

Editorial

As citizens of the Knowledge Age, we demand more and more information about the environment in which we live, the materials around us and the food we eat. Western society demands extensive testing and verification of products before they are released onto the market. This is never more evident than in the construction industry where we demand certainty that the structures in which we live, work in and travel across are not only fit for purpose, but will withstand natural hazards such as storm, earthquake, fire, wind and flood. Research into iron and steel slag products has been ongoing across a range of end uses for many decades in Australia.

Australian iron and steel slag products have been, and continue to be, well-researched as new product opportunities, and frequently result in revised construction requirements. Since the end of the 1980's, Australian slag producers have been engaged in significant knowledge transfer activities through conferences, workshops lectures and participation in research forums. With the formation of the Australasian (iron and steel) Slag Association in 1990, these conferences and programs have come to centre stage as part of the Association's charter. Technical exchange arises from the meeting activities of the Association. Allesandra Mendes reported to the Technical Committee on her research on Slag Blended Cements and the way they improve the durability of fire impacted concrete structures.

Participation in the Concrete Institute's Concrete Research Forum by Association members demonstrates our commitment to research and knowledge transfer in support of the products of iron and steel slag and their beneficial use in the construction industry.

Knowledge transfers through ASA Conferences

Technical exchange and knowledge transfer processes lead to the greater acceptance and recognition of the potential contribution of iron and steel slag products to the sustainability of the construction sector. Given the Association's affiliation with international like-minded bodies, it benefits from an exchange of information and experience in the use of these materials across the globe.

Prior to the Association's formation in 1990, a great body of technical data and experience had been accumulated by those closely working in what might loosely be called the 'Australian Slag Industry'. International conferences staged in Australia in the late 1980's; Concrete 88 and Concrete for the Nineties were significant early efforts by companies who are now members of the Association. These conferences transferred significant knowledge into the broader construction and environment domains. In 2007 the Association presented the successful 'Sustainability and Slag' conference and is now planning for another Sydney conference in the second half of 2009.



An active program of presentations to university students at a number of the country's leading engineering schools is a key part of the Association's knowledge transfer. Presentations are also made to key specifiers and end users principally in NSW and Victoria. Through its members, contact is maintained with a number of allied organisations such as the Concrete Institute of Australia, Institute of Quarrying Australia and Engineers Australia. These contacts enable the potential of slag products to be known to a wider audience.

Advance Notice – Conference 2009

Plan now to be in Sydney for the 2009 ASA Conference to ensure you don't miss out. Register an interest in attending, presenting or exhibiting at info@asa-inc.org.au. Check future issues of *Connections* for call for paper, conference program and registration details.

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ASA Technical and E&P Meetings travel interstate

An active committee structure has always been at the heart of Australasian (iron and steel) Slag Association's work. These committees provide ways for practitioners from the member companies to contribute to the Association and work together on projects of common interest across the group. Given the geographic distribution of the membership, one of the quarterly meetings of the Technical and Education and Promotion Committees is held interstate each year. In August this year, both committees met in Queensland, and were hosted by Sunstate Cement.

The ASA meetings take the opportunity to review research projects and engage in technical exchange. On this occasion, the opportunity was taken to review a project being conducted by the University of Queensland on behalf of the Association. Research projects form a core part of the Association's work and help to build on its significant knowledge base. The Technical Committee has oversight of this work and Australian Standards representation.

Currently, the Association is active in a number of Australian Standards writing committees and their working groups. Qualified individuals represent the Association and contribute a wealth of experience, knowledge and time to the generation of technically competent and

useable standards. The Technical Committee supports these members and acts as a reference group, arriving at consensus on the Association's views.

The role of the Education Committee is to plan and implement communications and education strategies. Output from this committee includes Technical Sheets, Connections Newsletter, the ASA Website and oversight of the Conferences and presentations that make the knowledge base of the Association available to students and practitioners alike. The online reference library is accessible by logging onto www.asa-inc.org.au. Members of the results from completed research form part of future conference and education programs.



ASA committee members meeting in Brisbane.



Melbourne City Council - Council House 2 (CH2)



Melbourne City Council - Council House 2 (CH2)

Concrete – a contributor to improving our environment?

Sustainability is now a topical issue, addressed by politicians around the world. However, realisation of the finiteness of the earth's resources began to dawn around the end of the 1960's with U Thant, then General Secretary of the United Nations concluding in 1969:

'... Members of the United Nations have perhaps 10 years left in which to subordinate their ancient quarrels and launch a global partnership to curb the arms race, to improve the human environment, to defuse the population explosion and to supply required momentum to development efforts.'¹

Now, just under 40 years later, the need for action is publicly recognised. One of the first actions of the new Rudd Australian Federal Government elected in November 2007 was to ratify the existing Kyoto Protocol.

From the earliest of times, humans have had an innate desire to master and improve their environment. However, the cost of these great advances has come through use of the earth's resources. Over time there has been degradation of earth's air and scarce potable water resources.

Cement and concrete have been key components in the building of the structures over the centuries. These structures and their long term operation along with global development have made a significant contribution to the rise in atmospheric CO₂ from 330 ppm in 1975 to 380 ppm in 2007, with levels projected to increase by around 2% pa to a critical tipping point of around 450 ppm in 2040 (Albrecht² 2007).

Concrete as a material is able to span many construction applications and because of its mass, it has the capability of adding to the thermal stability of structures, potentially moderating the operational energy consumption. Using Ground Granulated Blast Furnace Slag as a cementitious component in concrete lowers the embodied energy whilst contributing to the durability of structures. These materials are recognised in environmental ratings systems such as Greenstar. Modern buildings such as the Melbourne City Council House 2 building has achieved a benchmark rating of 6 under this code and are designed to reduce lifetime environmental impact.

Albrecht² describes sustainability as the master concept of the twenty-first century. The challenge is to work with designers and architects to achieve sustainable design and choose materials such as slag cements, lowering concrete's environmental footprint and potentially improving durability. In this way, the concrete industry can make significant contribution to global sustainability now and into the future.

1. As reported in Meadows DH; Meadows DL; Randewrs J and Behrens III WW. The Limits to Growth – A report of the Club of Rome's, project on the predicament of mankind. First Published Earth Island Ltd. London March 1972
2. Albrecht G. PhD the University of Newcastle – Sustainability Australasian (iron and steel) Slag Association Conference Sustainability and Slag Sydney 2007

Slag Blended Cements improve the durability of fire impacted concrete structures

Allesandra Mendes' reported to the Technical Committee of Australasian (iron and steel) Slag Association on her research into the Fire Resistance of Concretes made with slag blended cements.

Concrete is one of the most commonly utilised construction materials in the world. When concrete is subjected to fire, deterioration of its mechanical properties occurs, leading to reduction of the safety of the structure. Consequently, the fire resistance of concrete has been the focus of many researches since 1920.

Using Ground Granulated Blast Furnace Slag (GGBFS) as a partial substitute of Ordinary Portland Cement (OPC) has widely increased in the last three decades, however, published data on how those blends would behave in high temperatures, such as in a fire event, is lacking.

This study aims to provide data on the fire resistance of concrete made with slag-blended cements. Study of the microstructure of the fire-damaged OPC concrete and concrete made with slag-blended cements will enable an understanding of the behaviour of those blended concretes after exposure to high temperature.

Both short and long-term behaviour (up to 1 year) of pastes after an initial exposure to high temperatures is being investigated. The long-term effect of high temperatures in Ordinary Portland Cement (OPC) paste is compared to OPC/slag paste. Both physical and chemical transformations of the binders of the concrete are analysed.

Ordinary Portland Cement (OPC) pastes, when exposed to a critical temperature of 400_C, undergo complete breakdown. This behaviour is attributed to the dehydration of Ca(OH)_2 , followed by the expansive rehydration of CaO . In contrast, partial replacement of the OPC binder with slag, has a beneficial effect in the mechanical properties of the paste after exposure to high temperatures, as slag significantly reduces the amount of available Ca(OH)_2 in the cement paste.

1. A. Mendes (&) _ J. G. Sanjayan _ F. Collins - Department of Civil Engineering, Monash University, Clayton Campus, Melbourne, VIC 3800, Australia - e-mail: alessandra.mendes@eng.monash.edu.au
This work has been reported in:

MENDES, A., SANJAYAN, J. & COLLINS, F. 2008. Phase transformations and mechanical strength of OPC/Slag pastes submitted to high temperatures. *Materials and Structures*, 41, 345-350.

MENDES, A., SANJAYAN, J. & COLLINS, F. 2008. Long-term progressive deterioration following fire exposure of OPC versus slag blended cement pastes. *Materials and Structures*, Online first - 1359-5997 (Print) 1871-6873 (Online).



Allesandra Mendes



Specimens immediately after 800°C showing the effects of dehydration of Ca(OH)_2



After 1 Year OPC Paste and 50% Slag

Company Members

A primary role of our Association is to bring together Slag Producers, Processors, Customers & Suppliers to the Slag Industry. Our activities cover Technical Developments, Plant Operations and processes, Education and Promotion. If you would like more information on the Association and how you can become involved, simply complete the information section at the end of this newsletter. Current membership is as listed below.

Australian Steel Mill Services Pty
BIS Industrial Logistics
Blue Circle Southern Cement
Bluescope Steel Ltd (Port Kembla)
Concrete Pty Ltd
HiSmelt Ltd
Holcim NZ Ltd
Hunter Mill Services Prt Ltd
Komatsu Australia Ltd
MultiServ (UK)
MultiServ Australia Pty Ltd
OneSteel Limited

Premium Tyre Service Pty Ltd
Readymix Holdings Pty Ltd
Roads & Traffic Authority of NSW
SCE (Steelstone)
Smorgan Steel (Melbourne)
Steel Cement Ltd
SteelServ Ltd (NZ)
Sunstate Cement Ltd
University of Newcastle
University of Wollongong

Personal Members

Anderson, L
Dobson, G
Gregory, G
Hanley, P (Hon.)
Heaton, B (Hon.)
Hinczak, Dr, I (Hon.)
James, W (Hon.)
Jones, D E (Hon.)
Maric, M
Prosser, S D (Hon.)
Venour, M (Hon.)

Related Associations - National Slag Association (US) | Nippon Slag Association (Japan) | European Slag Association (EU)

Sustainability from the use of Slag Cements

Recognising the use of slag from iron production is not a recent phenomenon. In fact, utilisation of this material dates back to the Roman times. We have finally come to recognise the finiteness of some construction resources, many of which have almost reached the point of exhaustion. Additionally, we are confronted with the problem that many other construction materials are becoming quarantined from use due to their harmful impact on the environment. Consequently, we are forced to explore alternative materials for construction, materials which are both sustainable and environmentally-friendly.

Ground Granulated Blast Furnace Slag Cement (GGBFS) contributes to sustainability by reducing the quarrying of limestone and other raw materials used in cement production. It requires significantly less overall energy to produce and contributes much less CO₂ to the atmosphere. Higgins¹ states 'GGBFS is closest (compared to Fly Ash and Silica Fume) to Portland cement in chemical composition and is actually a slow-setting cement in its own right. However in practice, it needs to be blended with Portland cement to give an adequate rate of strength development.'

'By comparison with Portland cement, manufacture of GGBS requires less than fifth of the energy and produces less than a fifteenth of the carbon dioxide emissions. Further 'green' benefits are that manufacture of GGBS does not require the quarrying of virgin materials' (CSMA2) Use of GGBFS in the UK is around 2 million tonne per year. As reported by the CSMA2, this reduces carbon dioxide emissions by around 2 million tonnes, primary energy use by 2,000 million kw/h and saves 3 million tonnes of quarrying.

Currently around 500,000 tonne of GGBFS is used in Australia. The main production centres are Port Kembla (South of Sydney), Port Melbourne, Brisbane and Kwinana (near Perth). GGBFS has been used in Australia since 1966 replacing Portland Cement in Concrete from 25 to 60% depending on the application, with the higher levels of replacement particularly in applications subject to marine or aggressive environments. ASA publication 'A Guide to the Use of Iron Blast Furnace Slag in Cement & Concrete' is available on the Association's website at www.asa-inc.org.au or by contacting the Association at info@asa-inc.org.au

1. Higgins D D, "Sustainable Concrete: How can Additions contribute?" The Institute of Concrete Technology Annual Technical Forum, March 2006.

2. Cementitious Slag Makers Association www.ukcsma.co.uk/sustainability

Note: The term GGBFS is used in Australia and GGBS in the UK for Ground Granulated Blast Furnace Slag, a milled co product from the production of iron.



Product loading ICL Victoria - Photo - James Lauritz

The 2008 Global Slag Conference and Exhibition

Strasbourg, France was the venue for this year's conference held from 10-11 November. The main themes for the conference were slag optimisation and new applications, innovations, and future horizons for slag use. Approximately 140 delegates from over 30 countries attended again this year. A successful trade exhibition was held as part of the conference.

The program covered various aspects of the slag industry, with a focus on alternative slag applications and slag cements. There were interesting talks from major manufacturers such as ArcelorMittal, as well as a session devoted to slag grinding and handling technology.

Interested delegates had the opportunity to visit ArcelorMittal's plant in Florange on Wednesday 12 November. A full-day excursion, left Strasbourg at approximately 8:30am and returned by 5:30pm.

Strasbourg Old Town is listed as a UNESCO World Heritage Site and the Global Slag gala dinner will take place in one of its historical buildings. This was an excellent opportunity for networking in an impressive environment.

The conference farewell reception will take place at EU Congress, where we have been granted access to one of the function rooms. There will also be an hour long tour of the Congress building.



EU Congress Building

Concrete Research Forum Attracts Senior Decision-Makers

In July this year, a Concrete Research Forum was held. Supported by KPMG in Sydney it was conducted by the Concrete Institute of Australia, and held at KPMG offices. It was attended by eighty (80) senior decision-makers from across academia, industry and government – each providing expertise in materials, construction, design and policy issues. The main objective of the forum was to stimulate discussion, share ideas and experiences, and identify a vision for concrete related research initiatives.

Even though the agenda covered a wide array of topics, at some point, every session led to discussion on the importance of sustainability. A secondary theme throughout many of the sessions was concrete durability and the need to understand what affects it, how to test for it and how to improve it.

An adaptation of the OECD's Pressure State Response model¹ was provided as a framework for the dialogue and analysis. Strategy/action was added to the model to emphasise the importance of behavioural change in achieving better practices.

Arising from the forum, five issues were identified that could enable more effective concrete research and industry operations, they are; (1) Sustainability; (2) Durability and Longevity; (3) Innovation; (4) Knowledge Transfer Mechanisms; and (5) Communication. In particular, SCM's received specific attention from the academia, industry, government and construction sectors about current and future supply capacity.



Immersed Tube sections Sydney Harbour Tunnel – Port Kembla

Knowledge transfer and knowledge relevance are significant factors for both researchers and industry. To ensure that the results of research are available, there exists a need for a central library of information. This is especially true for research papers enabling the dissemination of knowledge more widely and efficiently.

The Concrete Institute of Australia has a broad membership including material suppliers, designers, construction, associations, government, researchers and users. As such, it is in a strategic position provide knowledge transfer across the sectors and consider facilitating research development and deployment (RD&D), on an in-kind basis, between interested members and research bodies.

The Australasian (iron and steel) Slag Association has a significant library of papers and technical reports available online or by request at www.asa-inc.org.au

1. OECD Pressure State Response Model (PSR) - This simple PSR framework merely states that human activities exert pressures (such as pollution emissions or land use changes) on the environment, which can induce changes in the state of the environment (for example, changes in ambient pollutant levels, habitat diversity, water flows, etc.). Society then responds to changes in pressures or state with environmental and economic policies and programs intended to prevent, reduce or mitigate pressures and/or environmental damage.

AUSTRALASIAN

Planning underway for 2009 Conference

Following the successful Sustainability Conference in May 2008, an ASA Conference Task Group is investigating the potential for a conference in 2009. Whilst planning is in its early stages, the possibility of cooperatively increasing its international reach is being considered. More details will feature in later issues.

New staff assisting ASA Members

Members calling the ASA office will notice that their call is being taken by someone they might not have met before. The new people who will assist you with Association matters are Kylie Dal Santo and Mona Forghani. Why not call them and introduce yourselves, they will be pleased to hear from you, and it will assist in helping them to become familiar with the ASA family.



Kylie Dal Santo, Administration Coordinator

Kylie has worked in Administration in both the public and private sectors for over 10 years. Positions have included National Marketing

Administrator, PA to GM, and Administration Assistant. An avid reader, she is currently studying for a Certificate IV in Frontline Management.



Mona Forghani, Research Assistant

Mona is currently undertaking a double degree in Bachelor of Law and Media and Communications (majoring in Advertising and

Marketing) at the University of Wollongong. In 2007 Mona volunteered at an International School in Bratislava, Slovakia teaching

English as a Second Language, was editor of the fortnightly newsletters and assisted with the school's marketing initiatives. She enjoys traveling, photography, film and music.

Insider liftout in demand

Responding to a reader request, 100 copies of the *Insider* from May 2008 were supplied. If you are interested in additional copies of *Connections* or a specific *Insider* issue, please contact the Association: www.info@asa-inc.org.au.

Port Kembla Granulator on target

The reline at BlueScope Steel (BSL) Port Kembla Steelworks continues on target. ASMS has begun piling work for the cold water cooling tower. It is planned to complete this work and the construction thereof prior to commencing the # 5 granulator rebuilt work which will take place during the actual reline of March 09 to June 09. Operational planning continues to minimise the impact to our and BSL's business when the reline takes place.

Source: ASMS Newsletter

all the way from South Africa and Australia to attend the event.

Source: www.footbridge2008.com

Global Slag Magazine now part of Global Cement

The editorial board at PPro Publications has decided to end the publication of Global Slag Magazine from this point on. Despite this decision, slag will be more than adequately covered as a regular feature section in Global Cement Magazine. In addition, Global Slag's internet home page (www.GlobalSlag.com) will continue to offer the latest news and industry links, as well as providing downloadable articles from Global Slag Magazine's extensive archives.

Source: Dr Nino Mancino, Editor www.GlobalSlag.com

The 6th European Slag Conference

The 5th European Slag Conference, organized by EUROSLAG - the European Slag Association, took place in the Conference Centre at Kirchberg/Luxembourg from 19th to 21st September 2007

Next year, the 6th European Slag Conference of EUROSLAG - The European Slag Association, will be held from 21st to 23rd of October 2009 in Madrid. The conference is being organised by UNESID (Spanish Steel Association)

The purpose of the conference is to encourage the exchange of knowledge and the promotion of suitable technical, innovative, efficient and environmental solutions using steel slag from Electric Arc Furnaces (both Carbon and Stainless Steel production) and from Linz Donawitz and Argon Oxygen Decarbonisation processes. A principal focus will be the improvement in utilisation of these materials in southern Europe. Preliminary program details for the conference and the organisation details will be published early in 2009.

Source: www.euroslag.com

INTERNATIONAL

4th Global Slag Conference, Strasbourg, 10-11 November 2008

This highly-successful conference again attracted around 140 delegates from slag producers marketers and processors around the world.

Source: www.GlobalSlag.com

Footbridge 2008

The Third International Conference was held on July 1, 2-4, 2008, Porto, Portugal. Winners of the Bridge design & engineering Footbridge Awards 2008 were recognised in a special awards presentation evening at the Footbridge 2008 conference in Portugal in July. Engineers, architects and owners representing seven winning footbridge projects and 12 highly commended projects collected their trophies and certificates at the event, which was held in the beautiful Alfândega building on the riverfront in the centre of Porto. Winning projects were represented by delegates from eight European countries, as well as delegates who traveled



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