

### 2012 Study Tour Key Topics

1. Long life pavements
  - o Experience, design systems, use, durability & performance
2. High performance asphalt & binders
  - o High modulus asphalt (EME, HiMA), modifiers
3. Sustainability
  - o RAP/WMA, bitumen substitutes, carbon calculators & energy analysis  
climate change impacts, societal concerns
4. Health & Safety
  - o Construction of road works, health considerations for bitumen and asphalt products
5. Procurement Systems
  - o Proprietary products (Avis Technique, HAPAS, etc.), "green" procurement, REACH, responsible sourcing, PPP and contract models

### Topic 3: Sustainability

*Overview of reasons - Challenges*

- o Climate Change – Green House Gases
- o Future Carbon Tax
- o Increasing Demand - Limited Resources
- o Ageing Infrastructure - Rehabilitation
- o Waste Reduction - Focus on Recycling
- o Reduced Construction Periods – Minimise Delays
- o 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 3: Sustainability

*"Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs."*  
United Nations World Commission on Environment and Development

3 Pillars

- Environmental
- Economic
- Social well-being

• Today and Tomorrow.



### Topic 3: Sustainability

**EU goal to reduce primary energy use 20 % in 2020**

UK targets		Swedish targets	
Reduction in GHG		Reduction in GHG	
2020	34 %	2012	4 %
2050	80 %	2020	40 %
		2050	no net emissions

Baseline year 1990

- EU's Emission Trading Scheme, where CO<sub>2</sub>- licences are sold
- Technique is not the problem, problems are always political and managerial

### Topic 3: Sustainability

- UK Decision Makers
  - Policy is not an obstacle - opportunity for the local industry
  - New Technologies
  - Competitive Advantage
  - Most Rapidly Growing Sector
  - Generates Jobs
  - Export Opportunities
- European Recession and Financial Crisis
  - Lowest Capital / Whole Life Cost ≠ Lowest Carbon Footprint?

### Topic 3: Sustainability

- European standardisation work - sustainable use of natural resources.
- CEN TC350 Sustainability of Construction Works
  - Designed, built and demolished so that the use of natural resources is sustainable.
  - Environmental product declarations (EN 15804) contain core rules
- Recycling, durability and environmentally compatible raw materials.

### Topic 3: Sustainability

#### Reduction in Delays has a big Effect on Pollution

Ecoles des Mines  
Source: EAPA

- Main environmental loads come from the use of the road, not from the initial investment.
- Low rolling resistance pavements => 3–5% reduction in fuel consumption

### Topic 3: Sustainability

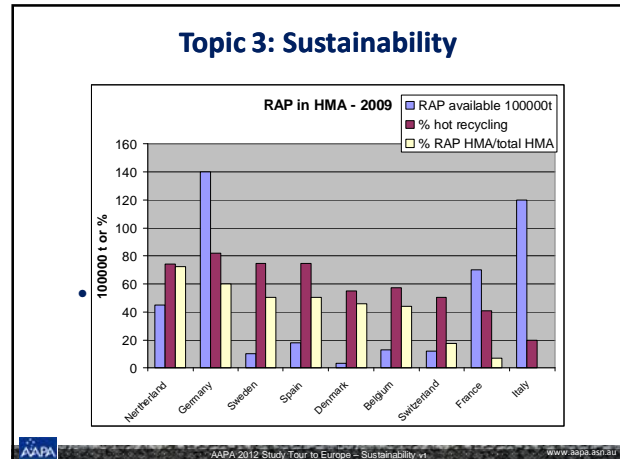
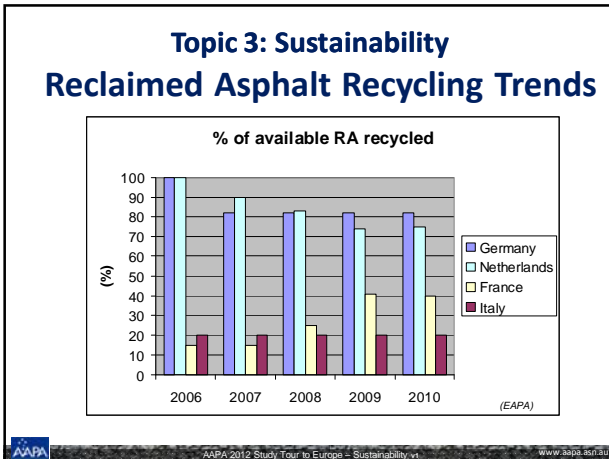
#### Globale CO2 footprint asfaltconstructie

- Recycled Asphalt Pavement (RAP) to reduce the demand for raw materials
- Warm Mix Asphalt (WMA) techniques to reduce the energy demand during asphalt production.

### Topic 3: Sustainability

#### Recycled Asphalt Pavement (RAP)

- 1st goal is Recycling of RAP
  - same function as in the original application
  - adding the reclaimed asphalt to new asphalt mixes
- 2nd option is Re-use of RAP
  - lesser function than in the original application
  - foundation, fill or base course material



- ### Topic 3: Sustainability
- %RAP depends on the type of mix (The Netherlands):
    - Stone Mastic Asphalt Nil
    - Porous Asphalt Concrete 20%
    - All other mixtures and layers 50%
    - Allowable amount of RAP will increase in the future
    - Mixtures made of 100% RAP have been produced.
  - Dutch practice is to mill off and separate each different mix type into separate stockpiles
  - French place strong emphasis on homogenous stockpiles of RAP
  - More optimal RAP management is needed to fully utilise the recycling potential

- ### Topic 3: Sustainability
- #### Approaches to Increasing RAP Content
- #### Circular letter of the French Ministry of Ecology February 9, 2009
- Two recommendations
- Authorize the incorporation of 10 % of recycled asphalt in the asphalt concrete without type testing (NF EN 13108)
  - Integration, into government contract, of criteria which encourage the use of recycled asphalt.

- ### Topic 3: Sustainability
- #### Approaches to Increasing RAP Content
- #### The Netherlands - "Rijkswaterstaat" (RWS) adopted a market approach
- Use functional specifications and give design freedom to the market
  - Do not prescribe solutions unless there is a specific reason
  - Do not prescribe recycling, low energy asphalt, sustainable materials
  - Challenge the market to come forward with innovations (techniques, materials, processes)

- ### Topic 3: Sustainability
- #### Increasing asphalt recycling requires:
- Stronger support from the authorities and engineering community / consultants.
  - Adapt asphalt specifications
  - Regulations with regard to dumping / tipping of re-useable material
  - RAP should be regarded as a building material and not as a waste
  - Client stimulus to recycle
  - Legislation to stimulate recycling
-



### Topic 3: Sustainability

WASTE / BY-PRODUCTS / SURPLUS

- Construction and demolition waste (mixtures of concrete and masonry) as high quality base and subbase layers. May be improved by foamed bitumen or cement stabilization.
- Slags from the metallurgic industry
- Ground tyre rubber (GTR)
- Polyolefin plastics recovered from waste streams
- Sulfur - “desulfurisation” to meet new sulfur limits in various light petroleum





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### Topic 3: Sustainability

WASTE / BY-PRODUCTS / SURPLUS

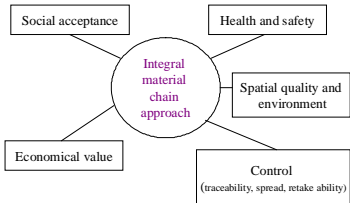
- “Re-recycling” of waste recycled asphalt pavements with respect to hazards and performance.
- Waste products in asphalt should not subsequently restrict the recycling of that asphalt.
- Adaptation or devising new test methods / specifications / mix design / pavement design for these new materials.
- The quality of asphalt must not be risked by solving a recycling problem of another material.

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### Topic 3: Sustainability

WASTE / BY-PRODUCTS / SURPLUS

- Some waste materials have a negative market value
- Who takes the long term risks?

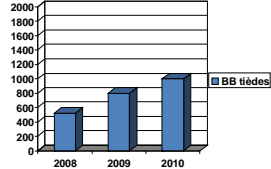


The diagram shows an 'Integral material chain approach' at the center, surrounded by five boxes: Social acceptance, Health and safety, Spatial quality and environment, Control (traceability, spread, remake ability), and Economical value.

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### Topic 3: Sustainability

- Many Warm Mix Asphalt production techniques originate in Europe
- Relatively limited use of the technologies
- EAPA Environment Group's 2012-2014 Work Plan for Sustainability - stimulate the use of Warm Mix Asphalt



Year	Production (tonnes)
2008	~500,000
2009	~800,000
2010	~1,000,000

WMA in France

- 2008 ≈ HALF million tonnes
- 2010 ≈ ONE million tonnes

40 millions tons/year of HMA

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### Topic 3: Sustainability

- Benefits of WMA recognised
  - Reduced energy costs
  - Reduced emissions
  - Better working conditions
  - Less oxidative hardening
  - Use of higher RAP contents
  - Extended paving seasons
- Some questions remain to quantify WMA efficiency
  - Reduced energy consumption
  - Environmental benefits
  - Performance of WMA mixes as compared to their HMA
  - Stiffness and rutting resistance (due to reduced oxidative ageing)
  - Water sensitivity
  - Low temperature performance
  - Relevance of the RTFOT short term ageing procedure

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### Topic 3: Sustainability

- A high degree of recycling gives far bigger effect on carbon emissions than low production temperature.
- The high recycling percentage should not be sacrificed to get lower production temperature.
- Both of these can be reached with WMA-process.
- RAP represents major stakes for both bitumen and aggregate resource conservation.
- Better and more optimal RAP management
- Waste / by-products must not reduce the quality of asphalt or restrict future recycling of that asphalt.

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### Topic 3: Sustainability

- Three pillars: environment, society and economy
- Sustainable development gives opportunities, it is not only a threat
- High quality durable pavements with long life
  - Reduce risk of premature failure
  - High quality during the asphalt production and paving
  - Well trained workers
  - Good knowledge of asphalt as a construction material

