AAPA 2012 Study Tour of Europe
Introduction to tour objectives & 5th E&E Congress

AAPA Study Tour to Europe & 5th Eurobitume & Eurasphalt Congress

Robert Vos
AAPA

Presentation Overview

AAPA Study Tour
- Itinerary, Delegates
- Key Topics
- Feedback and early observations

5th Eurasphalt and Eurobitume Congress
- Congress, Themes
- USB Congress proceedings
- Details of Sessions 1 to 8

Itinerary

- 2nd to 21st June 2012
- Tour group 9 Australian roads people
- Six countries & 5th E&E
  - France / Belgium / Netherlands / UK / Turkey / Germany
- Five key topics
  1. Long life pavements
  2. High performance asphalt & binders
  3. Sustainability
  4. Health & Safety
  5. Procurement Systems

Travel route

www.aapa.asn.au
Key topics 2010, 2011, 2012

1. Perpetual Pavements / Long life pavements
2. Warm Mix Asphalt
3. Recycled Asphalt Pavements
4. Accelerated Pavement Testing

1. Surface Treatments
2. Binders
3. Improving Pavement Performance
4. Sustainability

1. Long life pavements
2. High performance asphalt & binders
3. Sustainability
4. Health & Safety
5. Procurement Systems

2012 Study Tour Key Topics

1. Long life pavements
   - Experience, design systems, use, durability & performance

2. High performance asphalt & binders
   - High modulus asphalt (EME, HIMA), modifiers

3. Sustainability
   - RAP/WMA, bitumen substitutes, carbon calculators & energy analysis
     climate change impacts, societal concerns

4. Health & Safety
   - Construction of road works, health considerations for bitumen
     and asphalt products

5. Procurement Systems
   - Proprietary products (Avis Technique, HAPAS, etc.), "green" procurement,
     REACH, responsible sourcing, PPP and contract models

Topic 1: Long life pavements

Overview of reasons

- A revision to the Austroads pavement design guide is required to keep flexible pavements competitive against rigid pavements.
- The proposed revision will take into account the "perpetual pavement concept" underpinned by the asphalt fatigue endurance limit and healing which is widely accepted in the literature (mainly NCAT test track findings).
  - A number of issues hinder implementation in Australia, e.g.
    - evidence of successful implementation by Road Authorities
    - proven structural and material design procedures
    - appropriate laboratory testing and criteria (moduli and fatigue properties)
    - specification, construction and quality control requirements.
  - European performance data will facilitate the validation and calibration of the limiting cumulative distribution of asphalt strain for long life pavements.

Questions

- Fatigue & healing
  - Definition of fatigue/failure
  - Fatigue testing and the determination of endurance limit
  - Correlation between laboratory test results and field performance
  - Effect of binder type on fatigue/endurance
  - Healing of asphalt mixes – testing, effect of traffic loading frequencies

- Contract and construction
  - Initial construction cost – flexible vs. rigid
  - Specification requirements in D&C contract

Topic 2: High performance asphalt & binders

Overview of reasons

- Bituminous binders – key component in the performance and service life of bituminous surfacings & asphalt pavements
- About 90% of the Australian all weather road network length is surfaced with sprayed seals – about 50% of binder usage
- Need to ensure optimum asphalt and seal performance in the field, and to promote best practices suitable to be adapted and adopted in Australia. Seeking details on:
  - new developments and test methods in high performance asphalt and bituminous materials (e.g. HIMA, EME, PMB, Emulsion)
  - actions taken by European and others (e.g. binder manufacturers, asphalt producers and researchers) to overcome field problems (e.g. climate change)
  - correlation between laboratory test results and field trials
Topic 2: High performance asphalt & binders

Questions

• Asphalt
  o EME/HiMA - specification, testing, field links, pavement & subgrade requirement, binder selection & processing
  o Performance & Construction
  o Reinforced, Modified Binders & SMA – design & composition, service life, pros & cons
  o Moisture Susceptibility: measures, tests & approaches
  o PGA/PA: maintenance & performance

• Specifications and Test Methods
  o Approaches to proprietary mix design, types of modifiers used, low temperature test methods, control of segregation & degradation, etc

Topic 2: High performance asphalt & binders

Questions

• Binders
  o concerns: climate change, quality & characteristic of imported material
  o testing level, lab-field correlation, stabilisation of unbound material

• Emulsions
  o test methods
  o types used in sprayed chip sealing
  o performance based specifications

• Surfacing
  o cost benefit of thin surfacings, reasons of application & modelling

Topic 3: Sustainability

Overview of reasons - Challenges

• Climate Change – Green House Gases
• Future Carbon Tax
• Increasing Demand - Limited Resources
• Ageing Infrastructure - Rehabilitation
• Waste Reduction - Focus on Recycling
• Reduced Construction Periods – Minimise Delays
• Society’s Perceptions & Funding Constraints

Topic 3: Sustainability

Questions

• Recycled Asphalt Pavement (RAP)
  o How Extensively Used / Percentage Added
  o RAP Materials – QA, Binder Types, Ownership
  o Mix Design Changes – Binder Type & Quantity
  o Production Issues – Blending, Mixing, “wet” RAP
  o Placing issues

• Warm Mix Asphalt (WMA)
  o How Extensively Used
  o What Technologies – Most common
  o Design & Testing Changes
  o Problems / Performance Issues

• RAP in WMA
• Other Low Temperature Technologies

Topic 3: Sustainability

Questions

• Bitumen Alternatives
  o Long Term Binder Availability
  o Reliance on Oil

• Carbon & Energy Calculators
  o What, When, Where & Why are they used?

• Climate Change
  o Is it being considered?
  o What Material / Specification changes?

• Societal Concerns
  o Perceptions of Asphalt Industry
  o Other Recycling Opportunities

Topic 4: Health & Safety

Overview of reasons

• Australia has high expectations & legal requirements for a healthy & safe operating environment – key operating focus
• Europe is considered to be aware and sensitive to this requirement
• Recent changes to the European operating environment (REACH, IARC, austerity) may have impacted and lessons learnt could be shared

• Specific issues and implications for Australia
  o Improving road work site safety
    - full closure / contraflow / automatic aids / speed
  o Increased environmental awareness & society friendly treatments
    - new developments / emerging concerns
  o impact of REACH on products and operations
  o IARC classification of bitumen
**AAPA 2012 Study Tour to Europe**

**Introduction to tour objectives & 5th E&E Congress**

---

### Topic 4: Health & Safety

**Questions**
- **Health**
  - Impacts of IARC classification of bitumen on industry?
  - Has REACH impacted on the supply and use of products?
  - Drive for healthier products? What products?
  - Noise – measured, surfacing, options, maintenance?
- **Safety**
  - Statistics – injuries & fatalities? How measured & collected?
  - What are the greatest road worker risks?
  - What training is available?
  - What techniques / methods for safer maintenance?
  - Communicating road worker safety needs to the public – how?
  - Urban & multi accessed sites – any special safety approaches?
  - Are higher safety road surfacing products preferred?

---

### Topic 5: Procurement Systems

**Overview of reasons**
- Australia has tried to set up systems like Avis Technique & HAMS but have been unsuccessful
- The benefits of innovation and declining skills in the road authorities point to its greater use.
- Lessons learnt, benefits of the systems used, changes to purchasing to accommodate and implications for road authority expertise is sought.
- Use of the systems to promote innovation and product development in new areas such as CO2 reduction, energy efficiency, noise reduction, etc.
- The use of procurement systems from PPP, Alliancing, DBOM, EO including normal contracts, long & short term contract maintenance systems.
  - What key performance characteristics over time?
  - How to retain the culture of stewardship in the contracting agency?
  - How to retain expertise on the road authority to manage / ensure value-for-money?

---

### Topic 5: Procurement Systems

**Questions**
- **Systems**
  - Avis Technique systems – are they working / cost effective?
  - Lessons learnt, still promoting innovation?
  - How are underperforming products addressed?
- **Functional and performance requirements**
  - Are performance based specifications used?
  - What test methods used to measure performance / proprietary?
  - Functional specifications and fitness-for-purpose assessed over time – how is this done?
  - How are environmental / traffic loading changes included in the assessment?
  - Define what a “warranty” means, for how long, end state?
  - Can proprietary product systems replace performance-based specs?
  - Can “green procurement requirements fit into the system (CO2, energy)
Introduction to tour objectives & 5th E&E Congress

Paris, France: USIRF, IBEF, Colas

Paris, France: Colas Lab

Paris, France: Colas Lab

Brussels, Belgium: Eurobitume & Eurasphalt

Netherlands, Amsterdam: Andre Molenaar & Kraton

Netherlands, Delft: DVS & VBW-Asphalt
AAPA 2012 Study Tour of Europe
Introduction to tour objectives & 5th E&E Congress

UK, London: Highways Agency

UK, London: TRL

Germany, Cologne: bast

Germany: Construction site

Germany: traffic lanes cleared for construction

Feedback sessions
November 2012
Adelaide, Melbourne, Sydney & Brisbane
Introduction to tour objectives & 5th E&E Congress

Three Day Congress held every 4 years
Premier European event for binders & asphalt
Over 1000 delegates
Moderated sessions & selected presentations
Eight sessions covering the selected paper themes

CONFERENCES USB PROCEEDINGS AVAILABLE

Themes

- Energy & Carbon
- Durability & Performance – mixtures & binders
- Resource use & recycling
- Adapting to climate change
- Societal impact
- Responsible sourcing and green procurement
- Improving health and safety
- Financing road infrastructure and maintenance

USB memory stick of the congress proceedings

Windows 7

Mac OS 10.8
Introduction to tour objectives & 5th E&E Congress
Energy & Carbon: Jan van der Zwan: How to minimise the carbon footprint of asphalt roads

Session 2

CO2 emission and Asphalt

- CO2 emission transport app. 4700 Mton
- Global annual asphalt production 1600 million ton / year
- Equals app. 96 Mton CO2
- ~2% of emission of road transport

Asphalt and other products

- Carbon footprint asphalt 00 g CO2e /kg
- Carbon footprint orange juice 1600 g CO2 e/kg
- Carbon footprint cheeseburger 0000 g CO2 e

Other possibilities?

- Highest emissions by traffic
- How to influence energy use by traffic?
  - Reduce rolling resistance
  - Reduce aerodynamic resistance
  - Traffic management
  - Speed

Asphalt, the sustainable road to success
Conclusions

- Yes, we can reduce the carbon footprint of roads
- Always take the life cycle effects into account
- Large effect by reducing amounts of asphalt (increase quality, rethink design and maintenance strategies)
- Reduce energy use in total production line
- Be clear about ambition and costs
- There is a need for standardisation in instruments and quality management of data
- Use the possibilities to reduce energy use by traffic

Durability & Performance:
Andre Molenaar:
Durability, a prerequisite for sustainable asphalt pavements

- Thinner Structures and Longer Lifetime
- Better Quality
- Extension lifetime by use of e.g. “Beauty Creams”
- High RAP % in new mixtures
- Warm asphalt mixtures (foam) especially in combination with recycling

CAN WE DO THIS?
Conclusions

- Perpetual asphalt base courses can easily be built using high % of RAP and other bituminous “waste”
- Fractionize the RAP
- “Green” modifiers are effective
- Energy needs to produce asphalt mixtures can be reduced further
- Recycling using low-temperature techniques is “green” asphalt technology

Sustainable AND Durable Pavements

- Thinner Structures and Longer Lifetime
- Better Quality
- Extension lifetime by use of e.g. “Beauty Creams”
- High RAP % in new mixtures
- Warm asphalt mixtures (foam) especially when recycling

CAN WE DO THIS? YES WE CAN!

Health & Safety in the 21 century:
Carl Robertus: Bitumen Health & Safety

Session 3

AAPA 2012 Study Tour to Europe – USC CPD Sept 2012 v1
www.aapa.asn.au

Context

Is working with bitumen safe?

- Scientific studies
- Society demands rigor & reassurance
- Aim for zero impact on people & environment

Yes, when used correctly, working with bitumen is safe

Hazard, Exposure and Risk

Risk is a function of Hazard & Exposure
Risk = Hazard * Exposure

- Health Impact
- Likelihood of a Health Effect

<table>
<thead>
<tr>
<th>Hazard</th>
<th>Exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heat / High Temperature</td>
<td>Dermal Contact</td>
</tr>
<tr>
<td>Irritation</td>
<td></td>
</tr>
<tr>
<td>Cancer (primary or secondary)</td>
<td>Dermal Contact, Irritation</td>
</tr>
<tr>
<td>Fumes (respiratory tract irritation)</td>
<td>Irritation</td>
</tr>
</tbody>
</table>

No Exposure
No Risk, No Health Impact
Introduction to tour objectives & 5th E&E Congress

IARC & REACH
IARC is all about HAZARD
REACH is all about RISK

EC Regulation (EC) No 1907/2006

Emission & Exposure

Emission
Exposure

Historic Exposure

Exposure Reduction
**Introduction to tour objectives & 5th E&E Congress**

**Safety**
- Safe Inacting & delivery
- Transportation
- Safe Handling, Burns Card
- Maximum Safe Handling Temperature
- Environment

**Recycling & Reuse**
- Success Story
- Use, use and use again!
- Fit for Tomorrow

**Conclusions**

**Health**
- Bitumen is not classified as hazardous to health or to the environment
- Karriers of working with bitumen are now defined
- Risks are very low and can be reduced further through exposure reduction
- Temperature control and reduction are key

**Safety**
- Bitumen is usually handled and applied hot
- Workers can be adequately protected by:
  - following good practices and
  - using the right equipment (PPE)

**Environment**
- Bitumen is Green
  - 100% renewable
  - Medium low footprint

**Finally**

*When used correctly, working with bitumen and asphalt is and remains safe*

**World in CO₂ emissions**

*Asphalt, the sustainable road to success*
Sustainability, Energy use and Climate Change:

Lazlo Gaspar: Adaptation measures to the challenges of climate change in Hungarian road construction

2 Climate change challenges in road sector I.

- Dangerous climate elements for highways:
  - extreme low temperature,
  - extreme high temperature,
  - extreme precipitation,
  - extreme hydraulic features,
  - excessive wind storms.

2 Climate change challenges in road sector II
AAPA 2012 Study Tour of Europe
Introduction to tour objectives & 5th E&E Congress

Climate change challenges in road sector

<table>
<thead>
<tr>
<th>Climate change element</th>
<th>Effect</th>
<th>Properive answer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drought</td>
<td>Embankment slope cracking</td>
<td>Paved slope</td>
</tr>
<tr>
<td>Steep embankments</td>
<td>Shoulder erosion</td>
<td>Proper shoulder</td>
</tr>
<tr>
<td>Accidental water on surface</td>
<td>Water penetration into pavement</td>
<td>Dense asphalt course</td>
</tr>
<tr>
<td>Intensive (heavy) rain</td>
<td>Closing of ditches and culverts</td>
<td>High capacity drainag</td>
</tr>
</tbody>
</table>

Asphalt, the sustainable road to success

3 Proposal for road specifications

- Review of Hungarian road-related standards and technical specifications
- Examples:
  - Design (minimum pavement and embankment slope crossfall, structure resistance to their damages etc.)
  - Construction (qualitying water pressure and freezingshawing effects, asphalt behaviour under extreme temperatures, rheological characteristics in changed environment, drain asphalt durability, etc.)
  - Maintenance and operation (special winter pavement maintenance techniques, techniques after flood, improved cold and hot pothole repair measures, new rut repair techniques against aquaplaning etc.)

Resource use and Recycling:
Jean-Pascal Planche: Moderators report

Session 5

- Resource use and Recycling
  - Session 5: Resource use and Recycling
  - Jean-Pascal Planche: Moderators report

- Case studies

E&E 2012 - Session 5
Resource use and Recycling

Jean-Pascal Planche
Istanbul. 06/14/2012

Western Research Institute

Main Theme: Waste recycling in Asphalts

- Waste recycling: a worldwide issue, and now a worldwide awareness
- Addressed in this session:
  - Ground tire rubber - GTR (7)
  - Recycled Asphalt Pavement - RAP (4)
  - Sulfur (3)
  - Waterproofing membranes (2)
  - Plastic (2)

End of life tire recovery in Europe since 1996

Asphalt, the sustainable road to success
Sulfur recycling

3 Papers: Nicholls, Nazarbevyl and Masegos

- Principle: Sulfur in bitumen or extended asphalt
- Dispersion of sulfur in bitumen: dissolved below 20% evaporated or segregated as solid crystalline
- Compatibility of bitumen, H2S emission at production and during hot recycling (not addressed in the papers), characteristics / performances

Ground Tire Rubber

Introduction to tour objectives & 5th E&E Congress

Warm Mix Asphalt and Low Temperature Techniques

Bernard Eckmann: Moderator Report
Introduction to tour objectives & 5th E&E Congress

Warm Mix Asphalt and Low Temperature Techniques

Session 6-1
Bernard Eckmann

Warm & Low Temp. Techniques – 6.1

- Inology: friction at interfaces
  - Foam technology:
    Greater binder film on coarse aggregate → easier compaction at lower temp.
  - Chemical or wax additives:
    Similar "lubrication" behaviour as unmodified bitumen at higher temp.

Warm & Low Temp. Techniques – 6.1

Performance of WMA - Emulsion technology

- Test trial – use of a bituminous emulsion
  - Specifically designed emulsion: 69% - 50/70 – special emulsifier
  - Studies on lab manufactured and re-compacted field samples
    - GC samples, Marshall, ITS, ITS, WT
    - Satisfactory and essentially comparable

Warm & Low Temp. Techniques – 6.1

Performance of WMA - Zeolite technology

- Binder hardening: RTFOT (Temp., Time)

Warm & Low Temp. Techniques – 6.1

Performance of WMA - Wax technology

- Performance of WMA - Surfactant technology

Warm & Low Temp. Techniques – 6.1

- WMA - Performance in comparison to HMA
  - Stiffness & permanent deformation (less oxidative ageing)
  - Sensitivity to level of applied stress (MSCR test)
  - Water sensitivity

- WMA - Relation between binder and mix characteristics
  - Standard HRTU procedure needs to be adapted
  - Are extracted binders truly representative?
Worth noting . . . .

- Significant work on binder rheology
- Frost / thaw damage & impact on design
- Specification harmonisation
  - Standardisation of test methods
  - Selection of tests & round robin testing
- Dynamic Shear Rheometer DSR and MSCRT Multiple Stress Creep Recovery Test
AAPA 2012 Study Tour to Europe
Introduction to tour objectives & 5th E&E Congress

**Permanent Deformation (0402)**
- Binder parameters vs WTT
  - 90°C softening point, PAV, DSR (0-6 GPa)
  - Small scale WTT (BS EN 12697-22)
- Binders
  - Larox data base
  - Penetration grades, multi grade & wax modified (9)
  - Elastomeric & plastomeric PMBs (11)
- MSCRT
  - 1 sec loading, 9 sec recovery
  - Stress levels (30, 100, 300, 1000 Pa)
  - 10 cycles @ each stress level
  - 40°C & 60°C temperatures

Jnr “non-recoverable creep compliance”

Asphalt, the sustainable road to success

**Durability & Performance**

- Development of new tests and techniques.
  - More than 10 new or not widely known tests
- Binders characterization
  - Performance properties related to mix properties
- Validation with asphalt mixes
  - Different experiences at laboratory and field level
- Development of new binders
  - New promising additives (organoclays, prepolymers or supramolecular)

Asphalt, the sustainable road to success

**Multiple Stress Creep Recovery Test** MSCRT

*Jn* has a very high correlation to WTT and pavement rutting incl
- PMB
- Aged binder

**Durability & Performance: Mixtures**

Ann Vanselstraete: Moderator Report

**Session 8**

**Durability & Performance: Mixtures**

Moderator report

Ann Vanselstraete
Belgian Road Research Centre
Introduction to tour objectives & 5th E&E Congress

General overview

- About 45 papers in total (too many to mention all papers here)
- Subtopics:
  - Testing methods to assess performance and durability
    - Tests for adhesion is an important item
    - Testing of fatigue, stiffness modulus, permanent deformation, low temperature cracking, ageing
    - New testing methods and equipment
  - Performance models: few papers
  - Products added to bitumen or mix to improve performance
  - Importance of production, laying and approval system
  - Monitoring of durability in the field

Products to improve performance

Mostly confirmations of earlier findings:

- The advantages of PMB:
  - Highly modified binders in either thin performing wearing courses or
    wearing courses with high demands for durability (188 – G. Simard et al.;
    196 – D. Timm et al.)
  - Direct addition of polymer powder into the mix: good experience and
    interesting for small job sites (paper 162 – B.B. Jensen et al.)

- The positive impact of crumb rubber: the increase in performance in
  fatigue and/or rutting depends highly on the technique used for
  blending (paper 483 – H. Ozturk et al.)

- Addition of polypropylene fibres: increase of stiffness modulus and
  resistance to permanent deformation (paper 170 – B. Tapkin et al.)

Testing methods and modeling

Modulus – Low temperature cracking

Testing methods and modeling

Adhesion and cohesion

Binder level

Adhesion

Binder - aggregate

Cohesion and Adhesion on asphalt

Testing methods and modeling

Resistance to fatigue

Mostly confirmations of earlier findings:

- Polyphosphoric acid: as additive especially to improve the stiffness
  and ageing performance (paper 140 – O. Shulak et al.)

- Advantages of applying hydrated lime:
  - Positive impact on the stripping potential, on winter damage and
    ageing (papers 372 – Dony; 355 – Iwanski; 437 – Mollahosseini)
  - An appropriate and practical method to determine the quantity of
    hydrated lime (paper 299 – Leveu)

No really new materials reported

Asphalt, the sustainable road to success
Congress - Concluding remarks

- Asphalt, the sustainable road to success
- Asphalt is 100% recyclable
- By reducing the risks of failure and by providing a high(er) quality, at reduced production and paving temperatures . . .
- Sustainability is a real challenge that can be realised by using the techniques and knowledge presented at the congress in Istanbul
- We have to move forward
- Road authorities: If you want higher quality: Ask for it
- We need to change attitude to move forward

Yes . . . Just do it

Thank you for your attention

Asphalt, the sustainable road to success

USB memory stick of the congress proceedings