a presentation by Bryan Perrie, MD of The Concrete Institute, on the latest amendments and refinements to the current South African concrete standards. He confirmed that three design codes were currently under review, namely:

- Loading code and basis of design (2010)
- Concrete water retaining standard
- Concrete design standard

Bryan Perrie

He continued by describing in some detail the progress being made by the various committees in bringing changes to these codes to fruition. Next to present was Johan van Wyk, GM of the SARMA and Vice-Chairman of the Inland Branch.

Slump test

Johan covered the importance of testing concrete in the quest to achieve a consistently high-quality end product. There were challenges he suggested with cement quality being regulated, concrete having specifications, but nothing governing its quality. He suggested that there should be a 'law' controlling concrete quality.

The various tests governing materials used in the production of concrete were covered, including cement, aggregate, sand, water and chemical admixtures. Given that all these were done to the satisfaction of the producer, trial mixes should still be carried out to verify mix design, Johan asserted.

Moving on to the concrete itself Johan described the various tests that should be carried to ensure a consistently good, quality concrete, including slump (for workability); flow; strength; air content; wet density and setting times.

He concluded his presentation with a quotation from John Steinbeck – "I am compelled, not to squeak like a grateful and apologetic mouse, but to roar like a lion out of pride in my profession".

The final speaker was George Evans, Technical Specialist with PPC, who presented and entertained in his own inimitable style. He focused his presentation on factors influencing test results. He considered inspection and testing plans, acceptance criteria, reference documents, and material and concrete sampling.

George went on to say that testing can be influenced by such factors as temperature, time, equipment used, and skill/experience of the tester. Several examples of the results of bad testing techniques and/or ignorance of the correct testing procedures, were shown.

In conclusion, George challenged the audience by asking what they had learnt from the presentation. He suggested that they should now know more about the factors that influence test results, i.e.

- Sampling – frequency, method, size
- Environment – access, ambient conditions
- Equipment – conformity, maintenance
- Understanding principles – training

In closing the seminar, Roelof Jacobs thanked the delegates for their attendance, and also PPC for their generous sponsorship of the event. ▲

Inland Branch committee member's profiles

Tina Coetzee was born and matriculated in the West Rand. Completed concrete technology courses SCT 30, 41, and 42 through The Concrete Institute, and is currently studying for the Advanced Concrete Technology Diploma.

She started a career in construction and concrete industry, firstly at Pro-Link developments, then Pratley-Perlite, and currently at BASF, where she is a key accounts manager in admixtures for the ready-mix, pre-cast and brick and block industries.

Tina has a creative streak, enjoys a challenge and is a 'go-getter'. She believes that concrete grows on people, and one can never stop learning about it.

Her view: *"Imperfection is beauty, madness is genius and it's better to be absolutely ridiculous than absolutely boring." Marilyn Monroe*

Natalie Johnson was born and bred in Johannesburg, Natalie is close to completing a B Phil Hons in Marketing through the IMM Graduate School of Marketing.

Natalie joined Ash Resources in December 2009 and was involved in the marketing of fly ash products and company communications in her role as Marketing Services Manager. She recently transferred into the country marketing function of Lafarge South Africa based at the Longmeadow head office. Her passion for creative brand promotion and flair for events management is being applied to the company's wide range of innovative cement and concrete products, in addition to continuing her fly ash role.

Her view: *"It always seems impossible until it's done" (Madiba). "Nothing is impossible even if it often feels that way. Give up too soon and you'll never know if you could have actually achieved your dream"*

Johan van Wyk (new Vice Chair) matriculated from Grey College, Bloemfontein in 1989. Studied Civil Engineering at the Central University of Technology (CUT) and Advanced Concrete Technology, Bloemfontein. Was a lecturer at CUT for 10 years, after which he worked for Lafarge, W R Grace, BASF and as a contractor. Johan is currently the General Manager for the Southern Africa Readymix Association (SARMA).

His View: *"Do concrete right, first time".*

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Roelof Jacobs, Chairman, Inland Branch

Inland Branch launches new initiative for undergraduate university students

Students from the Universities of Pretoria and Johannesburg and WITS competed recently in a newly-launched programme from the Inland Branch of the Concrete Society which aims to recognise and reward the best current concrete research being undertaken by students at three Gauteng universities.

Lecturers and members of the Society gathered to receive presentations on this work given by the students themselves, who had been shortlisted to enter the award scheme.

All the presentations were delivered in a thoroughly professional manner, and a very comprehensive description of each project was given. The papers and presenters, in order of presentation were:

"A preliminary investigation into the use of calcined clay as a partial replacement for Portland cement in concrete in South Africa".

Clara Kasongo & Ntombikayise Dube (WITS)

"Investigating the feasibility of using kimberlite tailings as aggregates in concrete".

Motseki Makoala & Sesethu Zibaya (WITS)

"An investigation into the effect of using grey water as mixing water on the production and quality of concrete".

Mishkal Bramdaw (University of Johannesburg)

"An Investigation into the Resistance of Small Scale, Fibre-Reinforced Concrete Slabs to Blast and Ballistic Impact Using Ultra-sonic Pulse Velocity as Non-destructive Testing Method".

Sibusiso Desmond Mabunda (University of Johannesburg)

"Cost optimisation of insulated concrete form T-Beams".

Christiaan Swanepoel (University of Pretoria)

"Optimum Cement Contents".

Isaac Kamya (University of Pretoria)

The three judges with the Chairman

Clara Kasongo & Ntombikayise Dube (WITS)

This was the first phase of the award scheme focusing on the actual presentation of the projects and these were adjudicated by three judges, namely Bryan Perrie, Managing Director of the Concrete Institute, Dr Reinhold Amstbüchler, Consultant and Johan van Wyk, General Manager of the Southern Africa Readymix Association.

Entries will be judged on:

- Relevance to the industry
- Referencing
- Conclusions
- Literature review
- Quality of presentation
- Applications
- Innovation

Cash Prize money for the winner has been sponsored by AfriSam.

The content of the research work will now be adjudicated and the winner announced at the Inland Branch Chairman's Breakfast on the 20th November at the Blue Valley Golf Estate in Midrand.

In thanking the students and their lecturers for their enthusiastic support of, and participation in the programme, Branch Chairman, Roelof Jacobs advised that it was intended to repeat the awards scheme on an annual basis from hereon.

He also thanked AfriSam for their sponsorship of the awards, which includes the monetary prize for the winning student(s). ▲

Sibusiso Mabunda (University of Johannesburg)

Christiaan Swanepoel (University of Pretoria)

Motseki Makoala & Sesethu Zibaya (WITS)

Mishkal Bramdaw (University of Johannesburg)

Isaac Kamya (University of Pretoria)

Western Cape Branch learns about the design of patch repair mortars for cracking resistance

The Western Cape branch members were treated to a very informative presentation hosted on the 17th September 2015 and presented by Philemon Arito, who is based at the Concrete Materials and Structural Integrity Research Unit (CoMSIRU) at the University of Cape Town.

Philemon's presentation outlined performance requirements for concrete patch repair mortars (PRM's) as well as the effect of mix design parameters on cracking in PRM's.

The bonded overlay technique is one of the most established, economical and widely-used concrete repair worldwide. It entails the removal of old and/or damaged concrete that is deteriorating and its consequent replacement with fresh concrete or mortar.

Philemon's presentation went on to talk about the cracking in PRM's and how this results from the differential shrinkage between PRM's and the concrete substrate.

In conclusion, his presentation showed that there is a need for performance requirements that are well defined and more relevant to non-structural PRM's, and the need for a proper definition of a 'good' PRM.

Ending on a positive note for 2015

The Western Cape branch committee would like to, once again, thank its members for their ongoing support for our events in 2015, and to extend a challenge to all of their members to 'bring along a colleague or friend' to future activities.

They would also like to wish everyone a safe holiday season.

Inland Branch

DATE	MEETING/EVENT	VENUE	CONVENOR
20 January	Committee Meeting	Lafarge, Longmeadow	Roelof Jacobs
10th February	Committee Meeting	PPC, Sandton	Roelof Jacobs
24/25 February	Technical Meetings	Kimberley/Bloemfontein	Mike Otieno/Johan van Wyk/ Tina Coetzee
10 March	National Seminar	TBA	CSSA Head Office
16 March	Committee Meeting	SARMA, Randpark Ridge	Roelof Jacobs
13 April	Committee Meeting	Royal HaskoningDHV, Pretoria	Roelof Jacobs
21 April	Technical Meeting	Polokwane	Martin Dube/Roelof Jacobs/Michelle Fick
04 May	Committee Meeting	BASF, Midrand	Roelof Jacobs
27-29 May	Large Dam visits	Lesotho	Roelof Jacobs/Johan van Wyk
08 June	Committee Meeting	AfriSam, Constantia Park	Roelof Jacobs
June	National Seminar	TBA	CSSA Head Office
13 July	Committee Meeting	Chryso-a.b.e., Jet Park	Roelof Jacobs
28 July	Technical Meeting	Nelspruit	Debbie Harvey/Kim Twiname/Natalie Johnson
12 August	EPD Casting	Not applicable	Jannes Bester/Johan van Wyk/Kim Twiname
17 August	Committee Meeting	University of Johannesburg	Roelof Jacobs
19 August	EPD Crush-In	PPC Jupiter Works	Jannes Bester/Johan van Wyk/Kim Twiname
September	National Seminar	TBA	CSSA Head Office
10 September	Annual Concrete Boat Race Day	Benoni Sailing Club, Homestead Lake, Benoni	Johan van Wyk/Michelle Fick/ Committee
14 September	Committee/Planning Meeting	TBA	Roelof Jacobs
October	Students' Research Papers Competition	TBA	Roelof Jacobs/Martin Dube/ Kim Twiname
12 October	Committee Meeting	WITS, Johannesburg	Roelof Jacobs
16 November	Committee Meeting	Lafarge, Longmeadow	Roelof Jacobs
18 November	Chairman's Breakfast and Annual Golf Day	Blue Valley Golf Estate	Natalie/Johnson/Debbie Harvey/ Committee

**Excludes ad hoc Site Visits – to be announced later*

Western Cape

DATE	MEETING/EVENT	VENUE	CONVENOR
17 April	MTM and AGM	UCT	Adrienne Taylor westerncapecssa@gmail.com
21 April	Golf Day	Rondebosch Golf Club (TBC)	Adrienne Taylor westerncapecssa@gmail.com
26 May	Site Visit	TBA	Adrienne Taylor westerncapecssa@gmail.com
23 June	MTM	TBA	Adrienne Taylor westerncapecssa@gmail.com
27 June to 1 July	Concrete Academy	UCT	Philemon Arito ARTPHI001@myuct.ac.za
28 July	Site Visit	TBA	Adrienne Taylor westerncapecssa@gmail.com
25 August	Site Visit	TBA	Adrienne Taylor westerncapecssa@gmail.com
22 September	Site visit	TBA	
October	Cube Crushing	TBA	
November	Annual Cocktail function		
	Committee Meetings are held the first Tuesday of every month	UCT	

International

DATE	MEETING/EVENT	VENUE	CONVENOR
09 -011 March	4th International Symposium on UHPC and High Performance Materials in Concrete: HiPerMat4	Kassel, Germany	Prof. Dr.-Ing. Ekkehard Fehling
13 – 15 June	2nd International Conference on Concrete Sustainability (ICC16)	Madrid, Spain	David Frenández-Ordóñez
28 – 31 August	11th International Conference on Concrete Pavements (ISCP)	San Antonio, Texas	Leif Wathne
29 – 31 August	The 11th fib International PhD Symposium in Civil Engineering	Tokyo, Japan	Koichi Maekawa
12 – 14 September	ConSec 2016 – 8th International Conference on Concrete Under Severe Conditions – Environment & Loading	Lecco, Italy	Laura Losapio
21 – 23 November	Fib 2016 Symposium	Cape Town, South Africa	A/Prof. Hans Beushausen

National Office

DATE	MEETING/EVENT	VENUE	CONVENOR
11 December 2015	CSSA Head Office Closing for December 2015 Holidays	-	-
11 January	CSSA Head Office Opening after December Holidays	-	-
March	Concrete Beton	Posted to All CSSA Members	CSSA Administration
07 – 10 March	Seminar Road Show: Recycling and use of Secondary Materials in Concrete	Cape Town, Port Elizabeth, Durban, Johannesburg	Seminar Committee
30 March	AGM 2016	Emperor's Palace, Kempton Park	CSSA President
31 March	1st Board Meeting	Emperor's Palace, Kempton Park	CSSA President
April	2016/2017 Source Book	Posted to All CSSA Members	CSSA Administration
June	Concrete Beton	Posted to All CSSA Members	CSSA Administration
06 – 09 June	Seminar Road Show Topic to be Confirmed	Cape Town, Port Elizabeth, Durban, Johannesburg	Seminar Committee
23 June	2nd Board Meeting	Emperor's Palace, Kempton Park	CSSA President
September	Concrete Beton	Posted to All CSSA Members	CSSA Administration
05 – 08 September	Seminar Road Show: Topic to be Confirmed	Cape Town, Port Elizabeth, Durban, Johannesburg	Seminar Committee
20 October	3rd Board Meeting	Emperor's Palace, Kempton park	CSSA President
31 October	2017 Membership Renewals Notices	E-Mailed to All CSSA Members	CSSA Administration
November	Concrete Beton	Posted to All CSSA Members	CSSA Administration

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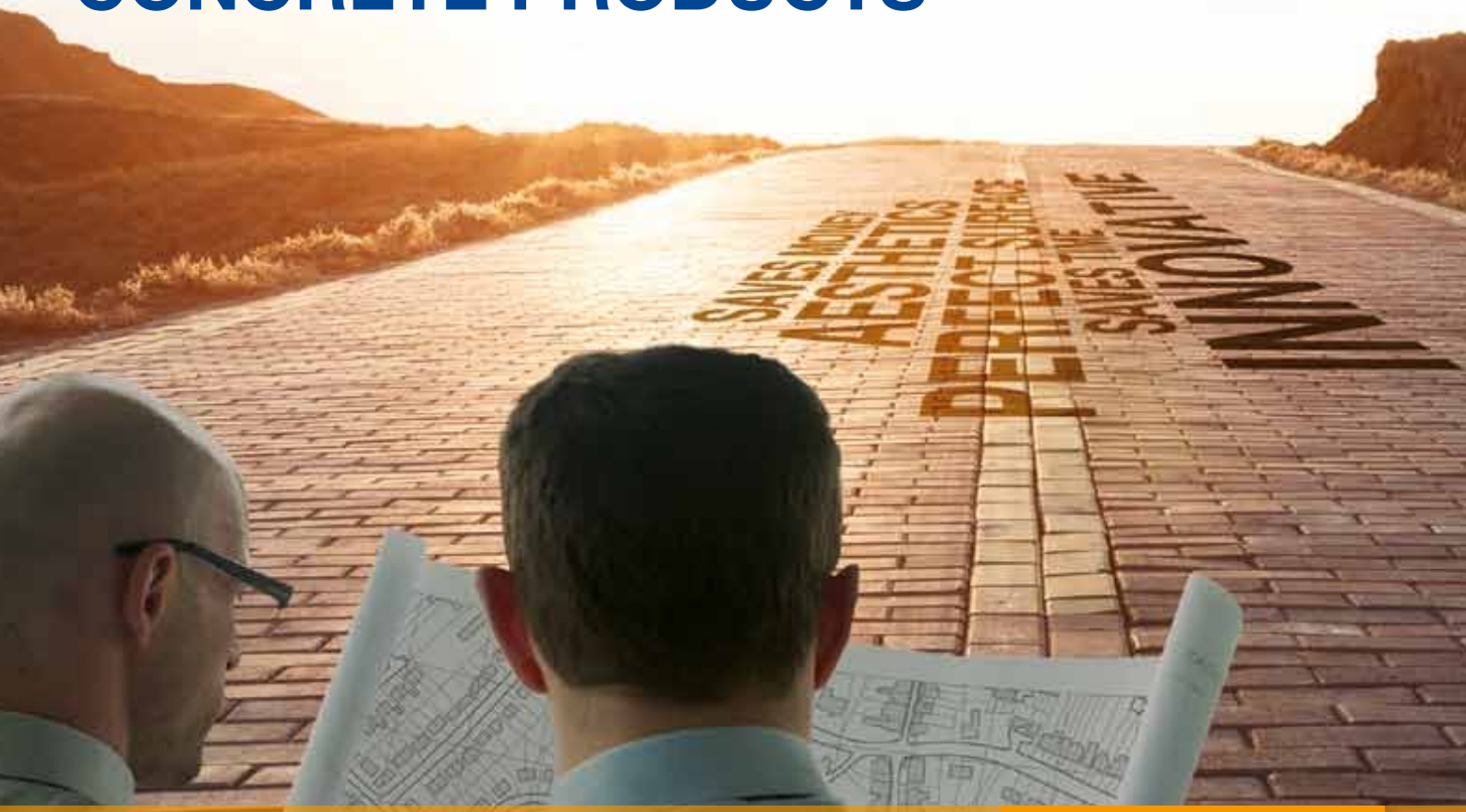

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