1. **European market is extremely competitive**
   - Coal dust is used as fuel -> big reduction in energy cost
   - High % of recycling -> big reduction in material cost
   - Latest technologies -> reduction in operating cost

2. **European Road Construction requires maximum flexibility**
   - Asphalt mix are adjusted to all kind of needs (>100 recipes)

3. **European environmental standards are different**
   - CO, NOX, C, dust ( applicable at all location ).
   - Wet washers/wet scrubbers are impossible to use in Europe
Sustainable road construction means:

- Intact living space
- High Mobility
It means also well maintained road network
Improvements of construction equipment

1. Environmental Requirements
2. Shift from “New Roads” to “Maintenance”
3. Improved Quality Requirement
4. Economical Crisis
5. Competitive Market
These methods have gone a long time ago...

In the Mountains of Nepal in 2002
The good old days
Today’s clean asphalt manufacturing
Shift from new roads to maintenance

Total global Asphalt Production

- Growth of 4.1% each year
- 2.2 billion tonnes in 2015
- 0.3 to p.a and Inhabitant
- North America 650 Mio. to p.a
  5% of the world population using 1/3 of the global production
- China 440 Mio. tonnes p.a

1980

Construction

Road Maintenance
The 3 segments of global road construction markets

- **Total Asphalt Production**
- **Maintenance**
- **Rural to Paved Road**
- **New Road**

India,
South America,
Africa

**Characteristics**

- low investment
- mobility
- projects
The 3 segments of global road construction markets

**India, South America, Africa**

- **Characteristics**
  - low investment
  - mobility
  - projects

**China, Russia, Eastern Europe, Asia Pacific**

- **Characteristics**
  - open for new technologies
  - environment coming
  - improved quality
The 3 segments of global road construction markets

India, South America, Africa

Characteristics
• low investment
• mobility
• projects

China, Russia, Eastern Europe, Asia Pacific

Characteristics
• open for new technologies
• environment coming
• improved quality

USA, Western Europe, Australia

Characteristics
• environment
• flexibility
• quality
Ammann’s answer to the 3 segments

Total Asphalt Production
- Maintenance
- Rural to Paved Road
- New Road

Total Asphalt Production
- Maintenance
- Rural to Paved Road
- New Road

Total Asphalt Production
- Maintenance
- New Road

EasyBatch
Speedy Batch
Blackmove

25-60% Recycling
75-100% Recycling
Wearing coarse with **92% RECYCLING**

in Hamburg Germany

**AC 0/11**

Recycling (0/11) 92 %
Mineral (8/11) 8 %
Strategy: Recycling and Economy of scale

- Consolidation: 100 → 50 plants
- High volume production
- High recycling ratios
- High flexibility

Production: 1000,000 t.p/a  
Recycling: 600,000 t.p/a
Hot and Cold Recycling up to 75%

Proven technology (Batch & Conti)
500 Parallel Drums for 60%
1000 Cold Additives for 30%

Limitations:
• Super-heating
• Emissions
• RA outlet temperature
Strategy: 100% Recycling

- Highly Competitive thanks to RAP
- High RAP storage volume
- High flexibility
- Quality Assured RAP
Ammann developed a new asphalt recycling concept for 0% - 100% reclaimed asphalt
World’s 1st Plant Using up to 100% Recycling Asphalt

100% Recycling Device

Why up to 100% recycling?

- Excess of reclaimed asphalt
- Ecological requirement to preserve natural resources
- Economical to reuse available material
100% Recycling Device

- RA Dryer
- Process Air Heater
- Process Air Circulation
100% recycling device (protected)

- Raw Gas to Filter (95°)
- Drying Drum (turning)
- Process Air Circulation
- Heated Reclaimed Asphalt (165°C)
- Gas Mixing
- Process Air Heater (combustion chamber)

**Low ageing of bitumen**
- No radiation heat
- Soft heat exchange

**High efficiency**
- Counter flow dryer
- Process air circulation

**Low emissions (TOC)**
- Indirectly heated
- Low temp. heat exchange
RAH 100% drying drum
Process air heater
## Treatment of reclaimed asphalt

<table>
<thead>
<tr>
<th>Component</th>
<th>RA 0/22</th>
<th>RA 0/8</th>
<th>RA 8/22</th>
</tr>
</thead>
<tbody>
<tr>
<td>Binder</td>
<td>4.0 %</td>
<td>5.1 %</td>
<td>3.6 %</td>
</tr>
<tr>
<td>Filler</td>
<td>10.6 %</td>
<td>12.4 %</td>
<td>6.9 %</td>
</tr>
<tr>
<td>Sand</td>
<td>45.8 %</td>
<td>52.5 %</td>
<td>24.7 %</td>
</tr>
<tr>
<td>&gt; 2 mm</td>
<td>43.6 %</td>
<td>35.1 %</td>
<td>68.4 %</td>
</tr>
</tbody>
</table>

**Screening**

- RA 0/22
- RA 0/8
- RA 8/22

Binder 3.6 %
Filler 6.9 %
Sand 24.7 %
> 2 mm 68.4 %
Well sorted recycling materials
Blending of reclaimed asphalt

Scalping screen

0/8 8/16 16/32
Bitumen characteristics after heating

- Sample A (cold) taken at RA feeder through-put time approx. 10 min.
- Sample B (hot) taken at drum outlet

**Determination of the parameter in the laboratory:**

- Bitumen content
- Grading curve
- Softening point ring & ball R&B
- Penetration
- Fraaß breaking point

\[ \text{to guarantee match of sample A and B} \]
\[ \text{characteristic to evaluate thermal stress of bitumen} \]
Bitumen characteristics after heating (guide values)

**Softening point ring & ball:**

- **R&B softening point before and after thermal stress of RA**

<table>
<thead>
<tr>
<th>Sample No. and RA outlet temperature [°C]</th>
<th>R&amp;B value [°C]</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. (160°C)</td>
<td>57,2</td>
</tr>
<tr>
<td>2.</td>
<td>57,5</td>
</tr>
<tr>
<td>3.</td>
<td>56,4</td>
</tr>
<tr>
<td>4. (190°C)</td>
<td>73,2</td>
</tr>
<tr>
<td>5. (162°C)</td>
<td>76,2</td>
</tr>
<tr>
<td>6. (155°C)</td>
<td>70,2</td>
</tr>
<tr>
<td>7. (120°C)</td>
<td>66,6</td>
</tr>
<tr>
<td>8. (167°C)</td>
<td>60,4</td>
</tr>
<tr>
<td>9. (170°C)</td>
<td>60,4</td>
</tr>
<tr>
<td>10. (192°C)</td>
<td>60,4</td>
</tr>
<tr>
<td>11. (170°C)</td>
<td>61</td>
</tr>
<tr>
<td>12. (145°C)</td>
<td>61</td>
</tr>
<tr>
<td>13. (183°C)</td>
<td>55,8</td>
</tr>
</tbody>
</table>

**Average:**

Increase of the temperature of softening point R&B of 3°C.
Bitumen characteristics after heating (guide values)

Penetration values:

Penetration in 1/10mm before and after thermal stress of RA

Sample No. and RA outlet temperature [°C]

Penetration values:

Average: Decrease of penetration value of 0.5 mm; respectively 21%
Intelligent, fully integrated road construction

- Closing the Loop: **from Road to Road**
- High quality, reduced costs and construction time
- Ecology, Economy, Safety
Australia Leader in Sustainable Road Construction

– What we take out of the road, we put back!
– Green Asphalt preferred in tenders
– Government adopts performance based principles
– Phase out processes that are not environmentally friendly.
### Leadership in sustainable road construction

<table>
<thead>
<tr>
<th>AAPA Resolution 2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>National and state road authorities</td>
</tr>
<tr>
<td>Supporting new technologies</td>
</tr>
<tr>
<td>Road construction companies</td>
</tr>
<tr>
<td>Investing in new technologies</td>
</tr>
<tr>
<td>Equipment Manufacturing</td>
</tr>
<tr>
<td>R&amp;D new technologies</td>
</tr>
</tbody>
</table>
Thank you very much for your attention

Productivity Partnership for a Lifetime

www.ammann-group.com
Drivers for sustainable road construction

Government:
- Emissions
- Recycling

Shift of Focus:
- From new roads to Maintenance

Financial:
- Lack of Funding
- Market competitiveness

Asphalt back to asphalt

Tier IV „TA Luft“
Objective: The $CO_2$ neutral asphalt plant

-25% $CO_2$

Direct and indirect emissions considered, without transport

- Asphalt Recycling
- Low Temperature Mix
- Lower Moisture Cont.
- Alternative Energies
- Ecology SW tools,
- Integrated Constr.
Solar heated bitumen farm
Many countries in best solar area
Wood dust fired burner

- CO$_2$ neutral fuel
- Cost savings
Wood availability