HAPAS and Warm Mix Asphalt

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Highway Authorities Product Approval Scheme

• Set up by Highways and local highway authorities
• Certification scheme to ease specification of proprietary products
• Proprietary products applies responsibility to suppliers
• Need buy in from suppliers
• Concerns about stifling innovation
Highway Authorities Product Approval Schemes (HAPAS)

• Schemes currently in place
  – SG1 - High-friction surfacing systems
  – SG2 - Over-banding
  – SG3 - Thin asphalt surfacing systems
  – SG4 - Modified bituminous binders
  – SG5 - Cementitious repair materials
  – SG6 - Parapet anchors
  – SG7 - Bridge-deck waterproofing
  – SG8 - Reinstatement materials (HAUC)
  – SG9 - Coloured surfacings (durability)
• ......
Definition of Thin Surfacings

• “A proprietary bituminous product with suitable properties to provide a surface course that is laid at a nominal depth of less than 50 mm”

• Permits:
  – Hot mixed asphalts
  – (Multiple) surface dressings
  – Slurry surfacings / microasphalts

• Categories of nominal thicknesses:
  – Type A < 18 mm
  – Type B 18 mm to 25 mm
  – Type C > 25 mm to < 50 mm
BBA-HAPAS procedure for thin surfacing systems

- Quality assessment
- System installation trial
- Three 2-year system performance trials
  - Mandatory properties
  - Optional properties
- Laboratory testing
  - Mandatory properties
  - Optional properties
Tests for HAPAS approval of thin surfacing systems

• Mandatory
  • Laboratory tests
    • PSV and AAV
    • Wheel-tracking
    • Torque bond
    • Water sensitivity
  • Road tests
    • Visual condition
    • Texture depth
• Optional
  • Stiffness modulus
  • Retained stiffness in diesel
  • Ageing
  • Resistance to stripping
  • Noise reduction
  • Improvement in regularity
  • Spray Reduction
  • Enhanced skid resistance
HAPAS procedure for high-friction surfacings

- Quality assessment
- System installation trial
- Performance trial
- Laboratory tests
  - Thermal movement test
  - Scuffing test
  - Wear test
  - Tensile adhesion test
  - Heat-ageing conditioning procedure
  - Freeze/Thaw conditioning procedure
  - Diesel Susceptibility conditioning procedure
- Optional tests
  - Installation temperature
  - Substrate texture depth
  - Concrete substrate
HAPAS Schemes

• Thin surfacing systems
  - Multiple properties (often mutually exclusive)
  - Need to specify each property required
  - Applicability to traffic assessed from trials

• High-friction surfacing systems
  - Primarily interested in skid resistance and durability
  - Allow classification into three classes
Categories of lower temperature asphalt

- Cold Mix Asphalt
- Half-Warm Mix Asphalt
- Warm Mix Asphalt
- Hot Mix Asphalt

Typical energy to mix (kJ/tonne) vs Temperature (°C)

- Heating
- Vaporisation
- Drying

Latent heat of Vaporisation
Approaches to produce cooler mixtures

- Many different approaches
- Categories in many ways
- Generally:
  - Organic additives
  - Chemical additives
  - Emulsion-based processes
  - Water-bearing additives
  - Water-based processes
Organic additives

- Waxes, amides and sulphur
- Reduce the viscosity of the binder above the melting point
  - Possible to reduce the production temperature
- Increase the stiffness of the binder below the melting point
- Melting point must be higher than in-service temperature
  - Permanent deformation may occur
  - Minimise embrittlement at low temperature
- Products
  - Asphaltan-B
  - Cecabase RT
  - Ecoflex
  - Isomerized Paraffin
  - Licomont BS 100
  - Sasobit
  - Shell Thiopave
  - Sübit
Chemical additives

• Includes surfactants
• Emerging group of additives for WMA
• Improves ability of bitumen to coat aggregate particles at lower temperatures
• Does not reduce the bitumen viscosity
• Some added similarly to anti-stripping agents
  - Concentrations as low as 0.3 % by mass of the bitumen
• Products
  - HyperTherm
  - Low Emission Asphalt
  - Qualitherm
  - Rediset WMX
  - REVIX
Emulsion-based processes

- High-residue bitumen emulsion mixed with hot aggregate at mixing temperatures between 85 °C and 115 °C
- Water flashes off as steam
- Bitumen emulsion specifically designed for the HWMA process
  - Includes additives to improve coating, workability and adhesion
- Modified process, called dispersed asphalt technology (DAT)
  - Same chemical package diluted with a small amount of water
  - Injected into asphalt line just before the mixing chamber
- Products
  - Evotherm / Evotherm DAT
  - Warm Recycling
Water-bearing additives

• Small amounts of water added to a warm mixture via
  - Foaming nozzle or expansion chamber
  - Incorporating a hydrophilic material such as zeolite
  - Having damp aggregate

• Water vaporises and encapsulated into the binder
  - Steam bubbles are forced into the continuous phase of the bitumen
  - Expands until thin film of bitumen holds bubbles through surface tension
  - Volume of water expands by factor of 1,673 when it turns to steam

• Dispersion of water in hot asphalt expands binder phase
  - Corresponding reduction in the mix viscosity
  - Improvement in the workability

• Product
  - Advera WMA
  - Aspha-min
  - ECOMAC
  - LEAB
  - LT Asphalt
Water-based processes

- Modified binder/aggregate mixing process to achieve lower mixing and placement temperatures

- Some require additives of various types

- Several proprietary processes based on:
  - Mixing the binder (in foam or liquid state) with coarse and fine aggregates sequentially
  - Mixing the aggregate with two different binders (again in foam or liquid state) sequentially

- Relatively inexpensive
  - Provided plant modifications are minor

- Products
  - Many
Water-based processes

• Products
  - Accu-Shear Dual WMA System
  - Aquablack WMA
  - Double Barrel Green
  - Eco-Foam II
  - Green Machine
  - Half-Warm Foamed Bitumen Process
  - HGrant Warm Mix System
  - Low Emission Asphalt (LEA)
  - Low Energy Asphalt
  - Meeker Warm Mix
  - Terex WMA System
  - Ultrafoam GX
  - WAM Foam
Will warm mix asphalt save the planet?

- Lower temperature = Less heating
- Less heating = Less energy (as well as less cost)
- Q.E.D. more sustainable

**BUT**

- That implies concrete more sustainable than asphalt !!!
- Need to include components
  - Winning
  - Preparation
  - Transport
Lower temperature asphalt

• What is it?
  - It is cool alternative to hot mix asphalt

• How is it done?
  - In various ways for various proprietary products

• Can it be made?
  - Construction is generally very similar to hot mix asphalt

• Does it work?
  - It can work

• Will it save the planet?
  - It can help to save the planet, but not as much as might be expected

• But it is worth consideration
Do You Have Any Questions?