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# ASA ASSOCIATION Connections

THE AUSTRALASIAN SLAG ASSOCIATION NEWSLETTER

## SLAG – capturing the essence of innovation.

**SINCE** Roman times, the production of SLAG as a product of the separation of a metal from its ores has posed a challenge and an opportunity. This has clearly been recognised in the Australasian context. More than 40 years of effort and ingenuity has gone into the development of applications for slag products that capture their inherent value. Being able to start at the molten rock phase, the opportunity exists to produce a range of end products from a single source of molten slag by varying the solidification processes. Underpinned by technical and scientific research along the way, slag products today are targeted to markets where their properties achieve results that reflect their intrinsic value.

In this issue, we highlight the ongoing research, application and product development efforts to capture the value and advantages of slag products. The opening of the Australian Steel Mill Services Ecocem grinding plant at Port Kembla recently by Bob Carr, Premier of NSW recognises the

potential to capture the benefits from slag products for the environment, community and the construction industry. Dr Ihor Hinczak from ASMS expects that the Ecocem will produce superior performing cement, giving up to 15 per cent better strength when used with ordinary cement, offering superior durability.

University students Matthew Thomas Biasutti and Trung Minh Luu proved winners in the Associations awards to encourage student research into "excellence and innovative use of slag materials in construction applications". Their papers contribute to the body of knowledge underpinning the use of slag products.

Establishment of the Independent Cement and Lime blending facility at Maldon some 100 kilometers to the south west of the Sydney CBD, consolidates its role as a major supplier of slag and hydrated lime blends. The use of these new binder materials had a significant impact on the road stabilisation industry, offering a viable

alternative to traditional binder systems.

Awarding of the prestigious Canada Centre for Minerals & Energy Technology and The American Concrete Institute (CANMET/ACI), Mohan Malhotra Award for Supplementary Cementing Materials to Dr Vute Sirivivatnanon of CSIRO Sustainable Materials Engineering is well deserved.

Slag Reduction New Zealand has, over a number of years been trialing and monitoring the use of melter slag as a filter medium to remove solids, nitrogen and phosphorus in the waste water treatment plant for a nearby rural township. Results over the past 7 years have provided the confidence to establish a second pond and look to extend this application to the treatment of dairy farm effluent.

The diversity of applications highlighted in this issue underline the value available to the end user and the environment from the innovative use of slag products. ...*SLAG capturing the essence of innovation.* ■



L-R: David Campbell, Colin Markham, Lance Hockridge, Bob Carr and Peter Taylor

granulated slag for the concrete industry and supplies about half of the Sydney and NSW market. Independent Cement Ltd (ICL) process 150,000 tonnes of Port Kembla granulate for the Victorian market.

Port Kembla granulated slag, ground with cement by Blue Circle Southern Cement was used in the Sydney Harbour Tunnel Tube segments to replace 65% of the ordinary cement used in the concrete. This was done because slag provides exceptional performance in the marine environment.

The shareholders of ASMS established the Ecocem grinding mill to broaden market availability and to focus on extracting even better performance from the material – "Taking it to the next level of performance".

Construction on the Ecocem plant started in August 1999 and was completed in July 2001. The plant was constructed using state of the art technology. The construction process employed approximately 110 people over the construction phase. Significantly, no environmental or safety incidents occurred during the construction period.

A lot of environmental innovation and creativity was incorporated into the construction

## Ecocem a boon for the environment

**THE PREMIER** of NSW, Mr Bob Carr recently opened the new \$18 million blast furnace slag recycling plant in Wollongong, which will produce 250,000 tonnes of high quality cement and reduce greenhouse gas emissions.

Owned by Australian Steel Mill Services (ASMS), the new company, Ecocem Pty Ltd, will specialise in processing and marketing blast furnace slag from BHP Port Kembla.

ASMS was established 12 years ago to focus

on marketing 1.8 million tonnes per year of iron and steel slag from BHP Port Kembla. Slag is the by-product from iron and steel production and for many years had been dumped or used as landfill. Slag generally looks like natural stone such as basalt, gravel and sand. Granulated slag when used in cement manufacture, provides significantly improved performance and durability.

Currently, Blue Circle Southern Cement grind approximately 250,000 tonnes of Port Kembla

from cover page

**With the Ecocem facility operating at its full capacity of 250,000 tonnes a year this would see almost 500,000 tonnes of Port Kembla slag will be used in cement – enough to supply the entire NSW market.**

of the plant and development of the surrounding area. The result is a safe, environmentally focused operation.

"For many years slag has been dumped or used as landfill, but it will now be re-used," Mr Carr said.

With the Ecocem facility operating at its full capacity of 250,000 tonnes a year this would see almost 500,000 tonnes of Port Kembla slag will be used in cement – enough to supply the entire NSW market.

This investment is a huge vote of confidence in the Illawarra and will go a long way to ensuring continued steel making in the region."

"The new facility will be of great benefit to local jobs," Mr Carr said. "It's good news for the 200 employees of ASMS as well as for BHP in the Illawarra."

With the Ecocem facility operating at capacity we will see full utilisation of Port Kembla slag production every year. This will significantly benefit

the Illawarra Community.

The full utilisation of the BHP Port Kembla slag production makes the Illawarra steel facility more sustainable.

Mr Carr said slag also has significant environmental benefits. "The ASMS Ecocem Group take pride in the fact that they are the largest industrial recycling operation in Australia," he said. "For every tonne of slag cement used in place of ordinary cement, a tonne of greenhouse emissions are cut." "That means keeping up to half a million tonnes of greenhouse gases out of the atmosphere each year," Mr Carr said.

General Manager of Ecocem, Mr Peter Taylor said the new facility would extract even better performance from the material, taking slag to the next level.

"Not only will it be stronger, concrete companies will get more value for their money," he said.

For further information on Ecocem and its



Premier Bob Carr opens facility.

products, please contact Greg McAlister or Ihor Hinczak on 02 4255 1100.

## Independent cement & lime



For further information,  
please contact Mr Gordon Dobson  
Ph 02 4964 4208 Fax 02 4964 4328.

**AS** one of the Country's leading suppliers of specialist blended cement products, Independent Cement and Lime has built a strong reputation for innovation and service.

From the earliest days of its inception, Independent Cement and Lime has had a special interest in the road construction and rehabilitation industries. This interest developed dramatically following an agreement with BHP in 1988 to purchase all of that company's granulated slag from their Newcastle works and resulted in the creation of Independent Cement's now wholly-owned subsidiary Steel Cement Ltd.

The rapid expansion in the use of ground slag with hydrated lime, particularly by the RTA in New South Wales, saw significant quantities of milled slag returning to the road-making industry in New South Wales.

The use of these new binder materials had a significant impact on the road stabilisation industry, offering a viable alternative to traditional binder systems.

In order to meet this increase in demand, ICL upgraded its blending capabilities at the Port Melbourne site through the construction of a high-capacity blending facility in early 1999. In addition, the company has also upgraded their New South Wales blending facility, relocating it to Maldon, in the New South Wales Southern Tablelands. The new plant will provide easy,

around-the-clock access for tanker drivers, together with automated blending and loading of a range of cement, slag, lime and fly ash blends.

Located just off the Hume Highway near Picton, some 100 kilometers to the south west of the Sydney CBD, the Maldon site offers the ideal combination of easy access via a major highway, and importantly, close proximity to various raw material sources.

The plant consists of four major storage silos, one of which has been designed with dual internal compartments. The largest of the silos (used for cement) has a capacity of 135 tonnes, followed by the 115 tonne capacity slag silo, the 70 tonne capacity Lime silo, and finally the split silo which provides 40 tonnes of storage capacity for fly ash, together with an additional 45 tonnes of storage capacity for special blends and other materials.

The Maldon Batch Plant also features a 26m x 3m, 80 tonne capacity weighbridge, which is large enough to cater for 'B-Double' tankers.

As with all of ICL's operations throughout Australia, ensuring the quality and consistency of all materials supplied from the new Maldon blending plant is one of the Company's primary considerations.

Quality control testing of all raw materials, together with regular batch testing of blended material is carried out on-site, with all test results logged and transmitted via computer to the Newcastle office. ■





# Second filter bed for Slag Reduction (NZ) Ltd



**THE** Slag Reduction Company (NZ) Ltd., the New Zealand subsidiary of Heckett MultiServ, has developed a unique end use for the by-products of iron making.

Slag Reduction provides a variety of services to BHP New Zealand Steel's 700,000 tonne per year operation at Glenbrook, about 52km south of Auckland, New Zealand's main city.

BHP New Zealand Steel operation is itself unique, as it is based on the titanomagnetite ironsand deposits, spread along the west coast of New Zealand's North Island. The ironsand is directly reduced to sponge iron, before being converted to molten iron in two 5000 tonne electric melters, before steel making in a KOBM vessel. Since the early 1990's, Slag Reduction have been examining end uses for the by-

products of the iron and steel making process, some of which in early testing, exhibited unusual characteristics directly related to the raw material and the process.

In 1993, after extensive evaluation, aggregate manufactured from one of the iron melter slags was used as filter bed material in the wastewater treatment plant for a nearby rural township.

**The filter beds were consistently removing 80% of the suspended solids, and 96% of incoming nitrogen, which was "impressive"**

A review of the plant's operation seven years later by the original consulting engineers, noted that enterococci levels in the water had been reducing and shell fish quality was better down stream from the plant's discharge than upstream. The filter beds were consistently removing 80% of the suspended solids, and 96% of incoming nitrogen, which was "impressive" in the consultant's view.

*continued back page*

## Thriving ecosystem built on slag



**CLOSE** your eyes near Sydney Airport's third runway and what would expect to hear? The roar of jets, certainly, but also some of the city's sweetest birdsongs.

The 2,438-metre artificial promontory is home to the largest population of song larks anywhere in the region, says NSW National Parkes and Wildlife Service wildlife management officer Mr Geoff Ross, who is into the second year of an ecological study on the site.

The birds thrive in their unlikely habitat by feeding on the swarms of insects that live there at ground zero and which are being collected and studied by a Dutch student, Ms Maaïke Bausch. She was stunned to discover that she had traveled so far to find such life to study on the edges of the nation's busiest airport.

The Ingredients that went into the third runway were simple, sand, blast furnace slag and recycled concrete, surrounded by a seawall and then overlaid with asphalt. But in less than seven years this barren and desolate construction site has begun to turn into a complex



ecosystem supporting an amazing array of wildlife. "It's like a natural recolonisation that occurs after a volcanic eruption," Mr. Ross said. "Here they built a runway that was like a sand desert and slowly the vegetation now supports not only insect life but quite a diversity of vertebrates, such as lizards and birds.

It has become a microhabitat in itself. There's a phenomenal amount of plant and animal diversity." Double-banded plovers, which arrive from New

Zealand every year, were thought to have been rendered extinct locally by the construction of the runway. But even these highly sensitive waders have found a niche beside the airport.

More than 40 birds arrived from New Zealand on Thursday. It may seem like a crazy place to

*continued back page*





**BHP Steel** has announced that it would re-build the second of its two smelters at its Glenbrook steelworks operation during early 2002. The NZ\$27 million upgrade will ensure the operational security of iron and steel making at BHP New Zealand Steel for the foreseeable future.

The smelter - one of two at Glenbrook - is a rectangular electric furnace that performs a molten separation process to produce slag and liquid hot metal for steelmaking.

Announcing the upgrade, President BHP Steel Kirby Adams said that over the past two years, BHP New Zealand Steel had delivered on its commitments to improve safety, financial and customer satisfaction and performance.

## BHP New Zealand Steel make big investment for future

"The 1300 employees of our New Zealand Steel business are to be commended for their progress and have earned this re-investment in their operation. BHP New Zealand Steel is an integral component in our flat and coated steel business network that services customers around the globe," he said.

Kirby Adams added that this announcement was a further demonstration of BHP's commitment to appropriately re-invest in BHP Steel as it moves towards becoming a stand-alone, publicly traded company during 2002.

President New Zealand Steel Cyril Benjamin welcomed the announcement as "a vote of confidence by our owners in the future of our

**"This announcement was a further demonstration of BHP's commitment to appropriately re-invest in BHP Steel as it moves towards becoming a stand-alone, publicly traded company during 2002."**

business." "The decision to re-invest in the iron and steel making operation at BHP New Zealand Steel will have benefits that will flow onto our customers, suppliers, employees and our local community," Cyril said.

The work program for the rebuild, which will maximise the involvement of local contractors, will necessitate a 10-week outage of No 2 Melter and involve about 60,000 person-hours of work.

### About New Zealand Steel

BHP New Zealand Steel is part of the Coated Products group operating a fully integrated steelworks in Glenbrook, New Zealand (south of Auckland) producing 600,000 tonnes of steel per annum.

With approximately 1300 employees, the Glenbrook facility processes local iron sands and coal to produce a range of flat steel products for New Zealand and export markets. These include hot and cold rolled coil, plate, metallic coated and painted steel products, hollow sections and welded beams. ■

## Bond strength in masonry Construction



**"Adequate bond strengths levels were achieved using the same mix proportions with Type GP and Type GB cements."**

Composite article prepared by Tom Wauer of Independent Cement and Lime.

The Cement and Concrete Association of Australia has recently published and released a Technical Note 65 on Bond Strength in Masonry Construction.

The issues of bond strength using various materials such as, Ordinary Portland Cement Type GP, Blended Cement Type GB, Lime and Sand with a variety of bricks has been a contentious issue for a number of years. Developing to the point where the Australian Standard AS3700 Masonry Structures was altered a number of years ago and mortar proportioning discriminate against Blended Cements Type GB.

The Australian Research Council, Cement & Concrete Association of Australia, Concrete Masonry Association of Australia, Clay Brick and Paver Institute, University of Newcastle and the CSIRO funded a five-year study on the Bond strengths.

Research conducted included: Surveys and database, Bond wrench studies, age and curing studies and interface studies. Key factors, which affect bond strength, are: Masonry units, Mix

proportions, Sand, Cement, Admixtures, Age of curing and Workmanship.

### In Summary

Adequate bond strengths levels were achieved using the same mix proportions with Type GP and Type GB cements. Water thickener admixtures as specified should be used. Lime incorporated in the mix is beneficial. Lime promotes adhesion improves cohesion and workability.

Sand should be well graded, clean and free of clay content. The fine fraction not exceeding 10% and the course retained on the 4.75mm and 2.36mm sieve not exceed 1%. Use of detergents, drinks, and sugar destroy bond strength. Overdosing with air entraining agents reduces bond strength. The mortar composition should match the masonry units.

Use volumetric measures not shovels full of ingredients. A minimum mixing time of six minutes is recommended. Where air entrainers are used do not over mix, this could lead to low bond strength. ■



# Inaugural education awards run, won and a big success

The ASA launched its inaugural "Education Award" in 2000, open to students undertaking Honours or Masters studies over the past 12 months. The award along with a cash prize was presented at the Annual General Meeting (AGM) in March at the Brighton Beach Novotel in Sydney.

Association Chairman Mr Peter Taylor presented the two certificate awards including a cash prize of \$1000 during the course of the AGM dinner to Mr Matthew Thomas Biasutti, and Mr Trung Minh Luu. Major industry members were present at the AGM and Dinner.

Papers based on the theme of "excellence and innovative use of slag materials in construction applications" received were of a high standard as commented by the Technical Committee Chairman Wayne James during the presentation. Mr James added that the submissions were received from Victoria, New South Wales and Queensland with paper topics covering various aspects of slag material uses.

Mr Matthew Thomas Biasutti, and Mr Trung Minh Luu, both graduates of the University of Wollongong, submitted the winning papers titled "Effect of limestone microfillers on the compressive strength of slag cement concrete" and "Early strength



L-R: Trung Minh Luu and Peter Taylor.

L-R: Thomas Biasutti and Peter Taylor.

development in concrete containing blast furnace slag products" respectively.

Mr Biasutti has joined the firm of Forbes Rigby Pty Ltd an Engineering and Scientific Consulting Firm based in Wollongong.

The next round of submissions close at the end of November 2001, so its time to get your application for the award submitted. All papers will be assessed by our Technical Committee in collaboration with various faculty staff and final notification will be given in Jan 2002 to the successfully winners.

**For more information visit our website at [www.asa-inc.org.au](http://www.asa-inc.org.au).**

## Industry by-products utilisation - Wins International Award

**AN** Australian scientist has won the concrete world's most prestigious award for his work in turning industrial by-products into useful components of concrete for building and construction.

Dr Vute Sirivivatnanon of CSIRO Sustainable Materials Engineering has won the Canada Centre for Minerals & Energy Technology and The American Concrete Institute (CANMET/ACI), Mohan Malhotra Award for Supplementary Cementing Materials.

The award recognises more than 12 years research Dr Sirivivatnanon and his team has dedicated to developing useful applications of fly ash,

slags and silica fume.

This work has resulted in the High Slag cement concrete, High Volume Fly Ash concrete (HVFA) and Silica Fume concrete being used in such high profile construction projects as the Sydney Harbour Tunnel, Sydney Parallel Runway and Melbourne Crown Casino. HVFA shotcrete was also used for the Sydney Olympic's white-water canoe course at Penrith.

A clever application, cost savings, increased durability and the contribution to sustainability principles offered by using HVFA shotcrete, was a significant factor in Pacific Power International winning the contract to build this new facility for the 2000 Olympics.

Fly ash, slag and silica fume are by-products from coal-fired power stations, steel mill blast furnaces and ferro-silicon or silicon metal production, respectively.

Dr Sirivivatnanon received his ward at the Seventh CANMET/ACI Conference in Madras, India in July 2001. ■



### New Members

- ▶ Lincoln Pacific Equipment

### Company Members

A primary role of our Association is to bring together Slag Producers, Processors, Customers and 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, just complete the information section at the end of this newsletter. Current membership is as listed below.

- ▶ Australian Cement Ltd
- ▶ Australian Steel Mill Services Pty
- ▶ BHP Flat Products - Pt. Kembla
- ▶ Blue Circle Southern Cement Ltd
- ▶ Boral Concrete & Quarries
- ▶ Brambles Equipment
- ▶ Brambles Industrial Services (Whyalla)
- ▶ Cleary Bros (Bombo) P/L
- ▶ Comsteel - Newcastle
- ▶ CSIRO DBC&E
- ▶ CSR Readymix Group
- ▶ University of Wollongong - Dr Denis Montgomery
- ▶ Gough & Gilmour
- ▶ Hecckett Multiserv (UK)
- ▶ HBL (Heggies Bulkhaul Ltd)
- ▶ Hunter Mill Services
- ▶ Kress Corporation
- ▶ Lincom Pacific Equipment
- ▶ Mahaffey Associates
- ▶ Metserv Australasia Pty Ltd
- ▶ Millburn New Zealand Ltd
- ▶ University of Newcastle - Mr Stephen Fityus
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- ▶ NS Komatsu
- ▶ Pioneer Construction Materials
- ▶ Port Kembla Copper P/L
- ▶ Premium Tyre Service P/L
- ▶ Queensland Cement Ltd
- ▶ Roads & Traffic Authority of NSW
- ▶ Slag Cement Sdn Bhd, Malaysia
- ▶ Smorgon Steel
- ▶ South Coast Equipment
- ▶ Steel Cement Ltd
- ▶ Steelstone Services (Aust)
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- ▶ Sunstate Cement Pty Ltd
- ▶ The Slag Reduction Company (NZ) Ltd
- ▶ UBE Industries Ltd
- ▶ Wormald Fire Systems

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- ▶ Jones D E (Hon.)
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- ▶ Marosszky M
- ▶ Prosser S D (Hon.)
- ▶ Reeves C M
- ▶ Venour M (Hon.)

### Related Associations

- ▶ National Slag Association
- ▶ Nippon Slag Association



**Slag Reduction** from page four

More importantly, the removal of phosphorus in the filter beds was considered to be a beneficial side effect of the melter slag. The consultants concluded that the melter slag aggregates had some significant advantages over quarried equivalents.

As a result of the successful long-term performance of this first scheme, the consulting engineers have specified the material for a second project and are considering it for a third. When completed later this year, the new plant's four filter beds will have used some

20,000 tonnes of Slag Reduction's "Eco Flow" aggregate, screened to a size range of 20mm to 10mm.

In a related project, Slag Reduction have been working with a Government funded research institute, to establish the practicality of melter slag filter beds for the removal of by-products from dairy waste. A pilot scheme was installed on a local farm some years ago, but the increasing requirement for more stringent methods of treating dairy effluent have prompted more detailed study. Results are expected in about a year's time. ■

**Ecosystem** from page four

cross an ocean for but they have the run of 150-plus hectares of grassland that virtually no one except the occasional security guard or tractor driver ever visits.

Lizards, mostly skinks, have moved onto the runway and its surrounding grasslands in huge numbers. At the bottom of the food chain on the runways fringes and even on the runway itself are the invertebrates – ants, spiders, mites, springtails, wasps, bees, caterpillars and beetles. These have been attracted by the increasingly diverse plant cover, which has established itself

despite a slashing rule that ensures nothing grows taller than 30 centimeters.

One of the most common of the native species is the succulent plant, with an edible fruit, known to beachgoers as pig face. Unwelcome feral inhabitants include foxes. Airfield operations manager Mr. Graham Giddey said that an ecosystem was welcome providing it didn't pose any threat to aircraft. Because of this, large birds such as pelicans, ibis, eagles, galahs or any others that fly in flocks are actively discouraged. "Just 20 or 30 seagulls could potentially bring an aircraft down," Mr. Giddey said. ■

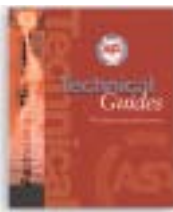


**Slag – "the ultimate renewable mineral resource"** – video has proved to be a favourite with many members. A considerable amount of

new additional footage has been incorporated demonstrating the beneficial properties of slag in various large-scale projects completed in recent years. The video (15mins duration) outlines slag's historical beginnings through to the various types of slag produced in a modern production process today.

Since our last issue we have had to produce another 100 copies to meet further demand. Copies are available to members at a cost of \$15.00 each, non-members \$20.00 plus postage and handling. Just complete and fax back the subscription/order form indicating your requirements.

**Given the number** of high quality guides the ASA has



produced, and continues to produce ("Guide to the Use of Steel Furnace Slag in Asphalt and Thin Bituminous Surfacing") together with bulletins,

newsletters and general correspondence, the Education and Promotion Committee have developed a Technical Compendium for the purposes of storing these important documents and more.

The Compendiums are an invaluable reference tool for engineers, specifiers, consultants, government authorities, and various slag users. Copies are available to members at a cost of \$15.00 each, non members \$20.00 plus postage and handling. Please note that as amendments are made to the contents of the compendiums, registered holders will receive updates. Just complete and fax back the subscription/order form indicating your requirements.

**Connections Editorial**

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