Sustainability: International Perspective

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The Agenda

- Quick presentation of COLAS SA
  - R & D in COLAS
- Ecological
- In place recycling & treatment
- How to implement innovations or new techniques
- Conclusions
COLAS (COLd ASphalt) in 2008

- ID Card
  - Turn Over 12.8 Billion Euros / 18 Billion $

- 74,000 personnel in 40 countries
  - 8,000 in North America

- Aggregates 118 Mt
- HMA 52 Mt
- Emulsion 1.5 Mt
Breakdown of Group activity

in millions of €

Roads: 7,712 (66.1%)
Building materials: 1,472 (12.6%)
Civil engineering, Pipes, Mains: 901
Safety, Signing: 291
Waterproofing: 517
Building: 404
Railways: 376

Concessions:
16.7% Cofiroute
Adelac (A41)
Mars (Reims tramway)
1,400 profit centers in 40+ countries
110,000 projects around the world
Scientific & Technical Campus
South West of Paris
Research and Development

Applied research network:

- 1,000 engineers, research specialists and technicians worldwide
  - 250 in North America

- 1 Campus for Science and Techniques, certified ISO 9001 and ISO 14000
European Approach

- More and More Performance based compared to the USA
- Innovations are part of the business
- Some owners promote it
- Patents, trademarks, ...
Environment is part of our business

- Thin and ultra thin overlay
- No more tar use even for fuel resistant properties
- Noise abatements systems
- Quarries
- HMA plants
- Emulsion plants
- Recycling
What about recycling?

- Cold in place recycling
- RAP
- Recycling centers (PCC, ballast, ...)

10
Positive actions

What do we do?

- Step by step
- Contractor versus market
- Recycling (no paper tools, RAP, PCC,...)
- Ambassadors in every company in North America
- Cars policy
- Tracking of energy (fuel, gas, natural gas,...)
- Training to save energy (moisture in ACP plant)
Energy Efficiency and Innovative Construction Practices

What do we do?

- Step by step
- Analyze road structures
  - Paper done in 2003 PIACR in Durban
  - The environmental road of the future
  - Recycling in place is the best technique

Ecologiciel
- Calculation per m2 of two criteria
- CO2 and Energy consumption
How to evaluate the effect of recycling?

- 2003
- Paper on the environmental road for the future
  - Comparisons between techniques
- PIACR Durban
Energy Consumption for the Manufacturing and placement of Main Road Technologies

- Hot Mix Asphalt (HMA)
- High modulus HMA
- HMA with 15% RAP
- Crushed aggregate 0-20 mm
- Aggregate 0-112 mm
- Cement Concrete
- Continuous reinforced concrete
- Stabilized materials emulsion + cement
- Stabilized materials emulsion
- Crushed in place concrete slab (rubblizing)
- Reclaimed or milled materials

Energy in MJ per Tonne:
- 0
- 200
- 400
- 600
- 800
- 1000
- 1200
- 1400

Values:
- 90
- 100
- 600
- 1100
GHG Emissions during Manufacture and Placement of Main Road Technologies

- Hot Mix Asphalt (HMA)
- High modulus HMA
- HMA with 15% RAP
- Crushed aggregate 0.20 mm
- Aggregate 0.112 mm
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- Stabilized materials emulsion
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GHG Emissions CO2 eq kg/tonne

- Hot Mix Asphalt (HMA): 50
- High modulus HMA: 10
- HMA with 15% RAP: 10
- Crushed aggregate 0.20 mm: 180
- Aggregate 0.112 mm: 180
- Cement Concrete: 180
- Continuous reinforced concrete: 180
- Stabilized materials emulsion + cement: 180
- Stabilized materials emulsion: 180
- Crushed in place concrete slab (rubblizing): 180
- Reclaimed or milled materials: 180
How to evaluate the effect of recycling?

- 2006
- Internal software ECOLOGICIEL
- Eco alternatives
- Optimization of RAP
- CO₂ eq
Energy Consumption in MJ per m2
For the construction of the Pavement for 100,000 AADT over 30 years

- Concrete slab
- Reinforced CS
- HMA
- Stabilization emulsion + HMA
- Stabilization Em + Cem +HMA
- Rubblizing + HMA

MJ/m2 of pavement

0 100 200 300 400 500 600 700 800

900
GHG Emission in CO$_{2\text{eq}}$ per m$^2$

For the construction of the Pavement for 100,000 AADT over 30 years

<table>
<thead>
<tr>
<th>Material</th>
<th>kG of CO$_2$/m$^2$ of pavement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concrete slab</td>
<td></td>
</tr>
<tr>
<td>Reinforced CS</td>
<td></td>
</tr>
<tr>
<td>HMA</td>
<td></td>
</tr>
<tr>
<td>Stabilization emulsion + HMA</td>
<td></td>
</tr>
<tr>
<td>Stabilization Em + Cem + HMA</td>
<td></td>
</tr>
<tr>
<td>Rubblizing + HMA</td>
<td></td>
</tr>
</tbody>
</table>
Per ton of HMA applied

GHG emission per pavement structure in equivalent CO₂ (kg/mt)

- Structure 1
- Structure 2
- Structure 3

1. Virgin HMA
2. 25% RAP HMA
3. 25% RAP WMA
Per ton of HMA applied

GHG emission per pavement structure in equivalent CO₂ (kg/m²)

- Structure 1
- Structure 2
- Structure 3

Legend:
- Binders
- Aggregates
- Mix manufacture
- Transport
- Laying

1. 1 ½” HMA + 5” CIR
2. 3 ½” HMA
3. 3 ½” HMA + 6” GB
First approaches

- Eco alternatives
  - Alternatives represent 5-8% of the tenders
  - Using a design software and properties of components
  - To show the gain in GHG per sy on a job

- The owner must be involved

- How to implement innovations or new techniques
How to implement innovations or new techniques?

In Europe

- Create the needs
  - Contest tenders
  - Performance based tender
  - Technical response to issues
  - Charter for innovations with funding

In Canada

- Value engineering (after the tender)
- Specific demands to answer issues
- 5-7 years warrantee projects (design included) per m²
- Promote actively a technique (environmentally friendly)
How to implement innovations or new techniques?

In Europe and elsewhere
- Industry promote also R&D labs, ...
- Long term commitment in a new technique
  - High investment (CIR, FDR, ...)
  - Difficult to invest for one job
- Training to various PP techniques
- Performance based contracts
  - Technical monitoring
  - Training
  - Training
Initiatives

- Washington State
- New York State
- LEED for Building
- Green Highway
- PPP
Green Roads is a rating system designed to distinguish high-performance sustainable new or redesigned/rehabilitated roads.

It awards credits for approved sustainable choices/practices and can be used to certify projects based on point value.
## Green Roads Categories

<table>
<thead>
<tr>
<th>Category</th>
<th>Goal</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sustainable Design</td>
<td>Reduce impacts due to alignment of the road.</td>
<td>10</td>
</tr>
<tr>
<td>Material &amp; Resources</td>
<td>Reduce impacts from material extraction, processing and transport.</td>
<td>11</td>
</tr>
<tr>
<td>Stormwater Management</td>
<td>Reduce impacts of polluted stormwater and treatment devices.</td>
<td>8</td>
</tr>
<tr>
<td>Energy &amp; Environmental Control</td>
<td>Improve human and wildlife health.</td>
<td>12</td>
</tr>
<tr>
<td>Construction Activities</td>
<td>Reduce impacts from construction activities.</td>
<td>9</td>
</tr>
<tr>
<td>Innovation</td>
<td>Encourage innovation in design.</td>
<td>4</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td><strong>54</strong></td>
</tr>
</tbody>
</table>
## Green Roads Category

### Materials & Resources (MR)

<table>
<thead>
<tr>
<th>Description</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction Waste Management</td>
<td>1</td>
</tr>
<tr>
<td>Reuse of Pavement</td>
<td>2</td>
</tr>
<tr>
<td>Recycled Content</td>
<td>4</td>
</tr>
<tr>
<td>Pavement Life Cycle Analysis</td>
<td>3</td>
</tr>
<tr>
<td>Regionally Provided Material</td>
<td>1</td>
</tr>
</tbody>
</table>

**Total Credits Available**: 11
Example MR Credit

Recycled Content  4 Credits

One credit: Use recycled content to a minimum of 20% in the HMA/PCC and 40% of the total material in the structure if base course is included in the project.

Two credits: Use recycled content to a minimum of 30% in the HMA/PCC and 50% of the total material in the structure if base course is included in the project.

Three credits: Use recycled content to a minimum of 40% in the HMA/PCC and 60% of the total material in the structure if base course is included in the project.

Four credits: Use recycled content to a minimum of 50% in the HMA/PCC and 70% of the total material in the structure if base course is included in the project.
Green LITES Labelling – NYSDOT
9/25/08

Green LITES Project Design Certification Program
Recognizing Outstanding Leadership In Transportation and Environmental Sustainability
September 2008

Certification Program for NYSDOT Designs Meeting Criteria for Sustainable Transportation Infrastructure using Environmentally Friendly Practices
Industry Response - HMA

ASPHALT: The Sustainable Pavement

- Leading America in Recycling
- Warm Mix Asphalt
- Quiet Pavement
- Perpetual Pavement
- Porous Pavement
- Lower GHG & fuel

Asphalt is the sustainable material for constructing pavements. From the production of the paving material to placement on the road through recycling, asphalt pavements minimize impact on the environment. Low consumption of energy for production and construction, low emission of greenhouse gases, and conservation of natural resources help to make asphalt the environment-friendly choice.
Click Here for Concrete Featuresavored by Mother Nature

Pervious Concrete

Environmental Properties of Concrete

Concrete is in tune with the environment. From homes to office buildings to highways, using concrete as a construction material actually helps protect our natural resources and offers unique benefits to consumers. From an environmental standpoint, concrete has a lot to offer.

Concrete is environmentally steady in a variety of ways. The ingredients of concrete (water, aggregate, and cement) are abundant in supply, and take a lesser toll in their extraction than other construction materials. Quaries, the primary source of raw materials, can be easily reclaimed for recreational, residential, or commercial use. Or they can be restored to their natural state.

As a nearly inert material, concrete is an ideal medium for recycling waste or industrial by-products. Many materials that would end up on landfills can be used instead to make concrete. Blast furnace slag, recycled polystyrene, and fly ash are among materials that can be included in the recipe for concrete and further enhance its appeal. Waste products such as scrap tires and limestone dust are used to fuel the manufacture of cement, and even old concrete itself can be returned as aggregate for new concrete mixes.

Another environmental plus for concrete is energy efficiency. From manufacture to transport to construction, concrete is modest in its energy needs and generous in its payback. The only energy-intensive demand is in the manufacture of portland cement, typically a 10-15% component of concrete. Since the materials for concrete are readily available, concrete products and ready-mixed concrete can be made from local resources and processed near a job site. Local shipping minimizes fuel requirements for handling and transportation.
Industry Response – AEMA

- Emulsion techniques
  - may be handled safely
  - no odors, fumes, smoke or dust
  - preserve the environment
    - protects air quality
    - recyclable
  - low cost techniques
    - quick application time
    - low energy consumption
  - many pavement preservation
ISSA Outlook

“Environmentalists, taxpayers and legislators will be pleased to know that ISSA member contractors are responsible for making their roads last longer, keeping them safer, and requiring the use of fewer raw materials.”
Industry Response - ARRA

ARRA techniques:

- most environmental friendly flexible pavement rehabilitation technique.
- reuse existing non-renewable material
- heating of material is not required
- haulage of material on or off site is not required, i.e. less disturbance to traffic

Environmental Benefits:

- Per 2-lane km, CIR/CIREAM emits approximately 50% less GHG, consumes 62% less aggregates, and costs 40-50% less when compared to a conventional mill and overlay treatments.
- Since the implementation of CIR/CIREAM contracts, MTO has reduced GHG emissions by:
  - 54,000 t of CO₂
  - 440 t of NOₓ
  - 9,400 t of SO₂
- And saved 740,000 tonnes of aggregates.
“Long-term strategy that enhances pavement performance by using an integrated cost-effective set of practices that extend pavement life, improve safety and meet motorist expectations”

The **Right** treatment, to the **Right** road at the **Right** time.
Conclusions

- Environment should be more than permits
  - Included in the pre tender or engineering approach
  - Consultants: awareness and training

- Numerous initiatives in the USA
  - In place recycling should be more used!
  - Promotion of innovations / training (DOT and Industry)

- Industry needs long term commitment

- Quality must be there
  - Needs for the road networks
  - Budget
Conclusions

- Vegetal binders at 250F
- FDR in the UK