

Report on 2nd Sprayed Sealing Conference 2010

11th–12th October 2010
Melbourne - Australia

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Conference was organized by the ARRB Group with support from VicRoads and contributions made by BP Bitumen among others

Conference theme – *Sustaining sprayed sealing practice.*

Attendance was over 500 delegates attended the Conference.

The Conference was to provide an opportunity for practitioners and policy makers to keep abreast of new developments in sprayed seal design, material selection and construction techniques. It was to contribute to the continued development of sprayed sealing procedures and technologies which are vital to improving the performance of a significant proportion of the road transport system. The focus was on practical issues

Conference commenced with a technical tour on 10th October. The Sprayed Sealing Conference Technical Tour showcased a visit to ARRB's research facilities in Vermont South, where participants had an opportunity to tour ARRB's bitumen laboratories. The Tour featured a visit to ARRB's full scale pavement testing research laboratory, currently testing a two coat emulsion seal on a granular base, and demonstration of a spray run using the French synchronized spraying / spreading method



Accelerated Loading Facility (ALF)



Wheel assembly



French synchronized spraying / spreading equipment

Day one included;

Opening ceremony by Mr Don Larkin, Chairman ARRB Board

Keynote address delivered by Mr Dennis Rossmann, South African National Roads Agency (SANRAL); topic: *Imperatives in sustaining sprayed sealing practice*

Mr Andrew Bethune, of VicRoads Australia presented a video on '*an oral history of Sprayed sealing in Victoria*'

Thompson, Hugh gave an account on '*Pushing the limits of surface seals (N3 Toll Road in South Africa)*'

Esnouf, John talked on *Sprayed seal on Australia freeway* and;
Harrow, Laurence gave an account on *the performance of slag aggregate in chipseals in New Zealand*

Day two of the conference featured special sessions that presented case studies and the biggest issues facing sprayed seals into the future as seen by Australia, New Zealand and South Africa. Practitioners from

Australia, New Zealand and South Africa later presented their solutions to the hypothetical problem

Papers presented in the conference included;

PAVING FABRIC SEAL DESIGN AND PERFORMANCE ON AUSTRALIAN ROADS

Rod Fyfe, Geofabrics Australasia, South Australia

The focus of this paper was the assessment of performance based on design considerations, selection criteria, installation history and overall performance the paper noted that without adequate maintenance paved roads rapidly deteriorate and the escalating cost of paved road rehabilitation highlights the need for cost effective solutions to this problem.

It was noted that Paving Fabrics has been proven to provide the following benefits:

- Prevent the ingress of water by providing a more flexible, homogeneous waterproof layer
- Stabilising pavement moisture content and curbing loss of fines due to pumping
- Bridging shrinkage cracks retarding their propagation to the surface.
- Acts as a stress absorbing interlayer allowing larger deflections in the order of 2–3 mm
- Reinforces and prolongs fatigue life when structural layers are weak/susceptible to rutting
- Cost effective alternative to expensive structural layer replacement
- Resistance to shrinkage from hot bitumen (polyester melting point; 260°C)
- Nonwoven needle punched construction provides bitumen reservoir
- Robustness retards stone penetration and settlement
- Prolongs surfacing life span
- Provides surfacing foundation for future seals

The paper concludes that considering the case studies carried out and taking account of the vast area of application of paving fabric over the last 20 years, evidence of paving fabrics extending the life of surfacing by up to 10 years above the design life of 8-10 years has been shown to provide real benefits to life cycle costing of seals.



Installation of fabrics

MODELLING THE FLUSHING MECHANISM OF THIN FLEXIBLE SURFACED PAVEMENTS IN NEW ZEALAND

Sachi Kodippily, The University of Auckland, New Zealand

Theunis F.P. Henning, The University of Auckland, New Zealand

Jason M. Ingham, The University of Auckland, New Zealand

Peter Genek, Opus International Consultants, New Zealand

The paper notes that flushing is a major cause of maintenance on chipsealed pavements in New Zealand and that accurate understanding of flushing can have a significant impact in terms of predicting future maintenance needs, expenditure, and performance of pavements. Flushing on chipsealed pavements is caused by the upward migration of

binder which results in full or partial covering of surface aggregate. This creates a smooth surface with low skid resistance. As a result, flushing causes major problems in terms of both safety and structural performance of the pavement surface

Factors that can lead to flushing on a chipseal surface include embedment of aggregate into the substrate under traffic loading excessive binder in the chipseal resulting from a build-up of chipseal layers, binder ageing, binder migrating to the surface due to water vapour or excessive amount of fine solid material occupying voids in the chipseal (Lawson and Senadheera, 2009).

Pavement deterioration models make up an essential part of a pavement management system and are used to predict the future performance, maintenance needs and expenditure of road pavements. Therefore, developing a flushing forecasting model remains a priority for the road asset management sector in New Zealand. The research aimed to develop a mechanistic understanding of the processes involved with the flushing defect.

Twenty five pavement sites on state highways of Napier/ Hawke's Bay region of New Zealand were identified, with top surface lives ranging from three to nine years.

The study noted that approximately 30% of chipsealed pavements on the state highway network have failed due to flushing before reaching half the expected life

The study concluded that Surface depth and roughness were found to have the greatest influence on flushing, while surface texture measured by sand circles was found to be a satisfactory indicator of probable flushed chipseals.

TRENDS AND CHANGES IN CHIPSEALING IN NEW ZEALAND

Joanna Towler, NZ Transport Agency, New Zealand

John Patrick, Opus International Consultants Ltd, New Zealand

Peter Howe, NZ Transport Agency, New Zealand

The writers note that an analysis of the age of chipseals when they are resealed on New Zealand state highways shows that, despite increasing traffic stress, there has been no significant reduction in chipseal life. The paper presents data on chipseal lives, compared with changes in traffic

volumes, over a 15 year period. Different initiatives covered include the change from single coat to predominantly two coat chipseals, changes in contract types from traditional to predominantly performance based maintenance contracts, and the introduction of a skid resistance policy. An analysis is made of reasons for resealing and other concepts that may have contributed to chipsealing life remaining substantially the same despite long term continued growth in traffic stress on the state highway network.

SYNTHESIS ON CAPE SEAL VARIATIONS IN SOUTHERN AFRICA

GD van Zyl, Mycube Asset Management Systems, Cape Town, S Africa

JD van Niekerk, PD Naidoo & Associates, Cape Town, South Africa

The writers note that Cape Seals originated in the Western Cape Province of South Africa and are used world-wide with success.

Due to various reasons, several variations to the original composition occur and include different aggregate sizes, binder types and slurry gradings. These alternatives are still referred to as Cape Seals and could perform well, provided appropriate adjustments are made to the binder application, slurry binder content and construction method.

Stone and slurry combination seals are generally referred to as Cape seals and although the initial Cape Seal consisted of 19 mm aggregate and two layers of fine slurry, numerous combinations of binder types, aggregate sizes and slurry gradings are currently used with success on southern African roads, both as initial construction seals and as reseals.

The Cape seal is considered a low risk seal, suitable for construction during cold periods, and can handle heavy vehicle turning actions without loss of aggregate.



Hand-spreading of slurry



Typical spread of aggregate for a Cape Seal

SPRAY SEALS: QUALITY + APPLICATION RATE = PERFORMANCE

*Willem Vonk and Robin van Veldhuysen, Kraton Polymers Research B.V.
Amsterdam, The Netherlands*

The intrinsic quality of spray seal binders is sometimes not reflected in the performance of the spray seal. They are expected to provide the following features: to seal the pavement, to provide skid resistance, not to lose aggregate and not to bleed or fat up.

The demands on the spray seal binder are such that it is not too difficult to define the required performance properties, but the intriguing question is whether one can transform the quality of the binder into the performance of the seal. Premium products are by no means proof and often require more attention than standard operation with unmodified bitumen.

Polymers can bring the cohesive/adhesive strength to keep aggregate in place and retain skid resistance and they also provide the high viscosity to prevent bleeding or fatting up. However, they may also change the boundaries in application conditions that allow these features to be retained on the road.

The paper described when and how critical application conditions will be approached and what can be done to shift the boundaries.

SPRAYED SEALS FOR AIRPORTS

Greg White, Fulton Hogan Pty Ltd, Australia

Where the establishment of mobile asphalt plant in a remote location and importation of asphalt quality aggregate is not cost-effective, sprayed sealing is often the only viable airport pavement surface.

The threat of loose aggregate being ingested into an aircraft engine drives the design and construction of sprayed seals for airports.

The successful adaptation of road sealing techniques to airport pavement application requires modifications to the design and construction of the seal. The design requires high application rates of premium binders to resist the high tyre pressures and wheel loads and to hold the aggregate particles tightly bound. Light aggregate spread rates are also required to prevent aggregate particles from being partially held and then coming loose. It is also common to provide a bitumen emulsion-sand overspray over the seal to lock the aggregate in place. Construction issues that require a different approach include steel drum rolling the uppermost layer and increased rolling effort at the time of construction



Bitumen filled seal

METHODOLOGY USED FOR IDENTIFYING RESEAL PROJECTS IN THE WESTERN CAPE

André van der Gryp, Dept of Transport & Public Works, Western Cape Provincial Administration, South Africa

Mervyn G Henderson, Department of Transport and Main Roads, Queensland, Australia

Gerrie D van Zyl, MyCube Asset Management Systems, Cape Town, South Africa

The paper presented the case of the Western Cape Provincial Administration, South Africa, and noted that it uses a Pavement Management System (PMS) to assist in managing their paved road network. Standardised visual assessments are carried out annually on each surfaced road segment to describe the condition of the road network and to identify the need for remedial action. The need for reseal and priority thereof are based on a calculated Reseal Condition Index (RCI), making use of the degree and extent of observed distress. The visual assessment data is further used to identify the type of seal best suited for each section of the road network requiring reseal treatment.

It was indicated that apart from the highly trafficked roads in the metropolitan areas, which have asphalt surfacing, and those roads connecting Cape Town and nearby rural towns, most of which have asphalt surfacing, surface seals are used on the majority of the WC 6 349 km roads to provide an all weather surface. Predominantly Cape Seals and double seals are used for new construction, while single seals and sand seals are used for reseals.

CHALLENGES FACING THE LABOUR-BASED CONSTRUCTION OF BITUMINOUS SURFACINGS IN AFRICA

David A Mfinanga, University of Dar es Salaam, Tanzania

The paper presents a case study in Tanzania

The writer notes that African countries have many low-volume roads whose management would be more cost effective if surfaced using surface treatments. In most low-income African countries there is scarcity of mechanical equipment for sprayed sealing or surface dressing and their use cannot be justified on many low-volume roads which continue to be more expensively managed as gravel roads. The use of labour based bituminous surfacing of roads is therefore an appropriate, resource conserving and sustainable solution for many rural roads in Africa.

The paper discussed the problems encountered in introducing the technology in Tanzania when training the trainers through practical field demonstrations and suggests solutions. Discussed problems include the low availability of the more appropriate emulsions and the need for a more cutback friendly technology, preparation of a uniform surface, and availability of angular and single sized chippings. A more serious problem is the need for some kind of design of the surface dressing which is a challenge to rural practitioners. This includes the determination of chippings spread rates, appropriate spray rate, choice of type of surface treatment, verification of the quality of chippings and determination of key design input parameters.



Continuous operation of spraying binder and spreading chippings

THE IMPACT OF COLD WEATHER AND HIGH NIGHTTIME TRAFFIC ON AGGREGATE STRIPPING OF A SINGLE SEAL: A CASE STUDY AT BEAUFORT WEST, SOUTH AFRICA

Alan Moffett, Irafaan Sambo and Derrick FJ Pretorius, ARCUS GIBB Consulting Engineers, Cape Town, South Africa

The paper concludes that seals should be placed during warm weather conditions and also not to endure high speed and high volumes of traffic

in the very early stages of the new seal to reduce majority of the stripping (if not all) as the aggregate would be better embedded in the binder

DEVELOPMENT OF A TEST METHOD FOR DETERMINING EMULSION BOND STRENGTH USING THE BITUMEN BOND STRENGTH (BBS) TEST – A SOUTH AFRICAN PERSPECTIVE

Timothy Miller, University Wisconsin – Madison, United States of America

André Greyling, University of Stellenbosch, South Africa

Prof. Hussain Bahia, University of Wisconsin – Madison, United States of America

Prof. Kim Jenkins, University of Stellenbosch, South Africa

Quantifying bond strength between bituminous binders and aggregates demands simple, inexpensive test methods as the road building industry moves toward performance-based specifications for surface seals. This research identifies the Pneumatic Adhesive Tensile Testing Instrument, commonly known as PATTI and originally developed for use in the painting industry, as an appropriate instrument for evaluating bond strength development in the newly proposed Bitumen Bond Strength (BBS) test recently developed at the University of Wisconsin – Madison in conjunction with the University of Ancona – Italy and the University of Stellenbosch – South Africa. The paper discusses the test method and evaluates the relevance of the procedure



Original PATTI assembly

The paper concludes that aside from loading rate, emulsion type and curing interval are identified as the most significant factors contributing to bond strength development. Substrate type is also identified as a significant factor leading to bond strength. Interactions between emulsion type and curing interval are identified as the most significant interaction

USE OF DYNAMIC SHEAR RHEOMETER FOR THE BITUMEN DURABILITY TEST – FEASIBILITY STUDY

Steve Halligan, Main Roads Western Australia, Australia
Sebastien Chatard, SAMI Bitumen Technologies, Australia
Garnet Gregory, Main Roads Western Australia, Australia

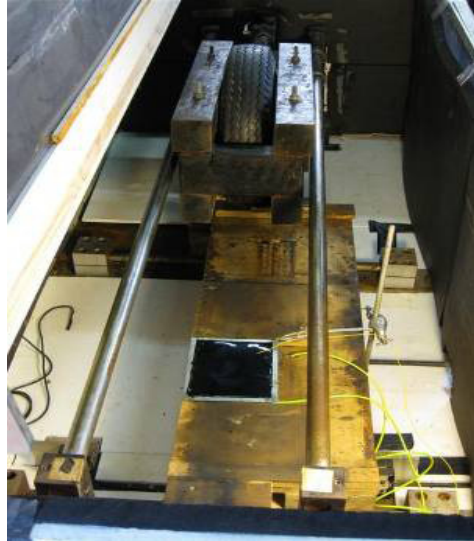
This paper presents work undertaken to investigate the use of a Dynamic Shear Rheometer (DSR) to measure the viscosity in lieu of the sliding plate viscometer. The work included developing a test protocol for the DSR, undertaking a pilot program and comparing DSRs in different laboratories. The work has shown a DSR appears to be an appropriate substitute for laboratories that do not possess a sliding plate micro viscometer

BITUMEN – TYRE ADHESION IN RELATION TO FLUSHED SEALS

Philip Herrington, Opus International Consultants Ltd, New Zealand
Gary Bentley, Opus International Consultants Ltd, New Zealand
John Patrick, Opus International Consultants Ltd, New Zealand
Martin Gribble, Capacity Infrastructure Services Ltd, New Zealand

The paper notes that Chip seals often exhibit substantial areas of bitumen near the seal surface which in hot weather can adhere to vehicle tyres. In New Zealand this 'pick-up' of bitumen onto tyres has in extreme cases led to damage of the seal, resulting in loss of traction and road closures. In less pronounced cases bitumen tracking along the road leads to a gradual loss of skid resistance on non-flushed areas.

Laboratory experiments were undertaken using a range of bitumens and polymer modified bitumens to determine the temperature at which 'permanent' adhesion (sufficient to result in cohesive failure of the bitumen film) to a clean moving tyre first occurs. The results of this work will be used in the development of performance based criteria in a new bitumen specification currently under development in New Zealand.



Bitumen adhesion apparatus.



Tyre with bitumen adhered.

SELECTION OF A SUITABLE PRIME COAT

Simon Kotze, Vela VKE, Pretoria, South Africa

Lucas van der Schyf, TOSAS, Potchefstroom, South Africa

Gerrie D van Zyl, MyCube Asset Management Systems, Cape Town, South Africa

The paper discusses the different prime coat products used under different conditions, highlights the typical problems and makes recommendations regarding the selection of an appropriate prime coat product type for different conditions including different base materials and moisture contents.

The paper concludes that problems are still experienced during the construction of sprayed seals, mainly related to poor adhesion, prime penetration and too slow drying. Observations made during the study indicated that certain products could be appropriate for conditions where it is currently not recommended.

Currently no product is recommended when the base moisture condition is high. However, no distinction is made in the recommendations between a granular and stabilised base. Results from this study indicate that an inverted emulsion prime could be applied under such conditions and also assists in reducing carbonation.

RESEALING WITH BITUMINIOUS EMULSIONS IN THE A.C.T.

Peter Thompson, ACT Government, Roads ACT, Australia

Dante Cremasco, Downer EDI Works Pty Ltd, Australia

This paper looked at the advantages to the Client and the Contractor of resealing with high bituminous content emulsions (HBCE). The new emulsions which have as much as 75% solids are able to be sprayed to produce a single / single reseal which are more cost effective to a client. ACT cites advantages of HBCE as:

- cheaper resealing rates
- extended resealing seasons
- improved safety.

This has been matched by some disadvantages such as:

- greater loose stone issues
- problems with rain events
- problems with high humidity.

THE USE AND PERFORMANCE OF BITUMEN RUBBER IN SPRAY SEALS FOR HOLDING ACTIONS IN RSA

Klasie Jooste, KBK Consulting Engineers, South Africa

Gerrie van Zyl, Mycube Asset Management Systems, South Africa

The paper notes that Non-homogenous Bitumen Rubber was introduced to South Africa in 1983. Due to a rapidly deteriorating road network and visible outstanding performance to extend the life of road pavements, the use of this binder type increased dramatically within a few years.

The purpose of this presentation was to provide some background to the composition of bitumen rubber as used in South Africa, to highlight successes using this non-homogenous modified binder in double seals and to share the lessons learnt

Bitumen rubber has been used with success on roads exhibiting serious cracking and also on roads carrying very high traffic volumes and loads. However the availability and lower costs of synthetic polymer modified binders since 1986, has resulted in more and more roads being resealed with these binders instead of with bitumen rubber.

Typical bitumen rubber composition

Component	% by mass
Bitumen	78
Granulated rubber crumb	20
Extender oil	2

Experience in RSA has shown that the bitumen rubber, mainly due to high viscosity, does not penetrate deep into the 19 mm aggregate matrix, facilitating good adhesion with the second layer of 9.5 mm aggregate and allowing a final product with a dense shoulder-to-shoulder matrix

24th ARRB Conference

12–15 October 2010

Conference theme - *Building on 50 years of road and transport research*

The 24th ARRB Conference held as part of ARRB celebrations of 50 years of service was to challenge participants to apply knowledge from a range of disciplines towards achieving more efficient, safe and sustainable road transport systems. The program focused on the following key issues:

- *Congestion, freight and productivity* (transport networks, transport planning, economics, freight and logistics, innovative heavy vehicle solutions, environment and sustainability)
- *Infrastructure sciences and technology* (pavement design and performance, pavement construction and maintenance, materials technology, concrete and structures)
- *Safe Systems* (road safety engineering, road user behaviour, road design, traffic management, safe vehicles)
- *Infrastructure management* (innovative inventory solutions, infrastructure assessment, asset management, bridge management, infrastructure maintenance, local roads).