

## IRON AND STEEL - SLAGS REDISCOVERED RESOURCES

There is 100 years of successful processing and use of (iron and steel) slags in Luxembourg, a recent Euroslag Conference was told. Slag products however, have made a contribution to construction since Roman times. Throughout history use of slag has ranged from the novel to the usual including; cast canon balls in Germany (1589), wharf buildings in England (1652), slag cement in Germany (1852), slag wool in Wales (1840) reinforced concrete in Germany (1892) slag bricks made from granulated slag and lime in Japan (1901). In Australia, slag products were used initially in the creation of industrial land, road pavement, concrete aggregates, lightweight aggregate, through to granulation for production of slag cements since the 1960's. Earlier in world history, slag was accumulated to later become a valued construction resource such as the 20 MT 'Brown's Mountain' in Pittsburgh USA and deposits at the site of the Lithgow (Australia) Ironworks (forerunner of Port Kembla Steelworks)

Since the 1970's, despite the general usage of slag products in construction and infrastructure development there has been the ongoing argument about whether slag is a waste or a by product. The European Commission has now clarified these terms and in England and Wales iron and steel making slags are now classified as by products. The European Commission's clarification should give Australian regulators confidence and remove an impediment to the use of slag.

### In England and Wales iron and steel making slags are now classified as by-products

Growing recognition of the finiteness of the Earth's resources and the impact of human activity on the environment has brought the focus back to slag products particularly the

use of Ground Granulated Blast Furnace Slag (GGBFS) as a cement replacement. Benefits from this include potential improvements in concrete durability, conservation of mineral deposits and an overall reduction in the CO<sub>2</sub> footprint of structures constructed using GGBFS cement. Recent release of the National Greenhouse Energy Reporting Act 2007 should also assist.

Expansion of the range of slag products now available in Victoria and updates on uses in South Africa and New Zealand further demonstrate the versatility and advantage of using slag products in development of infrastructure and construction.

### Iron Works in Australia opens in 1848 with stop start history, closing in 1880's Story P5



Fitz Roy Ironworks foundations conserved in shopping centre car park

## SOUTH AFRICA- Steel Slag Stabilises Major Highway

The most heavily trafficked road in South Africa is the N3, which stretches between Johannesburg and Durban. It carries around 800,000 tonnes of cargo per annum, which in terms of heavy vehicle traffic equates to between 1,369 and 3,027 heavy vehicles per day (AADTT), depending on the location of the route. This road is currently undergoing extensive renovation and widening under contracts spanning 25 years. These contracts are operated by consortiums and controlled by consulting engineers. They are currently 3 years into this contract period.



Through discussions with one of the consulting engineers, it was evident that the current natural aggregate at one particular location was causing problems with the asphalt quality. The asphalt was deforming at a very early stage and the binder was stripping from the asphalt due to poor quality fines. It soon became apparent that the properties that steel slag had to offer could possibly present a solution to these problems. [CONT PG 5](#)

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# Australian contingent attends the 5th Euro Slag Conference held in Luxembourg



Euroslag  
Luxembourg

Grand-Ducal Palace

Representatives from Australian Steel Mill Services & Ecocem and other Australasian Slag Association members attend the 5th Euro Slag Conference held in Luxembourg over 19th to 21st September this year. There were over 230 people from over 32 countries. Luxembourg has a strong history in iron & steel making and, of course, in slag generation and

applications. Historically, it has been the centre of the European Steel industry over many decades but with industry rationalisation over recent years – the industry has reduced and now centres around electric arc furnace steel operations rather than the integrated facilities of the type we see at Port Kembla.

The conference concentrated on 4 key themes – Legislation and Standards, Quality Management, Slag Applications and the Environment. The Legislation & Standards theme highlighted all the issues that players in the slag industry are faced with – not just in Europe but around the world. For example – slag can be called many & varied names – is it a “by product” or perhaps a “waste” or perhaps even a “secondary raw material” – all these descriptions are very important for law makers and environmental authorities needing to interpret laws. Law makers are quickly coming to the conclusion that slag applications should not be hampered by unnecessary and complex legislation that limits the use of slag or applies tariffs and taxes to that usage.

Law makers are now coming to grips in Europe with the environmental advantages of slag use and drawing up modern legislation to reflect this.

Under the Quality theme it was fascinating to see how diverse and wide the quality standards are in various countries. For

example in Australia we would test granulated blast furnace slag for two key variables – basically moisture and residual iron levels – however in Denmark and other Scandinavian countries up to 24 separate tests are done on GBFS to ensure granulate quality for various applications.

Many different slag applications are being investigated around the globe. The most extensive by far in Europe are the road and paving applications. Significant and world best practise research is being undertaken on various road mixtures for a range of applications particularly specialised rural road applications. This research has significant value to Australian conditions. The Europeans have a unique issue in that their roads need to withstand very low / freezing temperatures which is unusual for us in Australia.

Research was presented on using slag as rail ballast under rail tracks and using various slags as kiln additions in the cement making process. There is excellent research being undertaken in New Zealand on using slag as a filtration mechanism to remove impurities from waste water.

The opportunity was presented to visit the Cloos SA plant and the Arcelor Mittal Plant in Differdange. The learning’s from these tours for ASMS are that all roads are sealed and dust generation is at an absolute minimum with all enclosed conveyors.

Source: Andrew Wilson ASMS/EcoCem

## Slag products improve water quality

In New Zealand the majority of slag products are utilised in road making including asphalt and chip sealing products, however there is an increasing market for water treatment and specialised drainage products.

An intensive programme of monitoring of the existing applications of slag aggregates for water treatment was also undertaken, allowing SteelServ to build up a comprehensive picture of how these products performed in the field and over time. This included working with a number of leading scientific laboratories in NZ who are studying the use of a range of materials to reduce nutrients such as phosphorous and nitrates entering sensitive waterways. Melter slag filter beds were also installed at NZ Steel to reduce the levels of residual heavy metals – particularly zinc - out of the site’s storm water. Partly as a result of these studies the Australasian (iron & steel)



Water quality Testing  
Okaro New Zealand.

Slag Association commissioned an in depth examination of a number of Australasian slags and their potential to treat storm water.

“NZ probably leads the world in the use and study of steel industry slags to treat degraded water” says Bill Bourke. “There is considerable international interest in what we have been doing and the results we have achieved. The ASA storm water study is really a bench mark report, which can provide consultants and their clients with a good lead and direction into the water treatment potential for these steel industry co-products”.

Source Bill Bourke – SteelServ NZ

# The versatility of slag expands in Victoria

Since around 1987, the Victorian construction industry has had available to it Ground Granulated Blast furnace Slag (GGBFS) as a cement replacement in concrete. This has become particularly important in more recent years, with the Victorian Government's push to reduce the environmental footprint of construction projects.

Now, MultiServ is making available high quality special aggregates from the OneSteel (formerly Smorgon) mini mill in Victoria. MultiServ has recently won a new seven year contract with OneSteel at their Laverton Steel Mill in Victoria Australia to actively market the Electric Arc Furnace (EAF) Slag and the Caster Ladle Slag (CLS). MultiServ has been supplying mill services at the Laverton site since 1990.

**EAF Slag** will target the Asphalt aggregates market manufacture and surface treatments where the exceptional properties of the slag can be utilised to a high potential. These materials have a high Polished Stone Value (PSV), high strength and cubical shape, form deformation resistant asphalt materials that are ideal for use in high stress areas, such as junctions, intersections and pedestrian crossings, where a high performance pavement is required.

The steel slag asphalt can be used to provide a deformation resistant material with a higher skid resistance to most alternative surfaces, in one single treatment saving time and money. Traditional methods have been to

repair the pavement with asphalt and then apply a specialised high grip aggregate such as calcined bauxite.

Steel slag, unlike most natural aggregates maintains its skid resistance throughout its life (as measured by Scrim – on-site skid resistance test). Tests by MultiServ in Europe have found that it can actually improve as traffic increases.

It is thought that due to the mineralogy and grain structure of the slag, it does not polish like a natural stone as it wears but exposes a new rough surface to maintain the skid resistance.

Research undertaken by MultiServ recently has proven **Caster Ladle Slag's** potential in the road stabilisation market. Its pozzolanic properties make it ideal to blend with cement and lime for use in this market, reducing the cost to the end user. The slag blends pass the current VicRoads specification and due to a lower early strength (compared to cement alone) the material has a longer working time providing further operational advantages.

## 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, just 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)  
Brambles Equipment Ltd  
Concrete Pty Ltd  
CSIRO CMIT  
EcoCem Pty Ltd  
Heckett Multiserv (UK)  
HiSmelt Ltd  
Holcim NZ Ltd  
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MultiServ Australia Pty Ltd  
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**Related Associations** - National Slag Association (US) | Nippon Slag Association (Japan) | European Slag Association (EU)



Constellation off ramp

# New Zealand Expands the Use of Slag Aggregates

SteelServ Ltd., a joint venture between New Zealand Steel and MultiServ, the world's largest supplier of steel mill services, now processes and markets around 300,000 tonnes of iron and steel slag aggregates a year. Success with the expanded use of these materials has been relatively recent compared to similar uses in Australia and Europe or the USA. "We had been selling slag based aggregates for nearly 15 years" says SteelServ's Bill Bourke, "But we tended to be in the lower end of the market, manufacturing non specified base course and sub base materials, as well as drainage products. As a result, output was limited and not keeping pace with the annual uprisings from the steel mill, resulting in growing stockpiles".

After a thorough re-assessment of the aggregate's market in the greater Auckland area, it was determined that there was a considerable opportunity to develop new product lines and to capitalise on some of the inherent strengths of slag based materials, particularly as high performance surfacing materials.

Aggregate consumers, particularly asphalt manufacturers, were looking around higher performance surface aggregates, some of which have to be transported hundreds of kilometres to the region.

"We knew from testing and trials, some going back to the early 1990's, that the aggregate was

very sound and had considerable potential for skid resistant surfaces", says Bill. "We also knew from a series of lengthy studies carried about by NZ Steel's environmental laboratories that the aggregate had considerable potential for water treatment, particularly for reducing phosphorous and a range of heavy metals".

After a major upgrade of the company's aggregate chip making facilities and closer attention to the overall aggregate manufacturing process, SteelServ began producing a range of products complying with TRANSIT NZ's specifications.

Monitoring of the slag surfaces in service at a number of sites confirmed their skid resistant qualities and was in line with similar experiences in the use of these types of materials internationally. A recent study of a road that was chip sealed two years ago with Melter slag aggregates, is still returning British Pendulum results in the mid 70's, even though the road in question has a very high proportion of heavy vehicles.

Source Bill Bourke – SteelServ NZ



New Chip making and washing facilities at SteelServ's operation helped achieve compliance with TRANSIT NZ's specifications.

# Foundations of historic Fitz Roy Iron Works conserved in Mittagong shopping centre car park

In 1833, well before the commercial production of blue metal from two of Australia's now famous quarrying areas, namely, Kiama and Bombo at New South Wales' South Coast and Prospect Hill west of Sydney and just 50 years after Captain Phillip brought the First Fleet into Farm Cove to found what we now know as Sydney, Surveyor Jacques discovered ironstone in a road cutting being excavated for a creek crossing near the present town of Mittagong in the NSW Southern Highlands, an hour or so's drive south of Sydney. The stone contained 48 % Fe, coal & limestone were found nearby so almost inevitably a Catalan furnace was built at Mittagong in 1848 and the first iron and resultant slag was produced in Australia, although of course, not in commercial quantities. This was to come half a century later with a different company in Lithgow NSW. History has shown that through a series of takeovers, this company – a century later, is known as Bluescope Steel, located at Port Kembla.

The original name of the Mittagong plant was Ironstone Bridge but in 1851, the Fitz Roy Iron Mining Company was formed. It's name came

about following a visit to the site in 1850 by the NSW Governor Sir Charles Augustus Fitzroy. Interestingly there are many spellings of the name of the company depending on the reference used; Fitz Roy, Fitzroy and FitzRoy. However like so many of the early attempts to produce iron and steel in the new colony, local companies could not compete with the cheaper iron 'pigs' imported from England as ballast for the clipper ships which came to the colony empty to load our wool and wheat back to the Mother country. The governments of the day would not allow any protective import tariffs.

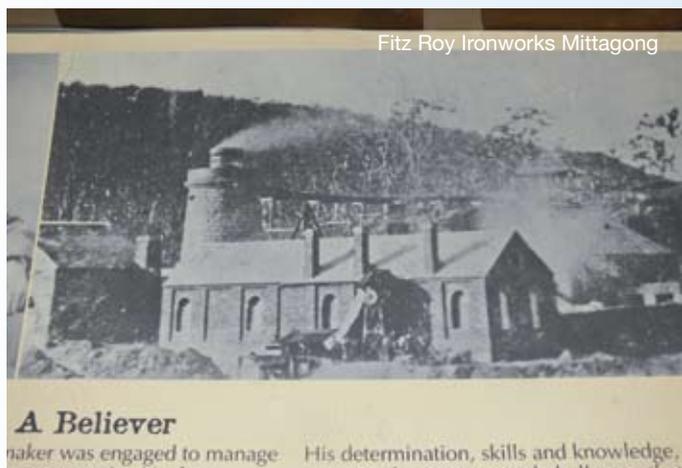
Over the past century, like many of our heritage items, very little remains of the Fitz Roy Iron Works other than some foundations which have been preserved by the Wingecarribee Council in a part of a local park. Following significant objections to a shopping centre at the site, preservation of these important heritage assets became a requirement of Council's development approval. During excavations for the large new building, quite extensive foundations were uncovered for an apparently forgotten section of the steelworks.

The excavation of the stone foundations also exposed some large & quite well preserved timber beams.

Next time you travel the old highway, just a couple of kilometers south of Mittagong, stop in at the new, very smart and modern elevated shopping complex. Ground level – not the usual below ground area, contains their under cover and convenient car park.

At the northern end of the new shopping centre car park, you will find, an area of about 40 x 30 metres of carefully restored historic foundations. Viewing areas, lighting and information panels have been installed and the recently exposed artefacts are now fully protected from the weather an important reminder of just where Australia's iron and steel industry commenced and the first of our iron slag was produced.

Text and Images extracted from a paper by Foundation ASA Executive Officer Doug Prosser - The Earliest Days of Slag in Australia



## SOUTH AFRICA- Steel Slag Stabilises Major Highway

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Following a series of laboratory tests by the consulting engineers, to confirm the properties of the slag, a mix design was formulated and actual laying trials were conducted on a road in the steel mill. The success of this trial then led to the same laying contractor being awarded a contract to install a series of surface patches using steel slag asphalt on the N3 to assess the performance in the field. From this work, steel slag asphalt was then manufactured and laid on a larger scale by the on-site contractor for the N3 consortium on the Van Reenan's Pass.

This section of road was very steep and carried slow moving heavy lorries; the most damaging type of loading for asphalt surfaces in terms of deformation and polishing. The steel slag mixtures, which have been made with both standard grade bitumen and polymer modified binders, have out-performed the natural aggregate asphalt materials and on this basis are now specified as the preferred materials for these contracts. To date, steel slag asphalt has been used in the rehabilitation of 75km of undivided dual carriageway and in excess of 200,000 tonnes have been placed on the N3.



## AUSTRALASIAN

### The National Greenhouse Energy Reporting Act 2007 (NGER) has now been released!

This establishes a national framework for corporations to report greenhouse gas emissions, reductions, removals and offsets, and energy consumption from 1 July 2008

The Act is seen as providing a quality and reliable greenhouse and energy consumption data stream to assist in meeting Australia's international responsibilities and providing a base upon which to establish an Australian Emissions Trading Scheme.

Source: Australian Government – Department of Environment and Water Resources

### Asia Pacific Partnership Steel Task Force meets in Wollongong

In October this year, the Asia Pacific Partnership on Clean Development and Climate – Steel Task Force 3rd Experts Workshop met in Wollongong. Workshop topics included: Climate Change Policies, Environmental initiatives in the Steel Industry, Energy Savings and CO2 Reductions and International Iron and Steel Institute (IISI) Breakthrough Programs. ASA Director Craig Heidrich gave a presentation on Iron and Steel Slag Use in Construction Applications and BlueScope Steel Vice President Slab and Iron and ASA Board Member Oscar Gregory co presented on Water Savings at Port Kembla Steelworks.

Contact: info@asa-inc.org.au

### ASMS to build new Granulation Facilities

Bluescope Steel (BSL) Port Kembla, has selected Australian Steel Mill Services (ASMS) to design, engineer, build, own operate and maintain some new facilities that will be constructed during the upcoming blast furnace 5 reline. These new facilities include a new cold water granulation system, a 3rd

cast house granulation system and a cold water cooling tower system. The selection by BSL of ASMS to undertake this new work represents a significant vote of confidence by BSL in ASMS. The investment required by ASMS will be many millions of dollars.

Source: Australian Steel Mill Services

### NSW Road Authority approves new pavement design

RTA NSW has approved a new concept of structural pavement design. Steel Slag Fines are now placed as a sub base layer at the RTA's major road, Princess Highway, approximately 100 kms South of Wollongong at Wandandian. The base layer used at the same section is Blast Furnace Slag roadbase. This is a classic example where Steel Slag and Blast Furnace Slag are used as composite layers in the pavement. Moreover, conventional sub base layer is replaced by steel slag fines.

Source: Dr. Vijay Joshi (ASMS)

## INTERNATIONAL

### Slag in UK no longer a waste.

Effective immediately, blast furnace slag is no longer classified as a waste in England and Wales. This determination has been made as an outcome of a joint project run by the Environment Agency and Waste Resources Action Program (WRAP).

The EU Commission has clarified the distinction between 'by products' and waste to be classified as a by product

- The material must be certain to be used
- No further processing is required prior to use
- The material used is an integral part of the continuing production process

Source: Global Slag Magazine Oct 07- www.globalslag.com

### IRC Forms—National Slag Association USA is a Charter Member

NSA, working with six other associations representing industrial by-products, formed a group to promote the use of industrial by-products throughout the US. The Industrial Resource Council (IRC) was established under an MOU with the National Recycling Coalition (NRC) of Washington, DC. At the urging of both the USEPA and FHWA, the associations for the 6 largest industrial byproduct volumes have begun to present to state highway transportation and state environmental departments around the US.

Source NSA Slag Runner Feb 07 : www.nationalslag.org

### Green Building Rises in Manhattan—

Building on a reputation as a green developer that was solidified with The Solaire, the Albanese Organization announced that its newest project. The 24-storey, 299,000-sq-ft building located in Manhattan's Battery Park City will bring 253 new green residences to New York. Construction began in September 2004. Sustainable features include energy saving measures that reduce peak demand for electricity by 65 percent, water recycling and rainwater harvesting, and high recycled content in all construction materials, including slag cement

Source NSA Slag Runner Feb 07 : www.nationalslag.org

### Global Carbon Standard Launched

A new global Voluntary Carbon Standard (VCS) has been launched (20th November 2007) at the London Stock Exchange providing offsets and a boost to market confidence in the new carbon offset market. The World Business Council for Sustainable Development (WBCSD) said the robust international standard would drive greater investment into credible offset projects certain to result in real and additional emissions reductions around the world.

Source: Environmental Manager EM651 Nov 20 2007



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