SUSTAINABLE SOLUTIONS FOR ASPHALT PAVEMENTS:
A EUROPEAN APPROACH

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International Bitumen Emulsion Federation
THE IBEF

- International Bitumen Emulsion Federation
- Founded in 1996
- 21 countries represented
- A forum of exchange and promotion of best practices
International Conference for Road Engineers

THE IBEF

- International Bitumen Emulsion Federation
- Worldwide production: 8,137,702 MT (2016)
- Bitumen: 103,120,054 MT
0. CONTENT

- Introduction to the European market
- Recycling
- Emulsion based systems
- Warm mixes
- Pavement design optimization
- Conclusions
1. INTRODUCTION TO THE EUROPEAN MARKET (EU28)

<table>
<thead>
<tr>
<th>Material</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asphalt mixes</td>
<td>227.1 Mio T</td>
</tr>
<tr>
<td>Bitumen</td>
<td>11.7 Mio T</td>
</tr>
<tr>
<td>Emulsions</td>
<td>1.8 Mio T</td>
</tr>
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</table>
# 1. INTRODUCTION TO THE EUROPEAN MARKET (EU28)

<table>
<thead>
<tr>
<th></th>
<th>EU 28</th>
<th>Korea</th>
<th>USA</th>
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<tbody>
<tr>
<td>Asphalt mixes</td>
<td>227.1 Mio T</td>
<td>26.2</td>
<td>340.0</td>
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<tr>
<td>Bitumen</td>
<td>11.7 Mio T</td>
<td>1.8</td>
<td>20.3</td>
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<tr>
<td>Emulsions</td>
<td>1.8 Mio T</td>
<td>0.07</td>
<td>1.9</td>
</tr>
</tbody>
</table>
1. INTRODUCTION TO THE EUROPEAN MARKET (EU28)

- A unified market
  - European standards and regulations
  - European organizations: EAPA, Eurobitume
- Some common drivers
  - Environmental, economical and social requirements
  - Budget restrictions
- With many national specificities
  - 28 countries with 28 sets of habits and regulations
1. INTRODUCTION TO THE FRENCH MARKET

- Focus on France
  - A large road network: 1 million km
  - A strong relationship between road authorities and the industry
  - Tools for innovation
  - 2009: a voluntary agreement gathering road agencies, consultants, counties, industry
1. INTRODUCTION TO THE FRENCH MARKET

- Voluntary agreement including 10 goals from which:
  - Preserving non renewable resources
  - Reduce emissions of GHG and energy consumption
  - Improve the environmental performance of the road
  - Promote R&D and disseminate outcomes
1. RECYCLING

- Preserving non renewable resources
- Asphalt recycling
- In plant
  - Hot recycling
  - Cold recycling
- In place
  - Cold recycling

In place recycling

Hot recycling use of RAP
Cold recycling with emulsion
Cold recycling with emulsion / cement

Graph showing percentage of countries' recycling methods.
1. RECYCLING

- Preserving non renewable resources
- Circular economy
  - (Scrap tires), polyethylene
  - Slag, fly ash
  - Demolition, de-construction
  - Plant industry: rejuvenating oils
  - Asphalt extenders
2. EMULSION BASED SYSTEMS

- Reduce emissions of GHG and energy consumption
- A historical French leadership

<table>
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<tr>
<th></th>
<th>Bitumen</th>
<th>Emulsion</th>
<th>Ratio</th>
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</thead>
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<tr>
<td>France</td>
<td>2,406,000</td>
<td>765,000</td>
<td>31.8%</td>
</tr>
<tr>
<td>EU 28</td>
<td>11,706,000</td>
<td>1,776,000</td>
<td>15.2%</td>
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<tr>
<td>Worldwide</td>
<td>103,120,000</td>
<td>8,138,000</td>
<td>7.9%</td>
</tr>
</tbody>
</table>
2. EMULSION BASED SYSTEMS

- Reduce emissions of GHG and energy consumption
- Maintenance techniques
  - Surface treatments (70% of the emulsion uses)
  - Cold mixes
  - Recycling
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- Reduce emissions of GHG and energy consumption
- Maintenance techniques
  - Surface treatments
  - Cold mixes
  - Recycling: in place and in plant
4. WARM MIX

- Asphalt mix to be produced, placed and compacted at 20 – 50°C lower than typical Hot Mix Asphalt
- Performances equivalent or higher than conventional Hot Mix Asphalt
4. WARM MIX

- Reduce emissions of GHG and energy consumption
- Benefits
  - Better workability, extending the construction season and earlier opening of the road
  - Reduced potential for exposure to fumes and odors and a cooler working environment
  - Savings thanks to lower fuel consumption
4. WARM MIX

- 3 main technologies
  - Foaming process: Addition of water that foams when in contact with the hot asphalt
  - Organic wax additive: Pre-blended or injected in bitumen to reduce viscosity
  - Chemical Surfactant: Liquid injected in line to improve workability
4. WARM MIX

- Efficient processes
- First experimentation in Europe late 1990’s (Germany, Norway, France)
- Used on large scale since mid 2000’s in Europe and North America
4. WARM MIX

Some figures in France

Warm Mix tonnage

GHG emission / HMA ton

Jeju Island Korea - May 29 – June 1 2018
5. PAVEMENT DESIGN OPTIMIZATION

- Preserving non-renewable resources
- Use of appropriate structural design method according to:
  - Effective load
  - Climatic condition
- Use of High Performances materials
  - For base course
  - For wearing course
5. PAVEMENT DESIGN OPTIMIZATION

- Rational Pavement Design Method which take into consideration
  - The Accumulated Traffic (ESAL) and real axle load
  - The real performances of ALL layers especially
    - The Stiffness Modulus
    - The Fatigue Resistance
  - The climatic conditions, i.e. Equivalent Temperature
5. PAVEMENT DESIGN OPTIMIZATION

- High Modulus Asphalt for Base Course and Reinforcement
  - High Fatigue resistance and complex modulus
  - Used in France since 30 years and in Europe
  - Optimizing thickness according to pavement design

Option 1 – DG20HM base
- 50mm SM14 asphalt
- 50mm DG14HS asphalt
- 250mm DG20HM asphalt (placed in 3 or 4 layers)

Option 2 – EME2 base
- 190mm EME2 asphalt (placed in 2 layers)

- 25%
5. PAVEMENT DESIGN OPTIMIZATION

- Very Thin to thin overlay Asphalt for Wearing course
  - Typically 25 to 35 mm
  - Need high cohesive binder
  - High skid resistance
  - High rutting resistance
  - Low rolling noise

- Perfect product for maintenance works and overlay
5. PAVEMENT DESIGN OPTIMIZATION

- Benefits for SBS Polymer Modified Binder
  - Able to resist to (very) cold and (very) hot climatic conditions
  - Improve rutting resistance (by 40 %)
- Increase of service life for pavement with PMB based mix
  - From 10 to 20 years
  - Less routine maintenance to schedule
CONCLUSIONS

- The European market is a mature market
- Maintenance techniques have been developed and used for years
- There is no single solution: optimization is needed
- Bitumen emulsions have their share of the market
- The industry has gained a high expertise and is ready to share it