Editorial

This edition of Connections reflects on the last six months of research, news and applications of iron and steel slag use across Australasia. The Australasian (iron & steel) Slag Association (ASA) would like to thank all of its members for their consistent commitment in furthering the ASA and the industry it serves.

In this edition we profile a great supporter, advocate and friend of the ASA, Joanne Portella from BG&BE Material Technologies. We twisted Joanne’s arm to provide us with a glimpse into her engineering career and experience with cementitious materials, in particular, iron and steel slag.

Contributors to this edition include Gavin Tory and James Hegarty from Australian Steel Mill Services with an update on the Appin Road Development, connecting South Western Sydney to the Illawarra region and highlighting the incredible scale of slag use throughout the development.

Further updates on major infrastructure include the Foxground and Berry Bypass, which commenced construction in 2014 and when completed will boast 11.6km of slag constructed road surface.

International concrete artist, Jamie North also provides us with a glimpse of his latest work. Jamie is currently travelling across the globe photographing slags on the micro and macro scale. His previous “Rock Melt” exhibition has been selected to be a permanent exhibition at the National Gallery of Victoria (NGV).

With the 2016 Rio de Janeiro Olympics behind us, this edition’s case study looks at how slag was used in the multiple stadiums and construction projects used to make the global event such a success. Moving forward, all eyes now turn to Japan for the 2020 Tokyo Olympics and how some of their 24 million metric tonne p/a output of slag will be incorporated into different stages of the construction.

Finally, the Australasian (iron & steel) Slag Association would like to wish its members and readers all the best with the final months of the year. The last edition of Connections Selections will be sent out in November to update readers of any changes to the industry, and to also provide a glimpse of what is planned for 2017.

Regards,
Team ASA.
JOANNE PORTELLA

How did you begin your career?
After I completed my undergraduate degrees in Engineering and Science at The University of Melbourne, I worked briefly in structural design with Beca Pty Ltd. I was then given the opportunity to return to University to undertake a Masters Degree, which I was honored to take on board. The Masters degree project was on the transmission of high strength concrete column loads through normal strength concrete slabs and was co-operatively funded by an Australian Research Council Grant and Readymix Pty Ltd (now LafargeHolcim Australia). The project involved experimental and research work and was very useful and practical in that the findings led to an amendment of the AS3600 Standard clause 10.8 on this topic.

From 2002 to 2011 I was mostly employed with Readymix Pty Ltd in a technical management role. I spent time in the laboratory as well as time out in the concrete plants gaining intimate knowledge of the influence of constituent materials in concrete during concrete production. I was responsible for mix designs and optimisation, review of technical specifications, R&D portfolios and concrete product development. I enjoyed the concrete batching buzz–there is never a quiet or dull moment in the concrete supply industry.

In 2011 I began working in consultancy with Engineered Material Solutions (EMS), a small, specialist materials consultancy group. BG&E MT acquired EMS in late 2014 and so the journey began. It is a challenging and exciting role. Every project is diverse, has its unique and complex challenges and offers the opportunity to connect with others in the industry. I am based in lovely Melbourne, though we have a presence in Sydney, Newcastle, Perth, Brisbane and the Middle East.

What is your role within BG&E MT Pty Ltd?
BG&E Materials Technology is a specialised engineering consultancy and we provide services covering a wide array of engineering needs. I am a principle and therefore responsible for the provision of specialist advice to industry clients on various aspects of concrete material technology. In turn, this helps with enabling informed decisions about materials incorporated into concrete, facilitating design and construction and advocating concrete sustainability.

What has been your involvement in the construction materials industry and experience with slag?
In my technical capacity with a major concrete supplier, I was involved with design and verification of concrete mixes containing slag as part of the cementious blend. A high proportion of mixes of all grades are designed with slag as part of the binder system, at varying proportions to suit the application. I was also involved with advising clients and engineers on the effects and benefits of incorporating slag in concrete mixes – the wealth of technical literature available on the use of slag as a SCM made this task easier.

What do you see as the key benefits that can be obtained by using Ground Granulated Blast Furnace Slag (GGBFS) as a Supplementary Cementitious Material (SCM) in the manufacture of concrete?
In my experience, there are various important benefits that can be obtained by using Ground Granulated Blast Furnace Slag (GGBFS) as a Supplementary Cementitious Material (SCM) in the manufacture of concrete. For mass concrete structures, it is an efficient and practical way of reducing concrete heat of hydration, minimizing thermal gradients within concrete and controlling the risk of thermal cracking. I have often recommended its use particularly for massive foundations and pier/bridge elements and have undertaken thermal modeling, which clearly shows how it helps to significantly reduce the peak temperature of the concrete mass.

Slag is very well recognised for improving the durability properties of concrete, including sulfate resistance, resistance to chloride ion penetration, reduced water absorption and mitigation of AAR. I have seen it almost invariably specified for marine applications, swimming pools and water retaining structures where concrete durability is most critical. Another main benefit is the contribution that slag makes to sustainable construction and meeting sustainability objectives. Being “a valuable resource material”, it has small amount of embodied energy and when used as a substitute proportions of General Purpose cement, it provides significant resource efficiency and CO2 emission reduction relative to General Purpose cement mix.

In my experience, I believe that using slag as a SCM can provide advantages with respect to plastic and hardened concrete properties, enhanced durability and sustainably along with its beneficial properties assisting in solving complex project issues. Slag makes an important yet often understated contribution to the success of infrastructure and sustainability outcomes in Australia.
“CAPABILITY AND INNOVATION”

For the tenth year running, Cement Concrete and Aggregates Australia (CCAA) and the Institute of Quarrying Australia (IQA) are working as a team to showcase CMIC16 as one of the most important conferences for the construction materials industry. Running 26th-28th October 2016.

Reviews of current practices and actions towards improving efficiencies are happening throughout many businesses in the construction industry. As a result of this, firms continue to ‘do more with less’ in order to survive in the business world.

The organisers behind CMIC16 believe that capability and innovation are the core of business improvement and for this reason, have chosen these attributes as the main themes to run throughout the conference. Examples of these themes include efficiencies in processes, support tools, business systems for frontline services and improved offerings to customers.

Much of what delegates know and love about CMIC will be retained while introducing new and exciting elements including:

**EXHIBITION**
- A re-energised exhibition with a focus on maximum delegate flow and exposure for exhibitors.
- Dedicated Vendor Innovation Portal where exhibitors can feature their new products with a parallel series of technical industry presentations.

**INDUSTRY INNOVATION DAY**
- Dedicated exhibition visitor full day on Wednesday expanding on 2014 with technical industry presentations providing increased opportunity and value for local day visitors from across the industry at a very affordable price.

**PARTNERSHIPS**
- An open and inclusive partnership offering more opportunities to show your support for the Conference to the delegates and industry at large.

**PROGRAM**
- A two day compressed and punchy plenary program with high profile, dynamic thought leaders.
- A closing Business Leaders Lunch Forum on Friday will be the perfect opportunity to wrap up and say goodbye to contacts old and new.

**SOCIAL PROGRAM**
- A networking focused Welcome Reception on Wednesday night to energise delegates for the official Conference opening on Thursday.
- Premier Gala Dinner to celebrate the industry on Thursday night at the National Gallery of Victoria under Leonard French’s stunning stained glass ceiling featuring high-profile entertainment and open to additional ticket holders.

The Association’s Executive Director, Craig Heidrich will be attending this year’s event as part of various Association exhibition displays – so come and say G’day.
Appin Road is a major arterial road connecting South Western Sydney to the Illawarra region. It passes through the town of Appin, Wollongong, Wollondilly and Campbelltown.

The project is progressing as planned and is expected to be completed by early 2017, weather permitting. This will provide a new, modern and safe piece of road at the site of a number of tragic fatal crashes.

As of June 2016 some updates and announcements of the project include:
- The NSW government’s allocation of $6.35 million in funding to improve safety at two key crash clusters along Appin Road.
- Realignment of two curves with high crash rates approximately 2km northwest of Loddon Bridge.
- Realignment of the eastern curves.
- Installation of intelligent warning signs to advise motorists using Appin Road when a heavy vehicle is exiting the side road.

Resurfacing to provide enhanced skid resistance is due to be completed by late 2016 and Investigations of the feasibility of installing additional street lighting to increase visibility at the intersection are currently underway.

Selected Association members are currently involved in the project and the Association’s Bre McMahon spoke with Gavin Tory, the Manager of Sales and Business Development at ASMS and James Hegarty, Product Manager – Civil, to provide an update.

“We are supplying slag-based products to the RMS for upgrades to Appin Road as part of their safety improvements on this road. We started moving material in at the end of July and have supplied 10,600 tonnes of slag with another 2,500 to go in around Oct 2016. In particular, we are supplying our very popular RBM800 (HBB) up to 2,000 tonnes per day.”

The ASA will provide a report of the finished project in the March Edition of Connections 2017.

More information about the project can be found here: http://www.rms.nsw.gov.au/projects/illawarra/appin-road/
Independent Cement & Lime (ICL) is a Melbourne based supplier of cement and blended cement products, specialising in cement alternatives, such as slag blends. Their products are supplied to a wide variety of projects and industries throughout Victoria and New South Wales. They are a joint venture operation, owned by its two shareholders; Adelaide Brighton Ltd and the Barro Group, better known for their Australian Pronto concrete operations.

The ICL group, which includes subsidiary companies, Steel Cement Limited (SCL) and Building Products Supplies Pty Ltd, was established in 1987 and has experienced significant growth in its operations and market divisions. While their profile and stature has grown significantly, they have remained committed to their original objectives, to support their shareholders and the development of independent operators in a wide range of markets throughout Victoria and New South Wales.

ICL group has facilities located in Victoria and New South Wales, including the recently commissioning Granulated Blast Furnace Slag Grinding Facility located at Yarraville which recently commissioned AUS $62.5M. The VRM at SCL now replaces the existing SCL operation in Port Melbourne, Australia. The new facility supplies ICL with combinations of slag, fly ash and cementious materials to meet specific project requirements, including the Ecoblend range and other environmentally preferable blends.

ICL is committed to sustainable products. The business is investing heavily in emerging products that reduce the environmental impact of the cementitious binders used in concrete. These products fall under the "Ecoblend" range of environmental cements. They are now an increasingly important part of ICL's business and meet the requirements of the Green Building Council of Australia's "Green Star" concrete credit.

At ICL, a variety of products are offered. Along with general purpose cement, ICL distributes off-white cement, Type GB Steelcement, shrinkage limited cement (SL), sulphate resistant cement (SR), lower heat cement ( LH), high early strength cement (HES), Steelpave product range of road stabilisation products, fly ash, and the Type GB Ecoblend cements.

Both Ecoblend & Steelcement is a Type of GB, general purpose blended cement, complying with Australian standard AS 3972 ‘Portland and Blended Cements’. The general portland cement and ground granulated blast-furnace slag (GGBFS) are selected for Ecoblend & Steelcement's particular mineral and chemical composition. They are processed and precision blended to produce a homogenous cementitious product.

The new grinding facility is a state-of-the-art Granulated Blast Furnace Slag (GBFS) import, grinding, and road dispatch facility that satisfies Australia’s stringent energy, emissions, and site discharge regulations. The facility combines leading specialised equipment from around the world. SCL’s goal was to choose the best equipment on the market that utilised the latest in technology, including a UBE Vertical Roller Mill, Leuhr Bag Filter, Beumer Bucket Elevators, Ibau materials handling equipment, and Tanks Connection’s dispatch Silo.

SCL has had a 25-year relationship with UBE Japan, having supplied their existing VRM, so the decision to be supplied with another mill from UBE was a simple decision for SCL. The new mill has a nameplate grinding capacity of circa 400,000 tonne pa, or 60 tph (dry weight) of GBFS which is twice the existing mill.
Another four years has past, the Rio de Janeiro Olympics have come and gone and the Australian Team managed to bring home eight (8) gold medals, eleven (11) silver and ten (10) bronze, overall taking out 10th place. Again punching well above our weight for our relatively small population.

Looking through the lens of the construction industry, the preparation for the Olympic games were deemed to be a planning and construction nightmare for the organising committee. However the team managed to complete the 34 venues and stadiums within the strict time schedule.

The United Nations Environment Programme (UNEP) agreed that the construction of these new venues in Rio de Janeiro needed to achieve a 100% local solid waste recycling target, as well as the inclusion of recovered resources in the construction of the venues. Interestingly, some of the major co-products used in concrete during the construction included slag, silica fume and fly ash.

The Federal University of Rio de Janeiro has also researched the potential use of more natural pozzolans such as sugar cane bagasse ash, rice husk and believe it or not, ash from burned sewage sludge! Some surprising results showed that using sugar cane bagasse ash as a cement replacement had little effect on the performance and strength of the original concrete.

The research resulted in multiple co-product and pozzolanic research findings. The Federal University of Rio De Janeiro concluded, “the mechanical, hydration and rheological performance of the mixtures presented in this paper could be a blueprint for further development of ecological concrete.”

A Gold medal goes to our fellow slag generators, processors and suppliers in South America for their ‘out of the box’ research findings and results.
CRC-LCL Cooperative Research Centre for Low Carbon Living

As an industry partner of the Cooperative Research Centre for Low Carbon Living (CRC-LCL) in this edition, as the CRC-LCL reaches its 4th year of operation, some more exciting projects have made news that the ASA would like to inform readers about.

As foundation member of the CRC, the Association has been working closely with engineers, researchers and scientists on the project “Impact Pathway 2: Lowering the Embedded Carbon in Buildings” which is on schedule to be completed in 2017. Reducing the commercial barriers for new low-carbon construction materials has been the main goal of the project.

The project outcomes are as follows:

• Handbook development to help with design and construction of new low carbon materials
• Developing confidence in use of new low carbon materials through attaining field data of real-life geopolymer constructions
• Undertaking a pilot program for producing lightweight concrete using geopolymerisation based low carbon processes, as well as alternative methods for producing aggregates from fly ash
• Delivering a standard for geopolymer concrete structure design
• Validation and adaption of appropriate test methods according to the standards to allow for the commercial use of synthetic aggregates.

The Final draft of “Impact Pathway 2” is expected to circulate to the work group members later this year. Read more: https://goo.gl/suj2h1

In relation to the “Impact Pathway 2”, a whole variety of PhD student projects, ten (10) in total are currently underway, gaining crucial and highly beneficial data and information.

The major project titles and researchers are summarised below, however please note not all projects are funded by the CRC.

**Project 1:** Steel reinforcement corrosion in geopolymer concrete (2013-2016)
*Researchers: Mahdi Babaee (PhD candidate) and Arnaud Castel*

**Project 2:** Durability of geopolymer concrete in Sulphate environments (2013-2016)
*Researchers: Supphathuch Ukritnukun (PhD candidate), Arnaud Castel and Chris Sorrel (Prof. Material science UNSW)*

**Project 3:** Carbonation and chloride diffusion in geopolymer concrete (2014-2017)
*Researchers: Amin Noushini (PhD candidate), Mohammad Khan (RA), Arnaud Castel and James Aldred*

**Project 4:** Alkali Aggregate reaction in geopolymer concrete (2015-2018)
*Researchers: Dinesh Habaragamu Arachchige (PhD candidate), Mohammad Khan (RA), Arnaud Castel, Pre De Silva (ACU Sydney) and Vute Sirivivatnanon (Prof. UTS)*

**Project 5:** Biogenic corrosion of geopolymer mortar (2015-2018)
*Researchers: Hammad Khan (PhD candidate), Mohammad Khan (RA), Arnaud Castel*

**Project 6:** Using steel furnace slag aggregate in low calcium fly ash geopolymer concrete (2016-2019)
*Researchers: TBA (PhD candidate), Mohammad Khan (RA), Arnaud Castel, Steve Foster*

**Project 7:** Field Testing of Geopolymer
*Researchers: (PhD candidate) Kirubajiny, Prof Sanjayan Swinburne*

**Project 8:** Geopolymer Truck Mixing Trials
*Researchers: (PhD candidate) Mithaq Kohees, Prof Sanjayan, Swinburne*

**Project 9:** Synthetic Aggregates Development from Fly Ash
*Researchers: (PhD candidate) Ahmed Graytee, Prof Sanjayan, Swinburne*

**Project 10:** Geopolymer Beam Tests
*Researchers: (PhD candidate) Chandani Tennakoon, Prof Sanjayan, Swinburne.*

2ND ROUND PROJECTS UNDER CONSIDERATION

As the final four (4) years of CRCLCL are fast approaching, industry research leaders, within working groups, have been exploring a range of research focus areas to go towards the last of CRCLCL’s future project ideas.

As a result of several meetings, a wide variety of excellent ideas were generated with a few agreed upon actions currently being under review, such as:

• Pre-mix delivery challenges using low carbon concretes in low risk structures (Sydney City Council, ASA, ADAA, UNSW, BG&EMT)
• Australian Ports and high durability Tetrapods using low carbon concretes (Port Kembla, Port of Brisbane, Newcastle Port, ASA, ADAA, UNSW, ASMS)
• Industrial Pavements using low carbon concretes: Guidelines - (Swinburne, Hanson, ASA, ADAA, BG&EMT).

As members of the CRC-LCL, Sydney City Council (SCC) was provided with an update of the CRC work, in particular low carbon concretes. SCC has expressed strong interest with taking leadership on low carbon concrete, more particularly, how they can incorporate into concrete construction and design guidelines to incorporate low carbon concretes.
Almost a year on since our November 2015 Connections report on the start of a $580 million construction of the Foxground and Berry bypass, some 11.6km iron and steel slag constructed road surface has been completed. Delivering durable, high skid resistant and longer service pavement.

Before this south coast road construction, access to the region was limited to a winding single-lane road. Shorter travel times and improvement of motorist safety were a few aims of the project while simultaneously creating five hundred (500) jobs as well as having great economic and safety benefits for the area.

Work that will be commencing in the next six (6) months includes:

• Continuing earthworks across the project
• Operating two (2) lanes of new highway south of Berry
• Substantially progressing nine (9) or the twelve (12) bridges
• Building new roundabouts and lanes in Victoria Street and Huntingdale Park Road.
• Completion of the controlled blasting at Toolijooa Ridge.

The overall plan has been to deliver a four-lane highway, with two (2) lanes in each direction and a median separation between Toolijooa Road and Schofields Lane. So far two (2) kilometers of new two (2) lane highway north of Berry has been opened, allowing for two (2) way traffic.

The realigned Toolijooa Road and extension of Hitchcocks Lane also opened and 1,100m3 of concrete for the Kangaroo Valley Road Bridge has been poured. As well as this, over 950,000 tonnes of rock is currently being processed for re-use on the project.
Continuing our theme of “gee I didn’t know slag was used in that!” we again feature Jamie North’s upcoming solo exhibition “Remainder”, at Sarah Cottier Gallery. The photograph features as one part of a continuation of series titled “Moving Mountains”. This series is shot exclusively in slag processing operations, focusing on piles of slag that show a resemblance to mountainous landscapes.

A few words from Jamie…

“When I first began to collect slag at ASMS in Port Kembla, I was struck by the austere beauty of these landscapes and wanted to apply the photographic techniques traditionally applied to photography of mountains, to them instead. I was thinking of the famous American photographer Ansel Adams and his epic mountain photography and the methods he applied to achieve it. I was also thinking of the Bernd and Hilla Becher, who photographed industrial buildings and structures and created “typologies” which are series of photographs where the subject have shared characteristics. My aim is to continue this series across all the continents and eventually join the mountains together into a continuous mountain range.”

Jamie photographed Moving Mountains (Dearborn #2) 2016 at Edward C Levy Co in Dearborn whilst he was on residency in Detroit in 2014. This photograph will join three other “mountains” from Detroit and will accompany a series of sculptures made with blast furnace slag, cement and marble dust.

Jamie would like to give special thanks to Matt Delphus of Edw. C. Levy Co. for his patience and hospitality during the multiple shoots that were required to photograph Moving Mountains in Detroit.

“Remainder” opens on 9th September at Sarah Cottier Gallery, Sydney.

See the website for details: http://www.sarahcottiergallery.com
CONFERENCE UPDATES

11TH GLOBAL SLAG CONFERENCE
With London acting home to 110 delegates from 24 countries meeting together for the 11th Global Slag Conference, the event proved successful. The two-day event hosted sixteen presentations and the farewell party at the end of the conference was seen to present numerous awards and prizes for titles such as best presentations and honorable mentions.

The sociable and comfortable atmosphere is just one factor that prompted commendation from delegates and along with the smooth and timely organisation; it was safe to say the overall experience was a proactive and beneficial one.

To read more about the 11th Global slag conference, click here www.globalslag.com

UPCOMING CONFERENCES
Following the successful 11th Global Slag Conference, held in London, delegates were all in agreement in the destination for the next Global Slag conference and exhibition. Düsseldorf, Germany was decided on, this will be the 12th Global Slag Conference and it will be running from 18-19 May 2017. Read more: www.globalslag.com/conferences/global-slag/introduction

The Concrete Institute of Australia is an independent and not-for-profit organisation, and every two (2) years a conference is dedicated bringing together global leaders in the concrete industry. Concrete 2017 is due to commence 22-25 October 2017 in Adelaide, South Australia and will be focused on themes such as materials, structures, durability, case studies and major projects and history and development of concrete, just to name a few. Read more: www.concrete2017.com.au

As earlier mentioned, CMIC16 is once again on for the tenth(10) year running showcased by the Cement Concrete Aggregates Australia and the Institute of Quarrying Australia. Regarded as the most important conference for the construction materials industry, with capability and innovation as themes throughout the conference, it will be running 26-28 October 2016. Read more: www.cmic.com.au

WE NEED YOUR CONTENT
Connections is produced twice a year for the benefit of ASA members and before each publication is drafted, an email is sent to all members urging them to contribute stories that they think are of interest.

The types of content we are looking for include:
- New developments or technologies
- New projects
- New employees

We also have a Member Profile section, which is open to all member companies for contributions on behalf of the business in general, or a specific employee. So if you have an idea or even some content that you think might make an interesting article for our readers, get in contact with Editor, Bre McMahon today: publications@asa-inc.org.au

SUBSCRIBE TO
www.asa-inc.org.au

Views expressed in Connections newsletter do not necessarily reflect the opinion of the Australasian Slag Association.
All contributions are welcomed, though the publisher reserves the right to decline or edit for style grammar, length and legal reasons.