



QUARTERLY
2002

www.asa-inc.org.au

VOL 2, ISSUE 4 FEBRUARY 2002

ASSOCIATION connections

THE AUSTRALASIAN SLAG ASSOCIATION NEWSLETTER

THIS QUARTER:

1 Editorial • EcoCem - a concrete success 2 Australian Historical Aviation Museum • Smorgon 3 Blended Slag pavement techniques 5 News in brief • Member Profiles 6 ASA formation brings significant changes

Editorial comment

MODERN construction requires materials that are readily specifiable and have predictable performance criteria, the essence of quality assurance. In order to provide reliable materials, a great deal of research and performance testing is required. For slag products in Australia, this work has spanned more than 50 years. Beginning with simple road pavements in the 1950's and 1960's through to sophisticated pavements and cements today, slag products have been well researched and tested by performance. In 1993, the Australasian Slag Association produced "A Guide to the Use of Slag in Roads". This guide is currently being revised, capturing all of the research and performance experience since then.

Launch of the EcoCem plant at Port Kembla during 2001, makes an important contribution to improving concrete properties. Results show improvements in pumpability, workability and

finishability of concretes containing EcoCem. There are now more than 20 concrete plants using EcoCem from Eden to Penrith and Sydney metropolitan area.

Blended slag pavements have made a significant contribution to the construction of roads in the Hunter region for a number of years. Since 1994, more than 1.1 million tonne of the popular mix 3 has been placed, much of it by the RTA. This has provided the opportunity to confirm the superior performance of this material and determine optimal placement techniques. This experience is shared in the article "Blended Slag Pavements –

Construction techniques" in this issue.

Slag is a by-product in the manufacture of iron and steel. A major new construction project in the Illawarra region brings these materials together, showcasing their performance characteristics. The new BHP Australian Historical Aviation Museum. BHP Coated Steel and BHP Flat Products will supply steel products for the buildings. Australian Steel Mill Services (ASMS) will provide materials for an upgrade of the Albion Park Airstrip.

The research and performance testing over the past 50 years underpins slag's reputation as quality construction material. ■

"There are now more than 20 concrete plants using EcoCem from Eden to Penrith and Sydney metropolitan area."

EcoCem a concrete success

Following the opening of the EcoCem Grinding Facility at Port Kembla by the Premier of NSW, Mr. Bob Carr, sales of EcoCem have been steadily increasing. Currently more than twenty concrete plants from Eden in the south to Penrith in the Sydney metropolitan area are utilising EcoCem in concrete.

In most concrete applications EcoCem is replacing up to 50% of the Portland Cement content. Concrete placement contractors report improvements in pumpability, workability and finishability of concretes containing EcoCem. Setting times, although slightly extended at the 50%

substitution level, are generally offset with the lower water demand and bleed tendency resulting in acceptable finishing times. Even in the southern reaches of NSW where winter temperatures are still experienced, setting times are not an issue.

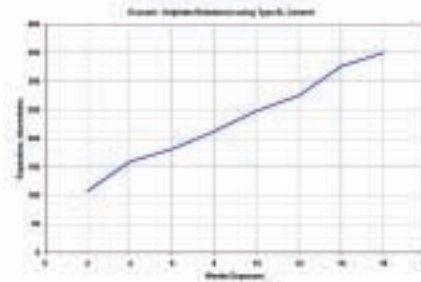
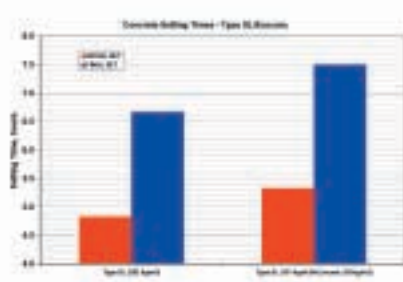
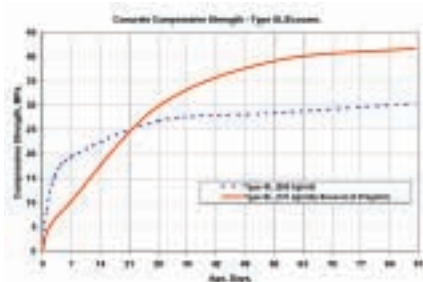
Early concrete compressive strengths are acceptable even in mixes containing fly ash. Compressive strength gain is excellent and later age strengths are greater than those without EcoCem by up to 20% at 28 days.

Replacement of 50 percent of Type SL with EcoCem produces significantly greater resistance to sulfate attack. This is demonstrated when EcoCem is



tested to AS 2350.14-1996 "Length change of portland and blended cement mortars exposed to a sulfate solution". Typical data are shown in the figure and expansion at sixteen weeks is significantly lower than the specification maximum of 900 microstrain.

For more information please contact Ihor Hinczak, Technical Sales Manager – EcoCem on 02 4225 7191. ■



"A recent feasibility study showed there was already significant development interest in the airport to create up to 223 full-time equivalent positions and contribute more than \$17 million annually to the regional economy."

Australian Historical Aviation Museum gets off the ground

Business based in the Illawarra, BHP Coated, BHP Flat Products and Australian Steel Mill Services (ASMS) will provide materials for an upgrade of the Albion Park Airstrip and the construction of a facility to house the Australian Historical Aviation Museum to be built at Albion Park Airport. The facility will be known as the BHP Steel Australian Historical Aviation Museum.

The proposed BHP Steel Australian Historical Aviation Museum will provide a wonderful permanent asset to the Illawarra generally and to Shellharbour region. The project will showcase premium BHP Steel Building Products, featuring cladding made from Colorbond® prepainted steel and purlins made from Galvaspan® galvanised steel for building structures. The airstrip upgrade will utilise some 100,000 tonnes of premium roadbase materials supplied by ASMS. This premium product was also used in the construction of the Third Runway project at Mascot Airport, Sydney.

The Museum can't proceed without an upgrade of the airstrip, and the museum provides an excellent motivation for upgrading the airstrip, so the projects are joined at the hip. The

upgrade of the airstrip might eventually lead to the recommencement of regular passenger services in and out of Albion Park.

In particular, once upgrades to the airstrip have been completed, larger aircraft similar to "Dash 8" will be able to utilise this Airport. This has obvious direct benefits to the region, affording greater economies of scale to prospective commercial airline operators.

The Museum will be a first class collection of historic aircraft, many of them operational, together with a relevant collection of artefacts, a library and conference and training facilities. It will generate both permanent and part-time jobs, training opportunities, provide an undercover facility for the housing of AVIEX, a major biennial exposition of aviation business and technology scheduled to be held at Albion Park November next year.

Shellharbour City Mayor, Cec Glenholmes welcomed the announcement saying the BHP Steel Australian Historical Aviation Museum would deliver substantial tourist and economic benefits to Shellharbour and the entire Illawarra region.

"To be able to attract a respected, national



organisation like HARS to our airport is a major coup and to have it backed by companies like BHP Steel and ASMS is a ringing endorsement of this project and Shellharbour City.

"A recent feasibility study showed there was already significant development interest in the airport to create up to 223 full-time equivalent positions and contribute more than \$17 million annually to the regional economy. We are delighted that our adjoining Councils, Wollongong and Kiama, are also contributing to the runway upgrade," he said.

Cr Glenholmes also recognised the considerable commitment from Australian Steel Mill Services who will assist with the provision and transport of road base material for upgrading the runway.

Smorgon commercial development of slag resource

The research for the project was carried out by CSIRO Sustainable Materials Engineering and funded by Smorgon Steel Group Ltd. The objective was to improve the overall environmental and financial performance of the steel making process.

The work of the CSIRO SME team has recently been recognised by winning the Mohan Malhotra Award for Supplementary Cementing Materials, awarded by the Canada Centre for Minerals & Energy Technology and the America Concrete Institute.

The Australian construction industry currently uses over 4Mt/yr of fly ash and iron/steel slag. These materials are used in road construction and blended cements, and can improve the life expectancy of concrete structures.

"In Victoria there has been little interest in the use of this valuable resource which has been

either stockpiled, land filled or used to stabilise boggy private roads in rural areas in the vicinity of our plant," said Smorgon's Joe Italiano.

60,000t of reprocessed slag is produced every year from the electric arc furnaces operated by Smorgon at its North Laverton plant in Melbourne.

"We have conducted trials on slag from Smorgon's electric arc furnaces and found a number of technically viable and commercially useful applications for this by-product" said Robert Baker, CSIRO SME's Business Development Manager. These include:

- base course and top course for asphalt roads,
- antiskid surfacing for roads on accident-prone intersections and curves,
- low-strength concrete for footpaths, bicycle paths, edge strips and behind kerbs and

gutters,

→ controlled low-strength fill for backfill for trench stabilisation concrete subbase for rigid pavements.

VicRoads tested the slag from the Smorgon steel mill in polished stone value testing, which confirmed that the material provides a good skid resistance surface material for roads.

"Smorgon is now progressing the commercial development of viable applications arising from CSIRO's research. With commercial viability will come the environmental benefits of replacing virgin quarried raw materials with an industrial by-product," said Mr Italiano.

Thousands of tonnes of slag from steel mills could be effectively utilised into a range of useful products for building roads and pavements.

For further information, please contact Sandro Costabile on (03) 9360 2489.



Blended Slag Pavements

Construction Techniques



By Adam Kelly – Steelstone Services (Aust)

THE use of blended slag pavements has become common place in the construction industry, especially in areas where steel making slags are readily available. Initially, slag road construction was carried out predominantly by the NSW Roads and Traffic Authority (RTA) and local councils. However due to the superior performance and consequently greater acceptance of these products, more and more civil contractors are using blended slag pavements.

Experience has shown that certain construction techniques will ensure that optimum performance of slag pavements is achieved. In the past, standard construction practices for conventional road bases have been used on slag blended pavements. The following report explains several issues that have arisen when placing Steelstone's Mix 3 slag road base in the Newcastle region with conventional construction techniques. Mix 3 is a 20mm minus blended slag pavement consisting of steel slag, granulated slag and fly ash.

Since 1994 Steelstone has supplied approximately 1.1 million tonnes of Mix 3, and in this time the RTA and local councils have provided valuable feedback on its performance. Due to the self-cementing properties of Mix 3 the slag pavement is heavily bound, and therefore the same construction principles as semi-rigid construction are required. RTA specification RN73A is a local Newcastle specification that has addressed the issues of construction, and the important points are outlined below.

Construction Jointing

Fresh Joints

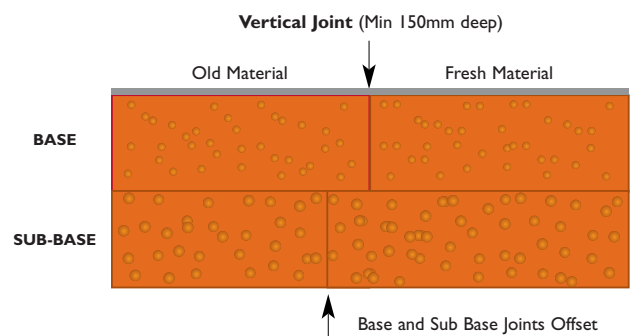
Fresh jointing techniques are used when the joints are constructed within the allowable working time of the older material. When fresh longitudinal joints are required the outer 300-400mm of the older material is left uncompacted until the adjoining material is placed ready for compaction.

Cold Joints

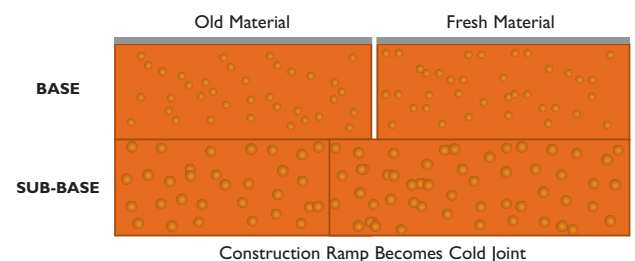
Where the older material has passed the allowable working time cold jointing techniques are required.

Transverse jointing is always at right angles to the road centre-line. Before fresh slag material is placed, a clean vertical surface is cut at a minimum depth of 150mm thickness. If a sub-base bound layer has been placed, the base layer transverse joints shall be offset at a minimum of 2m from the sub-base joints.

Longitudinal jointing should be constructed in a similar fashion. If a sub-base bound layer has been placed, the base layer longitudinal joints shall be offset at a minimum of 150mm from the sub-base joints.



Instances have occurred where ramping of the pavement has occurred during construction, and these ramps have remained in the pavement at the end of the day as cold joints. This has resulted in a wedge effect at the joints from day to day construction.



Movement due to thermal expansion at this wedge has caused elevation differences at the joint, resulting in deformation of the wearing surface similar to the effect of tree roots. This is normally evident at regular intervals along the pavement coinciding with the end of each day's construction. The deformation to the asphalt can be seen in the pictures following:



(Deformation to the asphalt – close-up)



(Deformation to the asphalt – across pavement)

CONTINUED PAGE FOUR

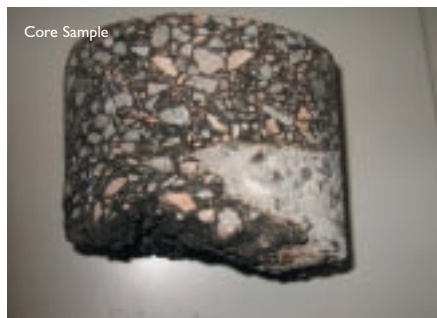


"Density testing should be carried out as soon as possible after compaction has occurred. This will ensure that if extra compaction is required the placement moisture content is still available before hydration occurs."

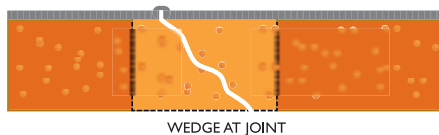
FROM PAGE THREE

Construction Techniques

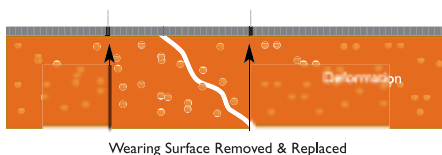
Confirmation of the wedging effect can be seen in the following picture of a core sample illustrating the distinct movement of Mix 3 into the asphalt layer, with the asphalt surrounding the resulting slag wedge.



This movement effects both the rideability and noise level of the pavement. The problem has been addressed by milling away either side of the wedged joint at least 150mm deep and replacing the material with a vertically jointed slag pavement.



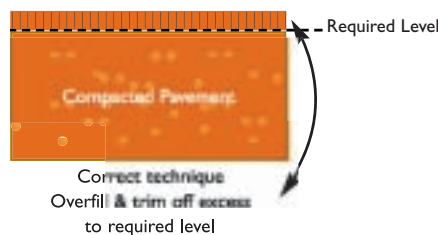
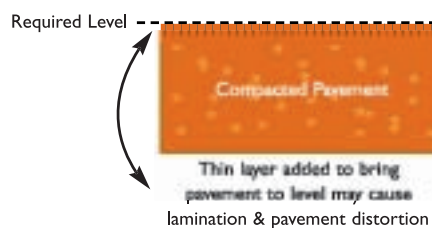
Alternatively only the deformation in the wearing surface has been removed and asphalt only replaced in these areas. There is no evidence at this time to suggest that more movement is evident at the joint when using this second method.



This is a low cost solution, however it may not be cost effective if movement continues to occur at the joint.

Compaction and Trimming

Due to the ease of compaction of slag blended products, Mix 3 has been able to be compacted up to 300mm in a single layer. This will ensure that lamination throughout the layer in the pavement does not occur.



Primary trimming should be completed above the required levels to ensure that when final trimming is done, extra material is not required in a thin layer. If extra material is required, the existing compacted layer should be ripped up and the extra product added and re-compacted. This will avoid thin laminating layers plating and causing pavement problems when the material has hardened. Plating is normally evident by similar movement in the asphalt to the above-mentioned jointing issues. However it will appear randomly in the pavement depending on where the lamination has occurred. Thin laminations are best fixed by removing the thin layer of slag and replacing the thin layer with asphaltic concrete. Alternatively, the base layer must be removed to a depth of approximately 150mm (including lamination depth) and the slag base replaced.

Moisture Content

Slag blended pavements are less sensitive to moisture than conventional materials. Mix 3 has been placed in wet weather, or placed when the moisture content is above optimum. In these instances the material will pass compaction tests

very easily, but will take longer to harden.

Moisture content becomes important with Mix 3 when it is used in applications where traffic is placed directly on newly constructed pavements. Extensive night work on major roadways requires the removal of old pavement, placement of Mix 3 and an asphalt layer within approximately 10 hours. Due to the lower temperatures at night, and immediate trafficking, moisture contents often are 2-3% below optimum laboratory moisture content to meet all the requirements.

Density testing should be carried out as soon as possible after compaction has occurred. This will ensure that if extra compaction is required the placement moisture content is still available before hydration occurs. The decision should be made as to whether the material can be close to laboratory optimum moisture content and allowed to dry over time, or whether trafficking immediately is required. The compaction ratio required should reflect the application of Mix 3.

Finished Surfaces

It is common to bring a slurry to the surface of Mix 3 when finishing. This will aid in the curing of the pavement by assisting to contain moisture for hydration. If this practice is used, it is imperative the slurry is removed before adding prime seals to the pavement. In several instances the slurry has been left on the slag base surface and there has been no bond between the base and asphalt interface. This has induced shoving of the asphalt wearing surface, and caused concern over the suitability of Mix 3 for asphalt surfacing. Contrary to this concern, the basic nature of Mix 3 assures an affinity to bituminous surfacing. Standard preparation of the base course including removing of slurry will ensure a successful pavement. If the slurry exists on the sub base course it is necessary to scarify the surface with a grader to ensure that a good bond is achieved between the base and sub base layers.

The uses of slag blended pavements and especially the placement of Mix 3, have assured that correct placement techniques have been formulated and are outlined in this report. Many thanks go to Newcastle and Lake Macquarie Councils for their input and advice. This allows suppliers such as Steelstone to ensure that all issues regarding our products are available to all involved in using slag blended materials.

For further information regarding this article please contact Adam Kelly on 02 4961 2393.

NEWS in BRIEF...



An essential Guide for all material users

The association has been over the last several months, carrying out a review of the first of the user guides published by the Association "A guide to the Use of Slag in Roads".

The original version of this guide was produced in 1993 after much consultation and reviewing. In fact at the time I remember seeing Draft 15 at least. Anyone who has seen the document, could see from the list of acknowledgments that there was a great amount of assistance given from throughout the construction and materials supply industry.

Geoff Youdale who was, at the time with the Roads and Traffic Authority, along with other RTA colleagues, gave valuable input in this original guide. It is with great respect for Geoff's ability and knowledge the Association again asked Geoff to assist with this review. In fact, Geoff is the main driving force in the review. This time we are helping him, rather than he, us.

Why review?

Firstly, the need for review came from the change in the Slag industry, or should I say, the Steel Industry. Availability of slag types and tonnages changed following the closure of the Newcastle Steelworks. Since the first guide, there has been a greater

emphasis on insitu stabilisation.

There was also the task of producing a Guide for Stabilisation. The Technical Committee came to the conclusion that the original guide was in need of an update and that the issues of Stabilisation could be integrated into that review rather than another document at this time. Partly because AustStab had recently issued guides on stabilisation and it was not the Association's intent to detract from these but to enhance them.

Where is the review up to?

The final draft which includes an enhanced section on stabilisation, has been circulated to a wide range of interested parties for comment and is in the final stages of completion. It is expected publishing will be carried out in February 2002.

The Association is excited about the chance to put into the arena of materials and construction a further document that will enhance the knowledge of people and the positive attributes of a product that is technically some of the best available. We are also looking forward to its launch early next year.

For more information please contact Wayne James, Chairperson - ASA Technical Committee on e: technical@asa-inc.org.au ■

Member Profile

South Coast Equipment Pty Ltd. is a longstanding, family-owned company involved in the handling/processing of bulk materials, industrial waste and mining. The business is based in Wollongong, New South Wales - 75 kilometres south of Sydney.

The company has been long involved in slag handling, processing, and product marketing within the region. The company operates concrete plants, quarrying operations within NSW.

The company can be contacted via [\[www.sce-aust.com\]](http://www.sce-aust.com)



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

The company can be contacted via [\[www.ecocem.com.au\]](http://www.ecocem.com.au)

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
- ▶ Heckett Multiserv (UK)
- ▶ HBL (Heggies Bulkhaul Ltd)
- ▶ Hunter Bulk Materials Pty Ltd
- ▶ Hunter Mill Services Pty Ltd
- ▶ Kress Corporation Ltd
- ▶ Lincom Pacific Equipment Pty Ltd
- ▶ Mahaffey Associates Pty Ltd
- ▶ Metserv Australasia Pty Ltd
- ▶ Milburn New Zealand Ltd
- ▶ University of Newcastle - Mr Stephen Fityus
- ▶ Nichimen Australia Limited
- ▶ NS Komatsu Ltd
- ▶ 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
- ▶ SteelServ Ltd (NZ)
- ▶ Steelstone Services (Aust)
- ▶ Sulphide Corporation P/L
- ▶ Sunstate Cement Pty Ltd
- ▶ Wormald Fire Systems

Personal Members

- ▶ Anderson L
- ▶ Dobson G
- ▶ Heaton, B (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)



Utilisation has increased significantly

Since the formation of the Australasian Slag Association in 1990, significant changes have occurred in the effective utilisation of slag materials. For example during the calendar year of 1990, approximately 4.5Mt of slag was produced, effective utilization of the total arisings were in the order of 30 to 35%. Note : Effective utilisation, means the use of slag materials in a productive or economically beneficial way and therefore not requiring disposal as landfill, which in today's society must always be a last resort.

The following simple multi-level pie graph



illustrates slag utilisation for 2000. Starting at the centre, some 3.1 million tonnes of various metallurgical slag's were produced during the period. The second outer circle represents the major slag by-products types production volumes. The last circle or coloured outer segments represents the total effective utilization, which has increased to approx 75%. The major contributors being GBFS (Granulated Blast Furnace Slag-Red) at 100%, BFS (Blast Furnace Slag - Blue) at 71%, BOS (Basic Oxygen Slag - Green) at 64%, EAFS (Electric Arc Furnace Slag - Light blue) at 54% and other slags (Purple) at 24%. The grey areas represent slag materials which are stored for some future use.

Compared to the early nineties and giving due regard for reduce slag production, effective utilisation has increased significantly. These achievements are a direct result of slag product benefits being more widely understood and appreciated by material users in the construction, agricultural and civil engineering industries.

For more information regarding this article please contact Craig Heidrich on 02 4225 8466.

Connections Editorial

Connections is published by ASA
The Australasian Slag Association
Wollongong NSW 2500 Australia
Phone: 02 4225 8466
Facsimile: 02 4228 1777
Email: info@asa-inc.org.au
Web: www.asa-inc.org.au

Publisher-----ASA inc.
Development Manager -----Craig Heidrich
Art Director -----Martin Costanzo
Pre-Press/Print-----In-House Graphics (nsw)

Contributors:

ASMS, Independent Cement and Lime, David E. Jones,
CSIRO, SRC, BHP (NZ) and Craig Heidrich.

Quarterly Publication

Circulation: 2,000

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, to publish or edit for style, grammar, length and legal reasons. ©2002



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.

Subscription Form: Connections

I received connections via a third party, please:

☐ Add me to your mailing list ☐ Send me only electronic copies via email ☐ Send me hard copies only

I WISH TO PURCHASE: ☐ ASA Video @ \$15.00* x ____ Qty ☐ ASA Compendium @ \$15.00* x ____ Qty

Name

Position

Organisation

Mailing Address

City

P/Code

Telephone

Facsimile

Email address

Business Category (please tick ✓)

☐ Producer ☐ Materials handler ☐ Industry supplier ☐ Government agency
☐ Processor ☐ Refining/value adding ☐ Specifier/Engineer ☐ Other _____

*Plus postage and handling • Inclusive of GST.

EXPRESS FAX: 4228 1777

