Concrete Beton

Number 129
November 2011

The Official Journal of
The Concrete Society
of Southern Africa

CONCRETE SOCIETY
OF SOUTHERN AFRICA

Platinum members:
AfriSam, PPC and Lafarge

Accredited Technical Paper:
Influence on pumping on the fresh properties of self-compacting cement

Fulton Awards:
15 Alice Lane Towers
Incrementally launched bridge

AfriSam
Build with Confidence

PPC CEMENT

LAFARGE

President's Message

As this is the final issue of the Concrete Beton for 2011, it is a good time to reflect on what has happened this year in the industry, and in Concrete Society circles.

The year started with concern over the outlook for 2011 with many predicting a contraction in the construction industry. This has clearly been evident with very competitive tendering and reduced demand for materials. Material price increases do not appear to have followed the discounting offered by consultants and contractors, with some steady increases seen at regular periods throughout the year in 'base' construction materials.

But the year has ended with a little more optimism creeping into the industry. While the outlook for 2012 does not look rosy by any stretch of the imagination, there has been a steady increase of inquiries from developers and the private sector.

If government is able to improve on its ability to spend the budget allocated to the various departments then this could certainly go a long way to shore up the workload for 2012.

The Concrete Society has been as busy as ever this year; with no global crunch being felt by the Head Office staff. The appointment of the CEO, John Sheath, at the start of this year has brought with it a tangible difference to the way in which the Society strives to serve its members. This effort has gone into aligning the Society with the latest legislation, which governs the way we operate in South Africa.

The focus of many discussions in the Society is how we can best serve our members. How can we ensure that we remain a relevant contributor to the construction industry landscape and not just become another association or society that has members? These discussions are ongoing and we trust that in the months and years ahead you will see the evidence of these discussions in the way we serve our members as well as being an active contributor to the construction industry.

As we look forward to the Christmas break, I want to take this opportunity to wish all - a blessed and safe holiday - and trust that 2012 will bring some new challenges and many new opportunities.

Nick van den Berg

President

The Concrete Society of Southern Africa

Cover: 15 Alice Lane Towers won the Fulton Awards 'Innovative Technologies' category and received a Commendation in the Fulton Awards 'Unique Design Aspect'

VISION: To be the most relevant forum for those who have an interest in concrete and to promote the related services of the CSSA members.

MISSION STATEMENT: To promote excellence and innovation in the use of concrete and to provide a forum for networking and for the sharing of knowledge and information on concrete.

OFFICIAL PUBLICATION OF: The Concrete Society of Southern Africa; Physical address: Suite 301, The Hillside, 318 The Hillside Street, Lynwood 0081; Postal address: PO Box 75364, Lynnwood Ridge, 0040.
Telephone: 012 348 5305 Fax: 012 348 6944
Email: admin@concretesociety.co.za
Website: www.concretesociety.co.za

FULTON AWARDS WINNER

15 Alice Lane Towers

The impressive 15 Alice Lane Towers, Sandton, project won the 2011 Fulton Awards for 'Innovative Technologies' and was awarded a commendation in the 'Unique Design Aspects' category. The 24 000m² iconic landmark building stands 90m high and is comprised of six levels of basement parking and 17-storey office space, with two sculpted towers linked by a vertical atrium.

The iconic property has created an exceptional addition to the ever-changing Sandton skyline precinct. 15 Alice Lane Towers was developed by Zenprop Property Holdings together with Tiber Property Group. The construction of this landmark building with the curved asymmetric shape of the towers proved a formidable challenge for the professional team and the contractors.

Commissioned and built during a global economic recession this building is a statement of faith in the future of Johannesburg and a measure of what can be achieved when well-integrated teams face challenges. In various ways, this project has benefitted from innovative technologies applied to a project by a highly skilled team. Concrete technology played a large part in bringing its various benefits directly to bear on the correct elements in this project. The right benefit from the use of concrete has been applied to the appropriate parts of the whole. It is in this context that the project represents excellence in the use of concrete.

From a construction procedure and planning point of view, the site was highly restricted due to the fall of the land, the necessity to keep access and visibility for the ABSA Capital offices and the high-value residential towers next door. Much of the materials handling had to be accomplished on part of the basement construction site, and this

The Team

Client:	Tiber Property Group & Zenprop Property Holdings
Principal Agent 1:	Capital Expenditure Projects (CAPEX)
Principal Agent 2:	Paragon Architects
Subcontractor:	Tiber Bonvec Construction
Submitted by:	Sotiralis Consulting Engineers

made logistics and management complicated. The basement façade itself, for example, is defined by a coequal board-like pattern of differently sized precast concrete panels, selected for the ability to produce and finish them off-site and bring them to the site quickly and install them with minimal handling and storage. In this way, concrete construction allowed interesting advantages to be added into an already difficult construction process.

The externally visible architectural form or silhouette of the building is that of two towers whose north and south faces are defined by irregular curves, resulting in a canyon-like atrium space between the two towers. This atrium space is about 6m wide at its narrowest, lowest point, and 11m wide at its widest point. The dramatic vertical space that results is enlivened by a series of precast concrete link bridges that have a fan-shaped arrangement in plan and spiral upwards in this tight space. The ability of precast concrete to produce high-accuracy and high-quality finishes was a criteria in selecting this construction technique for these elements, coupled with the advantages of rapid installation and reductions in scaffold costs and other handling costs associated with more conventional ways of constructing link bridges. Interestingly, steel was rejected as an option as steel bridges would have involved more finishing trades with their associated time, handling and safety risks. Also, services such as lighting channels could be cast into the concrete bridges, reducing the number of trades on site while improving the quality of the finish. Unfortunately, and as a single drawback, the clients chose to paint

over the surface of the precast finish of the underside of the bridges, hiding what would have been a perfectly acceptable and attractive interior finish for this type of building.

The geometry of the towers themselves presented its own challenges, with each floor of both towers extending to a different extent at its edge. Modern scaffolding techniques and systems were used to cantilever the slab edges from floor to floor, and the edge columns on all floors are cast as round elements set at sometimes extreme angles. All of this was achieved by the contractor to a remarkable degree of accuracy, using in-situ concrete casting. While concrete is not part of the final appearance of the project except for the sculptural basement façades, it was critical to the success of the construction and assembly process

The north and south façades are wrapped in a patterned 'skin' of seemingly random planes of clear, dark grey and translucent glass. The east and west façades eliminate direct sunlight with sculptural hand-formed aluminium boxes set around deeply incised glass lines. These unique façades alter dynamically according to light and atmosphere changes due to their highly patterned and abstract surfaces. The entire façade was constructed off the floor plates, with pre-manufactured modular units lifted up onto the floor plates by tower crane, and then slid onto tracks fixed to the slab edges. Limited numbers of custom-made aluminium extrusions had to be formed, using CNC technology, which made it possible to assemble and waterproof the ever-changing façade profile that resulted from the towers' curved form.

The ability to construct the façades off the floor plates led to large cost savings in terms of scaffolding, and construction time. It also enhanced safety on site, limiting work on external scaffold platforms. As a design technique, the design team preferred to spend less of the available funds on construction process items such as scaffolding, and more on elements and finishes that are visible in the final product.

Paragon Interface, the space planning and interior business group, undertook the sophisticated interior fit-out of the towers. Use of low-energy glass, good orientation and functional detailing contribute to minimising energy usage, which are imperative goals amongst responsible developers and tenants.

Judges' Citation

This innovative technology project benefitted from innovative technologies in a number of fields. Concrete technology played a large part in bringing its various benefits directly to bear on the correct elements in the project. It signifies the multi-dimensional structural flexibility and integrity of concrete.

The externally visible architectural form, or silhouette, of the building is that of two towers whose north and south faces are defined by irregular curves, resulting in a canyon style atrium space between them. This atrium is about 6m wide at its lowest point, and 11m wide at its widest.

The dramatic vertical space that results is enlivened by a series of precast concrete link bridges that have a fan-shaped arrangement in plan, and spiral upwards in this tight space.

The judges noted that the ability of precast concrete to produce high-accuracy and high-quality finishes was a criteria in selecting this construction technique for these elements.

Modern scaffolding techniques and systems were used to cantilever the slab edges from floor to floor, and the edge columns on all floors are cast as round elements set at sometimes extreme angles. The judges commend the contractor who achieved a remarkable degree of accuracy, using in-situ concrete casting.

This project is a very worthy **winner of the 2011 Fulton Awards 'Innovative Technologies'** category.

The architectural form of this structure is unique in South Africa and received a **Commendation in the Fulton Awards 'Unique Design Aspects'** category. The project creates its own impact and visibility on the Sandton skyline. The use of both precast and in-situ concrete has brought the correct benefits to the appropriate parts of the whole building.

The project teams decided to use concrete for the structural frame due to its stiffness, cost effectiveness and 'flexibility' for future tenant requirements. They fully appreciate that although concrete is not part of the final appearance of the structure, it was critical to the success of the design, construction and assembly process.

From the CEO's desk

Dear Members,

Thank you to those of you who took the trouble to complete our online survey on the Fulton Awards weekend. The results were very informative and interesting and I would like to share some of the key findings with you.

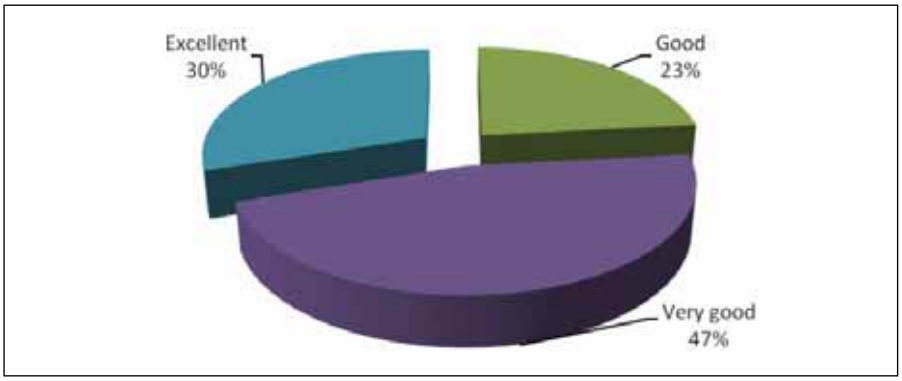
There were 10 questions posed and full details of the findings are already featured on the website under the Fulton Awards section.

Some of the key findings were:

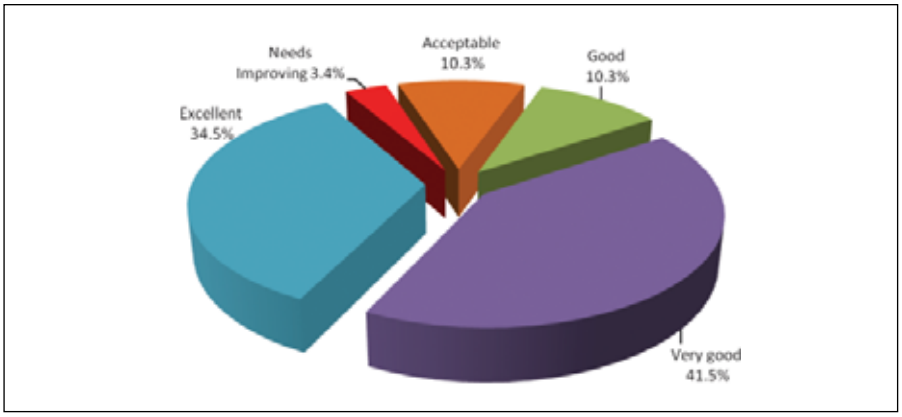
Question: Do you believe that the 2011 FA celebrations succeeded in promoting excellence and innovation in concrete? - 96% of respondents said 'Yes.

Question: Will you recommend the FA weekend celebrations to other industry partners? - 100% of respondents said 'Yes'.

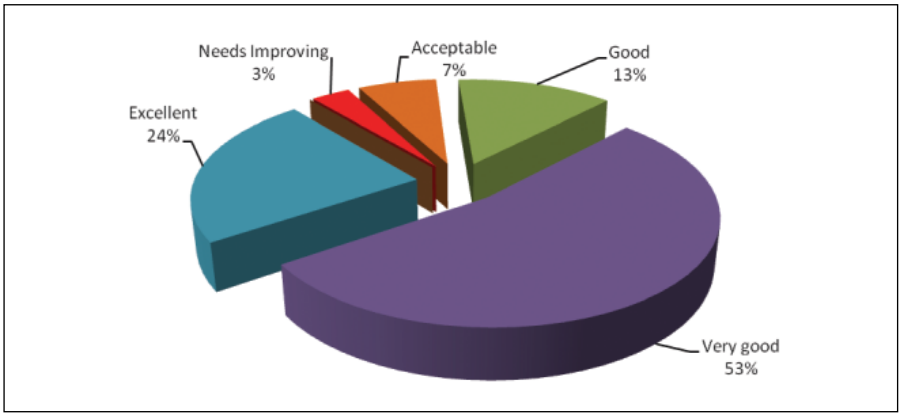
Question: What is your overall impression of the 2011 Fulton Awards weekend?



Question: How do you rate the gala event overall?



Question: How do you rate the Champagne Sports Resort in terms of location?



Of course, not everything was perfect and we received some negative comments about the temperature in the chalets, which will definitely be addressed, if we return to the same venue in future. Other aspects mentioned included the length of the audio-visual during the proceedings; the lack of exposure for the project teams (only mentioned in the magazine); the fact that one or two projects won awards or commendations in more than one category and at least one sponsor felt that they did not get value for money from their investment.

All of these are very valid observations, and the new Organising Committee will take these into account when planning for the 2013 awards.

I would like to express a huge thank you to the many sponsors, who supported the event and especially the Cement and Concrete Institute as Anchor Sponsor. I am pleased to confirm that the C&CI has committed itself to being Anchor Sponsor for both the 2013 and 2015 awards.

In the meantime, preparations are under way to prepare the 'Call for Nominations' for the 2013 awards so any project that is completed in 2011 or substantially completed in 2012 will be eligible for nomination. I urge all members to take a good look at the projects they are currently working on and seriously consider putting them forward for an award.

John Sheath

Chief Executive Officer
Concrete Society of Southern Africa

Influence of pumping on the fresh properties of self-compacting concrete

D Feys, *Magnel Laboratory for Concrete Research, Department of Structural Engineering, Faculty of Engineering, Ghent University, Gent, Belgium Hydraulics Laboratory, Department of Civil Engineering, Faculty of Engineering, Ghent University, Gent, Belgium*

G De Schutter, *Magnel Laboratory for Concrete Research, Department of Structural Engineering, Faculty of Engineering, Ghent University, Gent, Belgium*

R Verhoeven, *Hydraulics Laboratory, Department of Civil Engineering, Faculty of Engineering, Ghent University, Gent, Belgium*

ABSTRACT: Pumping of concrete is a frequently applied casting process. For traditional concrete, slump losses have been reported in literature, but the real cause is still unknown. In case of self-compacting concrete, it is not known how the fresh properties evolve due to pumping. This paper will describe the evolution of the fresh properties of Self Compacting Cement (SCC) due to pumping operations, in which the velocity is increased stepwise. Two different effects modify the fresh properties: structural breakdown and an increase in air content. Both effects cause a decrease in viscosity, which is translated in a lower V-funnel flow time and lower pressure losses during pumping. On the other hand, structural breakdown and the increase in air content have an opposite influence on the yield stress. If structural breakdown dominates, the yield stress decreases; if the effects of the increase in air content dominate, yield stress increases. In the first case, as both yield stress and viscosity decrease, segregation can be provoked. In the second case, due to the increase in yield stress, the filling ability of the SCC is reduced, which can lead to improper filling of the formwork. The results show a trend that the more fluid SCCs tend to segregate and the less fluid SCCs tend to lose even more fluidity. Furthermore, the magnitude of these effects appears to increase with increasing velocity in the pipes.

1. INTRODUCTION

On site, concrete can be placed in the formwork in two different ways: by means of a bucket, inducing a discontinuous casting process, or by means of pumping. In case of pumping, the casting rate can increase and savings in time and labour costs can be achieved. On the other hand, very few studies on the pumping of concrete exist (Kaplan, 2001; Chapdelaine, 2007) and the fundamental understanding of this Self Compacting Cement process has not been completely achieved. The research field is still completely open as this type of concrete is more fluid compared to the ordinary vibrated concrete types. As a result, the flow behaviour of SCC in pipes is reported to be different (Feys, 2009).

Although from a scientific point of view, the phenomena occurring during pumping of SCC are not completely understood yet, this casting process is applied daily. Sometimes, it is reported that the fresh properties are significantly influenced by the pumping operation, but also in case of ordinary concrete. This paper will describe the test method used and the results of the influence of pumping on the fresh properties of SCC. Before the description of the pumping tests, a short introduction will be given dealing with the rheological properties of fresh SCC.

2. RHEOLOGY

2.1 Steady state

In steady state conditions, during which no time-dependent effects influence the results, fresh concrete in general can be described as a Bingham material, showing a linear relationship between the shear stress (related to the pressure loss) and the shear rate (related to the velocity gradient), according to equation 1 (Tattersall & Banfill, 1983).

$$\tau = \tau_0 + \mu_p \cdot \dot{\gamma} \qquad (1)$$

where: τ = shear stress (Pa)
τ_0 = yield stress (Pa)
μ_p = plastic viscosity (Pa s)
$\dot{\gamma}$ = shear rate (s^{-1})

As can be seen, at least two parameters are needed to describe the fresh behaviour of concrete: the yield stress, which is the resistance to the initiation of flow; and the plastic viscosity, which is the resistance to a further acceleration of the flow.

When comparing ordinary concrete and SCC, it is observed that the yield stress of SCC is much lower in order to achieve the self-compactability and that the viscosity of the SCC is generally higher to assure the segregation resistance of the SCC-mixture (Wallevik, 2003a).

Note that under some circumstances the rheological behaviour of SCC is non-linear, but this is beyond the scope of this paper (Feys et al., 2009).

2.2 Time dependent properties

In time, the obtained rheological properties vary, of which the cause can be theoretically divided into three main parts: thixotropy, structural breakdown and loss of workability (Wallevik, 2003b; Wallevik, 2009).

Thixotropy is defined as the reversible breakdown and build-up of connections between small particles in the concrete. The 'structuration state (λ)' represents the amount of connections. The lower λ, the less connections, the more fluid the concrete (Roussel, 2006).

Structural breakdown is known as the disruption of chemical connections under the influence of shear. In contrast to thixotropy, structural breakdown does not show, strictly speaking, any rebuild over time (Tattersall & Banfill, 1983).

Loss of workability represents the increase in number of connections of any type in the concrete, which can no longer be broken by the acting shearing forces. As a result, the structuration state permanently increases and the concrete becomes more stiff. Finally, the chemical bonds become very strong transforming concrete from the liquid to the solid state.

Under influence of increasing shear, the distinction between thixotropy and structural breakdown is very difficult to make and as a result, these effects will be examined together in the discussion in this paper. The general effect of this structural breakdown 'in its broad sense', as it is considered in this paper, is that λ shows a certain equilibrium value for each applied shear rate (except for the very low shear rates), which will be achieved after a certain time. The higher the applied shear rate, the lower the equilibrium value of λ and consequently, the more fluid the concrete. For example, due to a sudden increase in shear rate, the stress shows a (mostly) exponential decrease with time, until equilibrium is reached.

2.3 Air content

In the previous sections, concrete is regarded as a homogeneous suspension. In case the sample of concrete on which the measurements are performed is sufficiently large, this assumption can be justified. But concrete does not only contain solid particles and liquid, it also contains a gas phase: air. The exact influence of air on the rheological properties of fresh concrete is currently under investigation, but at this moment, some qualitative conclusions can be drawn.

The influence of air in a liquid material (or a suspension) is governed by the capillary-number (Ca), which is the ratio of the shearing forces to the surface tension forces (eq. 2) (Rust & Manga, 2002).

$$Ca = \frac{d \cdot \mu_a \cdot \dot{\gamma}}{\Gamma} \qquad (2)$$

where: Ca = capillary-number (-)
d = bubble diameter (m)
μ_a = apparent viscosity (Pa s)
Γ = surface tension (N/m)

In case the Ca-number is low (< 1), the shearing forces are not sufficiently high to overcome the surface tension and the bubble remains spherical. As a result, the flow resistance increases with increasing air content. In the other case where Ca > 1, the bubbles deform due to the shearing forces and they align in the flow direction. Consequently, the flow resistance decreases with increasing bubble content.

3. PUMPING TESTS

3.1 Concrete pump

The concrete pump used is a standard available truck-mounted piston pump, depicted in figure 1. Inside the pump, two cylinders alternately push concrete in the pipes or pull concrete from the reservoir. Once the first cylinder is empty and the second is full, a powerful valve changes the connection between the pipes and the cylinders. The operator of the pump can vary the discharge in 10 discrete steps from 4-5 l/s (step 1) to 40 l/s (step 10). For safety reasons, step 5 has never been exceeded in the tests.

Figure 1. Concrete piston pump.

3.2 Circuit

Behind the pump, an 81m or 105m (figure 2) loop circuit has been installed by means of steel pipes with an inner diameter of 106mm. The circuit consisted of five horizontal sections, of which three were instrumented, and an inclined part. At the end of the circuit, the concrete falls inside a reservoir, which can be closed for sampling and discharge calibration, but which is mostly open. In case the reservoir is open, the concrete falls back inside the reservoir of the pump and is ready to be re-used.

Figure 2. 105 m loop circuit.

3.3 Instrumentation

In the last horizontal section of the circuit, two pressure sensors were installed in order to measure the pressure loss (figure 3). In three of five horizontal sections, including the section with the pressure sensors, strain gauges were attached to the outer pipe wall, recording the expansion and contraction, which is related to the local pressure (Kaplan, 2001). Only the results of the last horizontal section will be discussed in this paper.

Figure 3. Pressure sensor and strain gauges.

Discharge is somewhat more complicated to measure as there is no direct tool available. On the other hand, due to the pumping mechanism, a pressure drop is observed each time the valve of the pump changes the connection (figure 4). Between two pressure drops, the total volume of one cylinder is pushed inside the pipes (which is called a stroke) and by measuring the time needed for a certain amount of strokes, discharge can be easily determined.

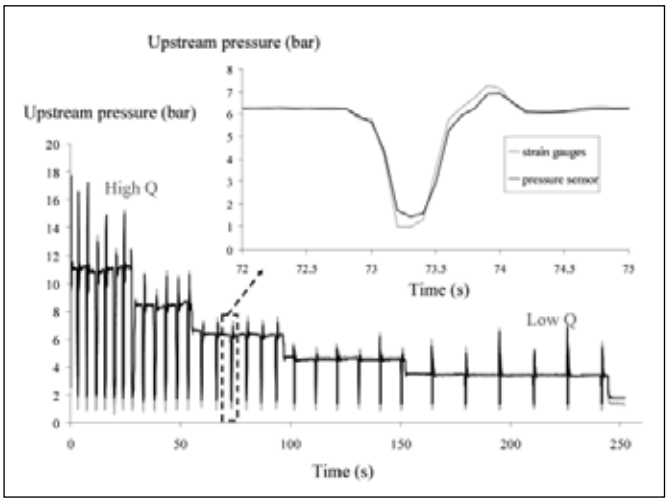


Figure 4. Determination of discharge by measuring the time needed for a certain amount of strokes. The time between two vertical spikes represents the emptying of one cylinder. The evolution of the pressure during the change of the valve is shown in the inset.

3.4 Concrete

During this part of the research programme, four SCC mixtures were pumped in the circuits described. The total amount of concrete needed per test was 3.25m³ and consequently, all concretes were produced by a ready-mix company and delivered to the lab in a time span of one hour. Mixtures 15 and 17 were commercial products of the mixing plant. Mixtures 14 and 16 were based on laboratory compositions, containing 697kg of coarse aggregates (up to 16mm), 853kg of sand, 360kg of CEM I 52.5 N (OPC) and 240kg of limestone filler. Mixture 14 contained 160ℓ of water, while mixture 16 contained 165ℓ of water per m³ of concrete. The amount of SP was adopted in order to achieve a target slump flow of 650mm in case of mixtures 14 and 15 and 700mm in case of mixtures 16 and 17. The SP were PCE-based, showing a long workability retention. For the commercial mixtures, the same sand, limestone filler and SP were used..

3.5 Testing procedure

In order to study the influence of pumping on the fresh properties of SCC, a special testing procedure was developed. It consists of three sub-cycles, repeated five times, each time increasing the maximum discharge. The sub-cycles are divided in three parts:

- Maintaining discharge constant until an equilibrium in pressure loss is observed. This can take more than 10 minutes, especially at the low discharges.
- Discharge calibration and sampling. The concrete samples were used to determine the rheological properties and to execute the standard tests on SCC, like slump flow, V-funnel, sieve stability, air content and density measurements.
- A stepwise decreasing discharge curve, maintaining each discharge for five full strokes, starting from the discharge in the first part of the sub-cycle. This procedure takes in average two minutes. At discharge step 1, which is the lowest discharge, no decreasing discharge curve was determined.

After the decreasing discharge curve, the maximal discharge is increased by one step and the sub-cycle is repeated, as shown in figure 5.

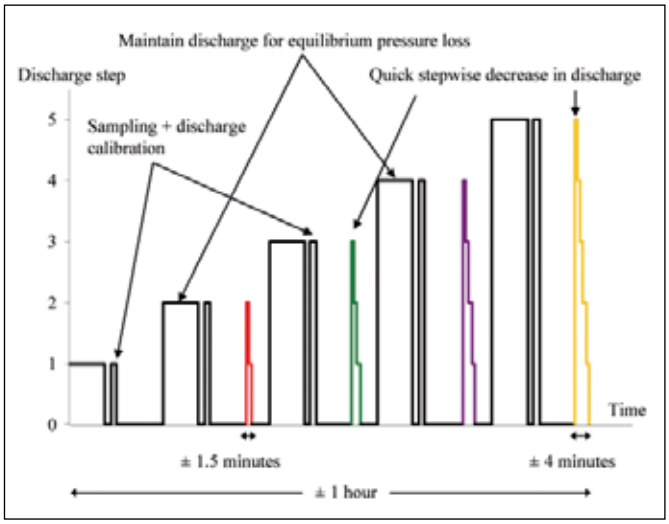


Figure 5. Testing procedure.

This procedure was executed once for mixtures 14, 16 and 17 and twice for mixture 15. For mixtures 14 and 16 and the first test on mixture 15, the discharge did not exceed step 4. For mixture 16, a small variation was applied, by repeating the step at discharge 3 for three times (step 3, step 3bis and step 3ter).

4. RESULTS

4.1 Pressure loss – discharge curves

Plotting the results of pressure loss as a function of discharge, for each equilibrium point at each discharge, and all downward curves reveals that the pressure loss at a certain discharge decreases when a discharge is applied before, which can be seen in figure 6 for mixture 14. As a result, if a higher discharge is applied, the flow resistance of the SCC in the pipes decreases. The results of the other SCC mixtures are very similar.

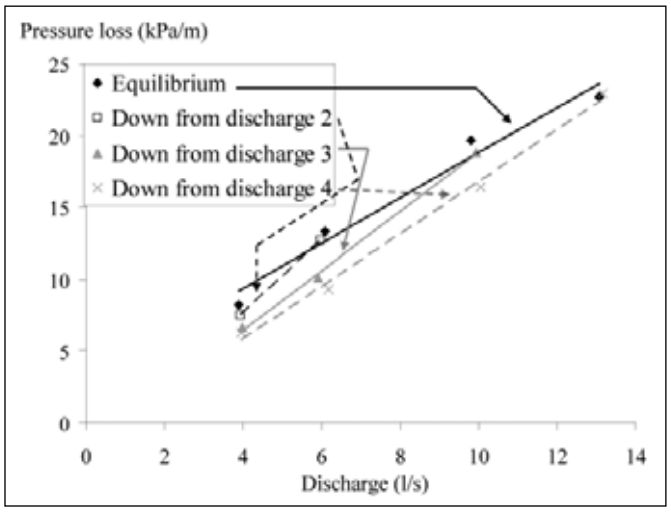


Figure 6. Pressure loss as a function of discharge, showing a lower pressure loss at a certain discharge if a higher discharge was applied before. Results from mixture 14.

4.2 Rheological measurements

The results of the rheometer tests executed on the sampled concrete indicate similar results. Although the test results are not always reliable, the general trend shows a decrease in plastic viscosity and in some cases an increase in yield stress. This confirms the pumping results as in the case of SCC, the pressure loss is mainly dependent on the viscosity of the concrete (Feys, 2009).

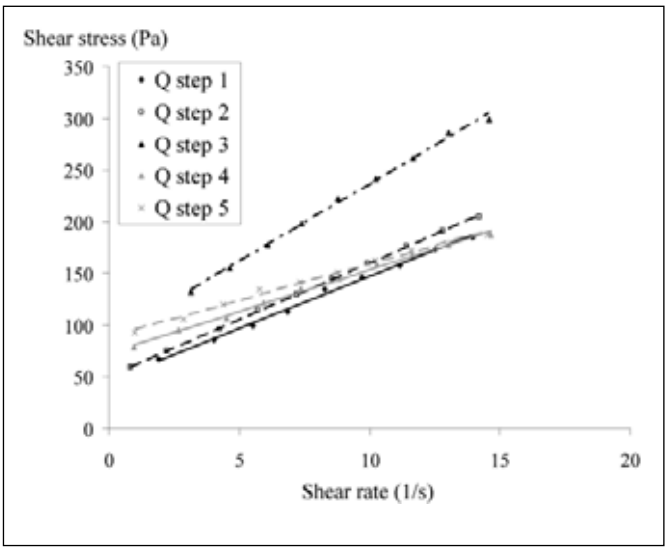


Figure 7. Rheological curves for mixture 15 – test 2, showing a clear decrease in viscosity (inclination) and increase in yield stress (intersection with shear stress axis), with increasing discharge step. Note that the results for step 3 are not reliable.

4.3 Tests on fresh SCC

The tests on fresh SCC indicate for all mixtures a decrease in V-funnel flow time. For all mixtures, except for mixture 14, an increase in air content and a decrease in density is measured. Mixtures 15 and 16 show a decreasing slump flow, while for mixture 17, slump flow remains constant. On the other hand, the sieve-(un)stability value appears to increase for mixture 17. The detailed results of all tests on fresh SCC can be found in table 1. All results are qualitatively in accordance with the rheometer results and the results of the pumping tests.

Table 1. Overview of the tests on fresh concrete for all mixtures.

	Mix 14			
	Q1	Q2	Q3	Q4
Age (hour)	2:30	2:45	3:00	3:30
Tests on fresh SCC				
Slump flow (mm)	818	758	745	658
V-Funnel (s)	5.23	6.1	3.65	5.82
Sieve Stability (%)	10.9	11.0	14.2	7.5
Air content (%)	1.6	1.8	1.6	1.5

	Mix 15 - test 1			
	Q1-1	Q1-2	Q1-3	Q1-4
Age (hour)	1:30	1:45	2:00	2:10
Tests on fresh SCC				
Slump flow (mm)	645	625	660	570
V-Funnel (s)	5.43	4.18	3.77	3.42
Sieve Stability (%)	4.2	7.0	6.6	4.0
Air content (%)	2.1	2.4	3.2	4.2

	Mix 15 - test 2				
	Q2-1	Q2-2	Q2-3	Q2-4	Q2-5
Age (hour)	2:50	3:00	3:10	3:20	3:30
Tests on fresh SCC					
Slump flow (mm)	525	543	505	498	445
V-Funnel (s)	3.54	3.06	3.29	3.46	3.74
Sieve Stability (%)	3.4	4.5	1.9	0.8	0.3
Air content (%)	3.7	3.9	4.6	5.0	6.2

	Mix 16					
	Q 1	Q 2	Q 3	Q 3 bis	Q 3 ter	Q 4
Age (hour)	2:35	2:45	3:00	3:10	3:20	3:30
Tests on fresh SCC						
Slump flow (mm)	670	675	655	585	620	535
V-Funnel (s)	5.24	4.02	4.78	3.72	3.76	3.89
Sieve Stability (%)	8.7	12.7	6.9	6.8	7.8	5.7
Air content (%)	1.1	1	1.4	1.3	2.2	3.9

	Mix 17				
	Q 1	Q 2	Q 3	Q 4	Q 5
Age (hour)	1:20	1:30	1:40	1:50	2:00
Tests on fresh SCC					
Slump flow (mm)	785	780	750	765	750
V-Funnel (s)	3.39	3.08	2.66	2.35	2.22
Sieve Stability (%)	10.5	-	11.7	15.6	18.5
Air content (%)	1.4	1.9	3.1	3.9	4.9

5. DISCUSSION

5.1 Structural breakdown

As mentioned in section 2.2, the equilibrium internal structure of the concrete decreases with increasing shear rate. As a result, the concrete becomes more fluid with increasing maximal discharge applied. This result is confirmed by the decreasing pressure losses, decreasing viscosity and decreasing V-funnel flow time. For mixture 17, the structural breakdown theory provides the ability to explain the observed segregation. Due to the decrease in viscosity and the constant yield stress, SCC becomes more sensitive to segregation. On the other hand, the structural breakdown theory is not capable of explaining the effect of increase in yield stress for mixtures 15 and 16.

5.2 Air content

For all mixtures, except mixture 14, the air content increases with increasing discharge up to values of around 5 – 6%. For

these values, the importance of the air bubbles on the rheological properties is no longer negligible, and as a result, the theory presented in section 2.3 should be applied.

Analysis has shown that the viscosity is determined at high Ca-numbers and as a result, it should decrease with increasing air content, as can be seen in figure 7 (Feys et al., 2009b). The yield stress in case of SCC on the other hand is determined at low Ca-numbers for the air bubbles sizes measured (on the hardened concrete). Consequently, the yield stress should increase with increasing air content, which is also visible in figure 7 (Feys et al., 2009b).

As a result, the air content theory is capable of explaining both the decrease in viscosity and increase in yield stress. On the other hand, it is not applicable to mixture 17, as it does not predict any increasing sensitivity for segregation.

From a practical point of view, an increase in yield stress can lead to a decrease of filling ability of the SCC, resulting in the imperfect filling of a formwork.

5.3 Combination of effects

Both effects of structural breakdown and increasing air content act simultaneously on the concrete. According to both theories, the viscosity decreases, but depending on the initial fresh properties of the concrete, the yield stress after pumping can evolve in two ways, as observed in the experiments. In case of SCC with a rather high slump flow, the structural breakdown theory is more dominant and an increased danger for segregation is noticed. In case the initial slump flow is low, the air content theory is more dominant and the yield stress increases.

From the restricted amount of results, it is also observed that the magnitude of the effects increases with increasing pumping velocity. As a result, in order to minimize the effects, pumping should be performed at low velocities.

5.4 Mixture 14

Mixture 14 shows different results compared to the other mixtures because no increase in air content is observed. The specific reason for this behaviour can be the very high amount of SP applied. As this mixture contained less water than mixture 16, and approximately the same slump flow was targeted, it contained more than double the amount of SP applied in mixture 16. Possibly, this amount of SP increases the surface tension of the air bubbles in the concrete, making it more difficult to deform (as Γ increases in equation 2).

On the other hand, due to large problems during insertion of the concrete, the concrete age was quite elevated (150 min) at the beginning of the test. As a result, some effects of loss of workability can affect the measured results. When omitting these possibly affected results (Q4 in table 1), the evolution of the concrete obeys the structural breakdown theory.

6. CONCLUSIONS

The fresh properties of SCC are described by its rheological values: yield stress and plastic viscosity. The yield stress is the resistance to the initiation of flow, while the plastic viscosity is the resistance to a further acceleration of flow.

By means of full-scale pumping tests in quite long circuits, it is shown that the fresh properties are affected by pumping. A special testing procedure was developed in order to investigate these effects. From the full-scale pumping tests, it is observed that the pressure loss at a certain discharge decreases when a higher discharge is applied before. The rheometer results and the tests on fresh concrete confirm a decrease in plastic viscosity, but the yield stress can evolve in two different ways.

Two causes are found to influence the rheological properties of SCC during pumping: structural breakdown and an increase in air content. Due to structural breakdown, both yield stress and viscosity should decrease and the danger for segregation increases. According to the increase in air content, viscosity should decrease, but the yield stress must increase, which can lead to an improper filling of the formwork. Both effects appear to become more important with increasing pumping velocities.

ACKNOWLEDGEMENTS

The authors would like to thank the Research Foundation in Flanders (FWO) for the financial support of the project, and the technical staff of both the Magnel and Hydraulics Laboratory for the preparation and execution of the full-scale pumping tests.

REFERENCES

1. Chapdelaine F., 2007, Fundamental and practical study on the pumping of concrete, Ph-D-thesis (in French), Université Laval.
2. Feys D., 2009, Interactions between rheological properties and pumping of self-compacting concrete, Ph-D-thesis, Ghent University.
3. Feys D., Verhoeven R., De Schutter G., 2009a, Why is fresh self-compacting concrete shear thickening?, Cem. Conc. Res. 39, pp 510-523.
4. Feys D., Roussel N., Verhoeven R., De Schutter G., 2009b, Influence of the air content on the steady state rheological properties of fresh SCC, without air-entraining agents, Proc. of the 2nd intern. symp. on design, performance and use of SCC, Beijing, pp 287-295.
5. Kaplan D., 2001, Pumping of concretes, Ph-D-thesis (in French), Laboratoire Central des Ponts et Chaussées, Paris.
6. Roussel N., 2006, A thixotropy model for fresh fluid concretes: theory, validation and applications, Cem. Conc. Res. 36, pp 1797-1806.
7. Rust A.C., Manga M., 2002, Effect of bubble deformation on the viscosity of dilute suspensions, J. Non-Newt. Fluid Mech. 104, pp 53-63.
8. Tattersall G.H., Banfill P.F.G., 1983, The rheology of fresh concrete, Pitman, London.
9. Wallevik O.H., 2003a, Rheology – A scientific approach to develop self-compacting concrete, Proc. of the 3rd intern. symp. on SCC, Rejkjavik, pp 23-31.
10. Wallevik J.E., 2003b, Rheology of particle suspensions Fresh concrete, mortar and cement paste with various types of lignosulfonates, The Norwegian University of Science and Technology, Trondheim.
11. Wallevik J.E., 2009, Rheological properties of cement paste Thixotropic behaviour and structural breakdown, Cem. Conc. Res. 39, pp 14-29.

Incrementally launched bridge

The Gauteng Freeway Improvement Project, an initiative of the South African National Roads Agency Limited, was commended in the 2011 Fulton Awards 'Innovative Technologies' category. Nicknamed the 'Flying Saucer Interchange' the 240m long incrementally launched bridge project and ramp joins the R21 North to the N1.

This project forms part of the R13 billion allocated by the South African National Roads Agency Limited to upgrade provincial roads systems. As part of this initiative, Aurecon was appointed to complete the design and contract for the Brakfontein to R21 interchanges on the N1 freeway, between Tshwane and Centurion.

The 240m long incrementally launched bridge provides a new directional ramp joining the R21 North to the N1, replacing the existing loop ramp. The new bridge had to span eight existing carriageways without any disruption to the traffic below. The incrementally launched method of construction had a number of special requirements: The geometry of the bridge had to follow an exact circle in space. A casting yard capable of achieving 1mm tolerances had to be constructed. Sophisticated monitoring equipment had to be used to control the progress of the bridge construction. A 1mm vertical tolerance on all sliding surfaces had to be adhered to.

In addition, it was decided to use long constant section circular piers for aesthetic and clearance reasons, which provide a single support at each pier position. However, during launching operations, two additional temporary supports had to be constructed under the webs of the box-girder at each pier position. These temporary piers were demolished after the bridge was placed onto its final bearings. Unlike conventional methods of bridge construction, this particular project required a more hands-on approach from the engineer as well as the compilation of monitoring, evaluation and progress report.

Concrete was the preferred option for the following reasons: A composite steel bridge deck is generally more expensive than a concrete bridge deck. The construction of the concrete top slabs would have posed a safety risk to traffic below without the provision of complicated safety nets.

A composite deck has much higher maintenance costs compared to a concrete bridge. The required maintenance (mainly painting) is difficult to undertake in the presence of heavy traffic.

The 240.385m long incrementally launched bridge has nine spans, all of which have different lengths. The longest is 30.012m and the shortest is 19.478m. There are eight piers, three of which are founded on piled footings whilst the other five are on spread footings. Both abutments are perched on piles with all piles and spread footings founded on hard rock shale.

A number of unique special features: The geometry in space of any incrementally launched bridge must be considered carefully during the design process. If either the horizontal alignment or the vertical alignment of the bridge is circular, or both the horizontal alignment and vertical alignment are circular, the resultant bridge geometry is a three-dimensional (3D) circle in space (eg this is similar to a bicycle wheel rotating on an axis). Both the horizontal and vertical alignments were required to be circular to conform to the geometry of the existing roads and the geometric requirements of the directional ramp. A special mathematical program had to be written to calculate the setting out coordinates of the piers, the casting yard, launching bearings and fixed bearings.

This program was also used to monitor the position of the bridge during the launching operation, which had to be accurate to within 1mm in the vertical direction. The contractor established a 60m casting yard behind the launching abutment. The geometry and accuracy of the casting yard revolved around the two skid plates, which were specially laser cut out of 10mm steel plate and accurately positioned to 1mm accuracy in the vertical direction. The skid plates provided the sliding surface on which the newly constructed segments would exit the casting yard. The skid plates also defined the outer portions of the bottom of the box girder which supported the bridge during the whole launching operation. After the deck was prestressed, the formwork in the casting yard was jacked off the bridge, leaving the bridge resting on the two skid plates.

The construction yard was laid out so that the contractor could assemble the reinforcement of a segment while the segment in front was being cast and prepared for launching. This method allowed the reinforcement of the following segment to be virtually completed by the time the forward segment had been launched. The contractor also provided a roof over the casting yard and the main part of the work area. This had many benefits including: Steel fixing and the pouring of concrete were not interrupted by inclement weather. Freshly poured concrete was not exposed to the drying effect of direct sunlight, contributing to a better curing process. Use of special monitoring and communication equipment had to be installed to enable the deflections of the temporary piers to be controlled during the launching operation. The system could monitor the deflections of all 16 piers simultaneously. It was designed to halt the launching process automatically if the deflection of any pier exceeded a prescribed limit. A communication system was installed at all eight pier positions, which allowed the launch team to stop the launching operation immediately if any problems arose. During a single launch, which took up to four hours, as many as 30 sliding pads had to be fed/removed from the bearing positions at each of the 16 temporary support piers. The sliding pads had to be inserted by hand, which increased the complexity of the operation.

Typically, 50% of the total prestressing force is applied during launching in the form of concentric cables and the remaining 50% of the total prestressing force applied after launching in the form of draped cables. On the bridge, 60% of the total prestressing force was applied during launching, while the remaining 40% was applied after launching, which could be affected by mining induced seismic activity. Bridge structures in Gauteng normally only require a resistance to earthquakes with a magnitude of 0.03g. In addition to the reinforcement Eurocode 8: 'Design Provision for Earthquake resistance of structures, Part 2' was added to the base of the piers and to the tops of all piles.

The result is both an aesthetic and functional asset to the country's road network.

The Team

Client:	South African National Roads Agency Limited
Architect:	Boogertman and Partners Architects
Structural & Civil Engineers:	Aurecon
Subcontractor 1:	BRCD Joint Venture
Subcontractor 2:	Stefanutti Stocks
Submitted by:	Aurecon

Judges' Citation

The innovative design and construction necessitated by the very narrow single, circular piers, demanded extreme accuracy in launching the deck. The conventional methods of setting out could not achieve the required tolerances, leading to the use of specialised setting out equipment. A special computer program and modelling software had to be developed, to meet the stringent requirements.

The final finish and quality of the concrete throughout was excellent, which makes this project worthy of a commendation.

Inland Branch awards

Construction industry writer and publicist, Jan de Beer, was honoured at the recent Inland Branch Chairman's Annual Breakfast, when he was judged 'Concrete Achiever of the Year for 2011'.

Jan de Beer receives his award from Armand van Vuuren, Chairman of the Inland Branch

In presenting the award, Inland Branch Chairman, Armand van Vuuren, commented that Jan had consulted on public relations in the concrete industry for more than 25 years and had been commissioned by such organisations as the Cement and Concrete Institute; Master Builders' South Africa; Chryso SA; abe Construction Chemicals; Ash Resources; and the Concrete Society of Southern Africa.

"Through his writings and networking on behalf of these clients, Jan has promoted the excellent use of concrete throughout the entire built environment, including civil engineering, architecture, building, property development and DIY. He has exposed concrete in the best possible light in both daily newspapers and industry/technical magazines", said van Vuuren.

"His commitment to total professionalism and honesty in his writings, networking and dealings with all those he comes into contact with, earns him the right to be recognised by the Inland Branch of the Concrete Society as someone who has made a significant and valuable contribution to the on-going success of concrete as a building material of choice, not only in the region, but also in the whole of South Africa".

'The Chairman's Award for 2011' was presented to Bombela CJV for their outstanding concrete work in constructing the balanced cantilever viaduct at the N1/John Vorster Drive Interchange.

The Balanced Cantilever construction method is used for building long-span bridges over areas where construction from the ground upwards is not possible, and was used on this project for an efficient and economical solution, as well as for ease of constructability. In his motivation for the award, van Vuuren cited the aesthetically-pleasing shape of the piers, the architectural 'flowing curves' and the advanced crystallisation technology used in control of concrete materials, production, placing and curing.

Mark Cabrita, Section Engineer, Bombela CJV and Sjoert de Boer, Concor Civils (M&R) accepts the Chairman's Award from Armand van Vuuren

"The viaduct", he said, "has become a landmark on the road from Johannesburg to the north and is testimony to the way concrete can not only be structurally sound, but also very pleasing on the eye".

Bombela Civils Joint Venture was responsible for the design and implementation of the civil works component of the Gautrain and comprises Murray & Roberts Construction, Concor Civils, Bouygues and Strategic Partners Group (SPG).

Roles and

The role of the three concrete industry organisations in South Africa, the Concrete Society of Southern Africa, the Cement & Concrete Institute and the Concrete Manufacturers Association, are often blurred, especially as they share a common goal of ensuring the optimum use of concrete in the built environment. However, each one has a specific target audience, objective and initiative that differentiates them. We hope to shed some light on their unique characteristics.

Concrete Society of Southern Africa

The Concrete Society of Southern Africa (CSSA) is a non-profit, public organisation that promotes excellence and innovation in the use of concrete, and related products and services.

Membership is open to any individual with an interest in concrete and the Society provides a forum for networking and technology transfer between its members. There is a range of corporate membership categories: bronze; silver; gold; and platinum packages.

The Society has four branches nationally and each region has its own events calendar. These include technical meetings and seminars, where information is disseminated among members and networking can take place. Members have the opportunity to visit sites, where projects of interest are in progress.

All the events on the Society's programme - meetings and seminars - are accredited with CPD points approved by the ECSA and issued by the Society with its identification number, for registered professionals. Some seminars also carry accreditation by the architects' professional body, the South African Institute of Architects.

The Society also organises a variety of networking events, such as the concrete boat race, concrete cube competition, egg-protection device competition, golf days and year-end functions provide ample time for further networking and social activity.

Every second year the Society hosts the prestigious 'Fulton Awards' to honour excellence in concrete construction. For the past 30 years the awards have recognised Southern Africa's major concrete projects. At branch level the 'Concrete Achiever Award' and 'Concrete Man of the Year Award' is presented to an individual, or a team in recognition of a noteworthy project. The Society is an international partner with the American Concrete Institute (ACI), and a Voluntary Association of the Engineering Council of South Africa (ECSA), whose members qualify for special benefits from the Society.

For more information, contact Natasja Pols on 012 348 5305, or email: admin@concretesociety.co.za or go to www.concretesociety.co.za.

Concrete Manufacturers

'Quality cast in Concrete' is the motto of the Concrete Manufacturers Association (CMA). The Association represents quality precast product manufacturers and is the primary representative of the precast concrete industry in the country.

It initiates and also applies standards in close cooperation with South African National Standards and in close collaboration with its members it develops new products and services.

The Association promotes the cost-effective and correct application of precast concrete products, ensuring that they are manufactured, and installed to South African National Standards or CMA standards.

Its promotional activities target architects, engineers, developers, contractors, and property owners through its six divisions: Concrete Masonry; Concrete Block Paving; Concrete Roof Tiles; Concrete Retaining Block Walls; Precast Suspended Floor Slabs; and Concrete Pipes and Infrastructural Products.

Although the maintenance of minimum product standards is an important CMA function, its primary focus is ensuring that its members' products are applied correctly. The CMA mark serves as a guarantee of quality, and the Association takes responsibility should a problem arise. Members are encouraged to hold an accredited product certification as per the relevant SANS standard, or to manufacture to specifications laid down

responsibilities

Cement and Concrete Institute

The Cement and Concrete Institute (C&CI) is a marketing organisation that promotes sustainable concrete by providing advice, education and information to all interested in concrete in southern Africa.

Members fall into three categories: Producers, Associates, and Built Environmental Professionals, and the Institute focuses their activities on areas of potential growth to strengthen concrete's competitive position in the building materials sector.

As the central marketing organisation for the southern African concrete industry, the Institute aims to assist those involved in design and construction to realise the potential of concrete products. The Cement & Concrete Institute's Information Centre offers the most comprehensive collection of books, journals and technical reports, on all aspects of cement and concrete in the southern hemisphere. Access is free through personal visits to the Centre or by electronic means.

The Information Centre's portal on the website is the gateway to vast volumes of information.

The Institute's 45 printed publications can be downloaded from the website free of charge. The 9th edition of Fulton's Concrete Technology, the definitive handbook on concrete, is available for sale. A quarterly journal, Concrete Trends, is published to showcase the many and varied applications of concrete and is available on request at no charge. The Cement & Concrete's School of Concrete Technology (SCT) offers professional courses at different levels of concrete theory and application. The portfolio ranges from basic introductory courses to the internationally recognised Advanced Concrete Technology course. Training is also offered in Midrand, Cape Town, Durban, and Port Elizabeth, and can be provided at other venues throughout the country. As the SCT has full National Qualifications Framework accreditation, organisations can be reimbursed and claim the training levies.

The Institute's members also sponsor involvement at tertiary level for students of civil engineering, architecture, building science and quantity surveying throughout South Africa.

Independent, professional advisory and consulting services are provided for private and public sector clients. Consulting can take the form of advice, verification or investigation and Institute engineers are available for consultation by telephone, at the Institute's offices, or on construction sites anywhere in Southern Africa. General technical advice is available through the free advisory service.

The Institute coordinates concrete research activities through its Research Advisory Committee. It oversees the review of existing concrete related standards and the introduction of new standards where necessary, with a view to ensuring effective implementation of South African National Standards.

For more information call Hanlie Turner on 011 315 0300 or email: info@cnci.org.za or go to www.cnci.org.za.

Association

by the CMA. Should a problem arise the CMA will carry out an investigation, and, if the product does not conform to the required standard, the member company is obliged to rectify the situation.

Research is another important CMA function. Several new products have been introduced to the local market over the past years for previously disadvantaged communities. These products are all manufactured to established durability standards. The CMA also runs regular refresher courses and seminars hosted by international experts to introduce new technologies and methodologies.

For more information contact Hamish Laing on 011 805 6742, or email main.cma@gmail.com or go to www.cma.org.za.

Are we providing value

'Value for money' (VFM) is a term used to assess whether or not an organisation or individual has obtained the maximum benefit from the goods and services it both acquires and provides, within the resources available to it.

Some elements may be subjective, difficult to measure, intangible and misunderstood. Judgment is therefore required when considering whether VFM has been satisfactorily achieved or not. It not only measures the cost of goods and services, but also takes account of the mix of quality, cost, resource use, fitness for purpose, timeliness, and convenience to judge whether or not, together, they constitute good value.

Achieving VFM is also often described in terms of the 'three Es' - economy, efficiency and effectiveness. The definition of the three Es' is as follows:

- **Economy** - careful use of resources to save expense, time or effort.
- **Efficiency** - delivering the same level of service for less cost, time or effort.
- **Effectiveness** - delivering a better service or providing a better return for the same amount of expense, time or effort.

So what of the Concrete Society? Do members believe that they are receiving value for money from their membership fees? Of course, the criteria for measuring this will vary, not only between companies and individuals, but also between different companies and different people such as engineers, contractors, suppliers, etc. The results of a survey carried out amongst the membership earlier this year, led us to believe that we were providing good value, but that there was still room for improvement. No surprises there, I think most people/organisations continually want more value from the services/products they subscribe to, or purchase.Our mission is

- Durability of Concrete
- Self-compacting concrete – with demonstrations
- Case Study – Highway Project in Boston, USA
- South African move to the Eurocode
- Concrete Elements in Structures
- Case study - Ultra-thin and Continuously Reinforced Concrete
- Green Star Concrete and Carbon Footprint
- Performance of Cements
- Precast hollow core floors and Load Bearing Structures
- Concrete Mix Design and the Use of Admixtures and Aggregates
- Polypropylene Fibres and Superplasticiser used in Readymix Concrete
- Surface delamination of concrete slabs
- How sustainable is concrete?
- Using Aggregate Grading and Micro Fines to reduce the Amount of Cement
- Advances in Cement-based Materials, and
- Many site visits to current projects

for money?

to promote excellence in concrete and to do this we organise many technical meetings, mini-seminars and the occasional conference. The challenge is to provide current, state-of-the-art events that provide our members with the very latest in concrete technology and showcase fine examples of concrete in action. I have listed the subjects on page 18 that have been presented at these various gatherings hosted by the different branches around the country over the past 12 months:

For the most part, members have attended these free of charge, or at worst at a substantial discount, and it is not difficult to make up one's annual membership fee by attending just two events in the year. In fact, for registered professional engineers, there is a substantial saving (nearly 40%) on their fees to ECSA each year, as the Society is a Voluntary Association of that organisation (incidentally, 1 CPD point is awarded automatically by ECSA to engineers, just by them being a member of the Concrete Society). Now is that value for money, or not?

For our Company Members there is the opportunity to promote their services and products through their presence at these various technical meetings, so the combination of the exposure and the valuable networking, provides a very cost effective platform for their marketing programmes. I would like to encourage more companies to take advantage of this category of membership, and there are four levels available depending upon affordability and level of exposure required.

Let's not forget also that the Society offers their Source Book as a handy directory of members' services. This year we started to up-date the on-line version on a regular basis, meaning that any changes can be carried out immediately, and therefore entries are, generally speaking, very current.

I don't want to go through all the 'products' within our value proposition to members, but it is worth mentioning, annual concrete boat race days, egg protection device competitions, concrete cube competitions, chairman's breakfasts and cocktail events, technical journals, website, and of course, the prestigious Fulton Awards.

So do members feel that they are getting good value? I believe so, but if you do not agree, let me know (ceo@concretesociety.co.za), and why you feel that way. We strive to continually improve!

John Sheath

Chief Executive Officer

Maliehe new National Vice President

Eastern Cape Branch Chair, Tseli Maliehe reports that as the end of 2011 draws near, the Eastern Cape Branch has planned a few interesting activities to wind up an eventful year.

All the committee members, including the new members have slotted in nicely to their various roles and there's a sense of vibrancy and enthusiasm. This can only mean that the coming year is worth looking forward to and with planning already underway, there are exciting times ahead.

There will be some changes in the committee structure with the recent confirmation that the Concrete Society of Southern Africa's Eastern Cape Branch Chair will become the Society's National Vice President. These changes will be discussed on October 26th 2011.

The committee congratulates Tseli Maliehe on his appointment, and the current Eastern Cape Branch Vice Chairman, Rob McSporran, will assume the responsibilities of Branch Chair from March 2012.

Very competitive starts

Concrete Boat

Another very successful Annual Concrete Boat Race was held at the Victoria Lake Boat Club, in Germiston, on 17th September 2011. The event was attended by more than 1 400 concrete enthusiasts and their families.

Conditions for 'paddling' were a little chilly to start, but fortunately the clouds cleared for most of the racing. This event has become the highlight of the Inland Branch event calendar, and is drawing interest from not only the local members, but also from international organisations who are either running, or planning to run, similar events. The day is organised into three main sections. Firstly, the judging of the university students' boats, which have been constructed as part of their study curriculum, aimed at testing their knowledge of project management and concrete technology. This year 48 boats registered and four judges were recruited to cope with the large number of entries. The Judges' Panel included: Inland Branch Committee member: Colin Kalis from Lafarge; Inland Branch Vice Chairperson: Hanlie Turner from C&CI; Inland Branch Committee Member: Darren Jacobs from Lafarge; and Andries Marais, Technical Manager of Chryso and a b e.

The construction of the boats had to adhere to very strict criteria, the most important aspect - they must float! The boats had to be made from a freely available, commonly-used cement, mortar or concrete. Lightweight aggregate could be used. The binding agent must 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


Winners: Industry Race


Winners: Ladies Race

Some fared better than others

Race Day 2011

boat and could be removed at the judges' discretion.

The prize winners in the students' construction category were the University of Pretoria's 'A Team' which took first place, University of Johannesburg entrants 'Heavy Bubbles' came second and 'Zephyr' took third spot.

The Concrete boats were not only constructed and raced by the students, but also members of the cement and concrete industry. The relay race included teams of four paddlers, each completing a leg in the race, in a single seat boat. Prize Giving consisted of the students' construction awards; the winners and runners up in the various categories of boat racing – Student Race, Industry Race and Ladies Race.

In the Student Race, first place was taken by 'Crocotix' from the University of Pretoria; second place went to 'Bokkies' from the University of Johannesburg; and 'Tuna' took third place also from the University of Johannesburg.

'Ash1' from Ash Resources took the top prize in the Industry Race, with Rocla's 'Racoon' in second position and its 'Croc' team claiming third spot.

In the Ladies Race, Rocla's 'Croc' took first place, second was the University of Johannesburg 'UJ Ladies', in third spot 'a b e Angels' from Chryso and a b e. The day attracted a record number of participating companies. Inland Branch Treasurer, Johan Delport, thanked the organising committee, the industry, sponsors, lecturers and students for their continuing support of this prestigious event on the Inland Branch calendar.

The racing was as competitive as ever. Prizes took the form of medals, which were well-received by all the recipients. A special award was presented to Deon Kruger from the University of Johannesburg for being the lecturer who registered the greatest number of entries for students and boats.

The Inland Branch would like to thank all Sponsors of the 2011 Boat Race Day!

Winners: Construction Prize

Winners: Student race

CONCRETE SOCIETY OF SOUTHERN AFRICA NATIONAL OFFICE PROGRAMME 2011 and 2012

DATE	MEETING / EVENT	VENUE	CONVENOR
4th Quarter of 2011			
30th October 2011	Membership renewal forms	Sent to all the CSSA Members	CSSA Administration
November 2011	Concrete Beton	Posted out to all CSSA Members	Crown Publications
November 2011	Council Nominations	Sent to all the CSSA Members	CSSA Administration
1st Quarter of 2012			
20th – 24th February 2012	FloorSem 2012	Durban, Port Elizabeth, Cape Town Johannesburg	Bryan Perrie / Hanlie Turner
28th February 2012	Closing date for inclusion in Source Book 2012/2013	Attention all CSSA Members	CSSA Administration
March 2012	Concrete Beton	Posted to all CSSA Members	Crown Publications
28th – 29th March 2012	AGM & Council Meeting	To be Confirmed	CSSA President
April 2012	Source Book 2012/2013	Posted to all CSSA Members	Crown Publications

CONCRETE SOCIETY OF SOUTHERN AFRICA EASTERN CAPE BRANCH 2011 and 2012

DATE	MEETING / EVENT	VENUE	CONVENOR
26th October 2011	Committee Meeting	BKS Offices	Tseli Maliehe
19th October 2011	Precast Hollow-core Flooring	To be Confirmed	Fanie Smith / Tseli Maliehe
3rd November 2011	VW SA Press shop Site Visit	VW SA Plant Uitenhage PE	Rob McSporran
November 2011	Chairman's Luncheon / Committee Meeting	To be Confirmed	Tseli Maliehe
TBC	Concrete Mix Design and Selection of Materials	To be Confirmed	Fnie Smith

CONCRETE SOCIETY OF SOUTHERN AFRICA INTERNATIONAL EVENTS CALENDAR 2011 AND 2012

DATE	MEETING / EVENT	VENUE	CONVENOR
23rd – 27th January 2012	World of Concrete 2012	Las Vegas, USA	ACI
17th – 20th June 2012	Bond in Concrete 2012	Brescia, Italy	Dr Giovanni Metelli
18th – 21st June 2012	1st International Congress on Durability of Concrete	Trondheim, Norway	Henny Carthrine Braarud
9th – 11th July 2012	Concrete in Low Carbon Era	Dundee, Scotland	Professor MR Jones

Company Membership Details

Platinum	Principal Member	Address	Tel No	Email
AfriSam SA (Pty) Ltd	Mr Mike McDonald	PO Box 15 Roodepoort 1725	011 758 6000	mike.mcdonald@za.afrisam.com
Lafarge Industries SA (Pty) Ltd	Mr Hennis van Zyl	Private Bag X26 Gallo Manor Johannesburg 2052	086 052 3274	hennis.van.zyl@lafarge.com
Pretoria Portland Cement Company Ltd	Mr Donovan Leach	PO Box 40073 Cleveland Johannesburg 2022	011 626 3150	donovan.leach@ppc.co.za
Gold	**Principal Member**	**Address**	**Tel No**	
BKS (Pty) Ltd	Ms Siyanda Ngebulana	PO Box 3173 Pretoria 0001	012 421 3681	siyandan@bks.co.za
NPC-Cimpor (Pty) Ltd	Mr Pieter Strauss	PO Box 15245 Bellair 4006	031 450 4411	straussp@cimpor.com
Sika South Africa (Pty) Ltd	Mr Paul Adams	PO Box 15408 Westmead 3608	031 792 6500	adams.paul@za.sika.com
Silver	**Principal Member**	**Address**	**Tel No**	
Ash Resources (Pty) Ltd	Mr Daniel Pettersson	PO Box 3017 Randburg 2125	011 657 2307	daniel.pettersson@ash.co.za
BASF Construction Chemicals SA (Pty) Ltd	Mr Johan Van Wyk	PO Box 2803 Halfway House 1685	011 203 2405	johan.van-wyk@basf.co.za
Cement & Concrete Institute	Mr Bryan Perrie	PO Box 168 Halfway House 1685	011 315 0300	bryan@cnci.org.za
Chryso SA (Pty) Ltd	Mr Norman Seymore	Postnet Suite 59 Private Bag X1 East Rand 1462	011 395 9700	norman@chrysosa.co.za
MAPEI SA (Pty) Ltd	Mr Christo Van Der Merwe	PO Box 75995 Garden View 2047	011 552 8476	c.vdmerwe@mapei.co.za
Stoncor Africa (Pty) Ltd	Mr Nico Van Eeden	PO Box 2205 Halfway House 1685	011 254 5500	nvaneeden@stoncor.com
Twintec Limited	Mr Darryl Eddy	Unit 409 The Cliffs Niagra Way Tyger Falls Belville 7530	021 914 7752	d.eddy@twintec.co.za
WR Grace	Mr Deon Van Den Berg	64 Rigger Road Spartan Kempton Park 1620	011 923 4630	deon.vandenberg@grace.com
Bronze	**Principal Member**	**Address**	**Tel No**	
a b e Construction Chemicals Ltd	Mr Reinaldo Ferreira	PO Box 5100 Boksburg 1461	011 306 9000	reinaldof@abe.co.za
Active Scanning CC	Mr Andrew Brown	Postnet Suite 152 Private Bag X4 Bedfordview 2008	011 616 5058	activescanning@telkomsa.net
Bapedi Civil & Structural Consultants CC	Mr Tumi Kunutu	PO Box 412689 Craighall 2024	011 326 3227	tumi@bapediconsult.co.za
Cementitious Inorganic Products CC	Mr Freddie McLennan	PO Box 12386 Mill Street Cape Town 8010	021 551 2142	freddiem@iafrica.com
Concrete Testing Equipment	Mr Marius Grassman	PO Box 77110 Fontainebleau 2032	011 708 6141	marius@cte-labsupplies.co.za
Doka South Africa (Pty) Ltd	Mr Uwe Meyer	PO Box 8337 Halfway House 1684	011 310 9709	Uwe.Meyer@doka.com
Empa Structures CC	Mr Cameron Bain	PO Box 3846 Durbanville 7551	021 979 1129	cameron@empa.co.za
Group Five Civil Engineering (Pty) Ltd	Mr Francois Maritz	PO Box 1750 Bedfordview 2008	011 922 3734	fmaritz@groupfive.co.za
Group Five Coastal (Pty) Ltd	Mr Gareth Chambers	PO Box 201219 Durban North 4016	031 569 0300	gchambers@groupfive.co.za
Hilti South Africa	Mr David Bredenkamp	PO Box 5588 Halfway House 1685	011 237 3028	david.bredenkamp@hilti.com
Jeffares & Green (Pty) Ltd	Mr Corrie Meintjes	PO Box 794 Hilton 3245	033 343 6700	meintjesc@jgi.co.za
Lategan & Bouwer Engineers	Mr Kas Lategan	PO Box 1215 Secunda 2302	017 634 4150	kblategan@latbou.co.za
Malani Padayachee and Associates (Pty) Ltd	Mrs Malani Padayachee-Saman	PO Box 3923 Randburg 2125	011 781 9710	malani@mpaconsulting.co.za
Metier Mixed Concrete	Mr Kenneth Capes	Postnet Suite 546 Private Bag X4 Kloof 3640	031 714 2130	kenneth@metiersa.co.za
Mexel Energy (Pty) Ltd	Mr Jurie Lombard	PO Box 1862 Brooklyn Square Pretoria 0181	012 743 5999	jurie.lombard@mexelenergy.com
Quickslab (Pty) Ltd	Mr Johan Coetzee	PO Box 9 Brackenfell 7561	021 982 1490	johan@quickslab.co.za
Sephaku Cement	Mr Andrew Schmidt	PO Box 68149 Highveld Centurion 0169	012 684 6300	andrew.schmidt@sephakucement.co.za
Shukuma Flooring (Pty) Ltd	Mr Andries Stücki	PO Box 15552 Emerald Hill 6000	041 372 1933	admin@shukumaflooring.co.za
Stefanutti Stocks Civils (Pty) Ltd	Mr Werner Jerling	PO Box 12394 Aston Manor Kempton Park 1630	011 552 4011	werner.jerling@stfstocks.com
Structural Solutions CC	Mr Rigo Govoni	PO Box 40295 Walmer 6065	041 581 3210	rigo@structuralsolutions.co.za
Upat SA (Pty) Ltd	Mr Kevin Owen	PO Box 53059 Troyeville 2139	011 624 6700	kevin.owen@upat.co.za
UWP Consulting (Pty) Ltd	Dr Anna Brink	PO Box 13888 Cascades 3202	033 347 7900	annab@uwp.co.za
Verni-Speciality Construction Products (Pty) Ltd	Mr Vernon Botha	PO Box 75393 Garden-View 2047	086 118 3764	vernon@verni.co.za