France's Perspective on the use of RAP
Practice
Research needs and results

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Contents

Introduction

Recycling…

- In a way …
  - Making new material from old stuff
- In the sustainable development context…
  - Resources saving
  - Energy saving (especially with in place recycling)
  - While keeping at least the same "global" performances as new materials ones

  ➢ Need for global analysis (technical, environmental and economical) on these materials

Current practice of RAP recycling in France

France – some figures

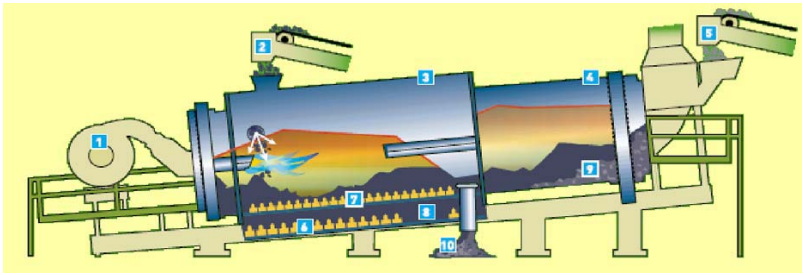
- Surface : 551 000 km^2
- Road network : 1 million km
  - 8 000 km Motorways
  - 10 000 km Highways (National roads)
  - 370 000 km roads owned by local authorities – departments (high or medium traffic)
  - 600 000 km private roads or owned by local authorities – cities (low or very low traffic roads)
- Annual Hot Mix Asphalt production : 40 million tons

State of RAP recycling in France (1)

- Quite old experience (since the 70s)
- Since 2003 :
  - 10% RAP allowed in surface layers without any further mix design study
  - 15% RAP allowed in base or binder layers without any further mix design study

State of RAP recycling in France (2)

- In practice :
  - Maximum 30% RAP in drum dryers plants equipped with RAP ring
  - Maximum 50% to 60 % RAP in double drums plants



State of RAP recycling in France (3)

- However RAP is not very used
  - Among the 6 millions tons RAP collected each year, only 1.7 millions tons is re-used in asphalt pavements in 2007
  - Only 23% of re-use !
  - Only 2.5 % in average in HMA!

New trends

- In 2007, French government impulse towards sustainable development (*Grenelle de l'environnement*)
- In LCPC, since 2004, research orientation towards "materials and structures saving energy and resources"
- 2009 agreement between government and contractors to re-use 60% of the collected RAP in 2012
- Goals for the future :
  - Reach 100% of reuse of collected
  - RAP Go towards 100% recycled roads

➢ Need to "speed up" and to get controlled and reliable solutions to reach these goals

Research on RAP

Research needs

- Assess relevance of performance-based specifications
  - Laboratory mix design procedure using materials representative in average of the RAP used → homogeneity of RAP?
  - Laboratory mix design procedure representative of laboratory manufacturing process vs. plant process
- Environmental aspects :
  - Fume emissions
  - Pollutant content of RAP (asbestos, tar…)
- Durability aspects :
  - Durability under traffic
  - Durability with time (aging properties)
  - Multiple recycling?
- Need for global evaluation vs. traditional HMA (technical, economical, environmental) → Life Cycle Analysis

On going research programs (1)

In France

LCPC Research project 'OPTIMIRR' 2006 -2010

Optimization of energy saving and recycled Pavement Materials

- Emulsion treated materials for base courses
- Warm asphalt mixtures
- Optimization of materials containing RAP
  - Homogeneity of RAP
  - Recyclability potential of mixes
    - Mixing between new and old binder
    - RAP fabrication in Laboratory
  - Pollutant detection in RAP
  - Mix design methodology for RAP containing materials
  - Durability of recycled materials with trafic

On going research programs (2)

In Europe, in the frame of EC 7th framework program

• Direct-Mat - DIsmantling and RECycling Techniques for road MATerials – sharing knowledge and practices

Cooperative and Support Action (2009 – 2011) Leaded by LCPC, 15 European partners

Main product : WEB Data base on European practices regarding recycling road materials back into roads (all types of materials)
http://direct-mat.fehrl.org

• Re-Road - End of life strategies of asphalt pavements

Collaborative project (2009-2012) ,leaded by VTI Sweden,

18 European partners

Aim : 99% RAP in bituminous materials (special focus on Polymer Modified Bitumen)

http://re-road.fehrl.org

On going projects

Global environmental evaluation

- Building of a global tool to evaluate recycled materials
- ECORCE (LCPC life cycle analysis software)
- Collecting field data shared by the whole road community

Durability and performances of recycled material

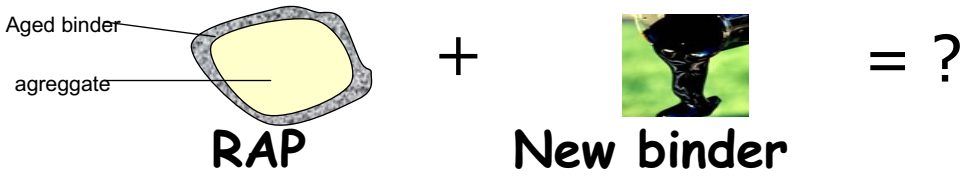
- Accelerated Pavement testing to assess durability under traffic of materials containing up to 15, 30, 50 70 (100%?) RAP

- Enabling to check performance based specification applicability for Recycled material

Chemical compatibility between new binder and old binder coming from RAP (1)

(*) PhD work of Laëtita El Bèze

- Aim: to assess the degree of homogeneity / heterogeneity between RAP bitumen and new added binder

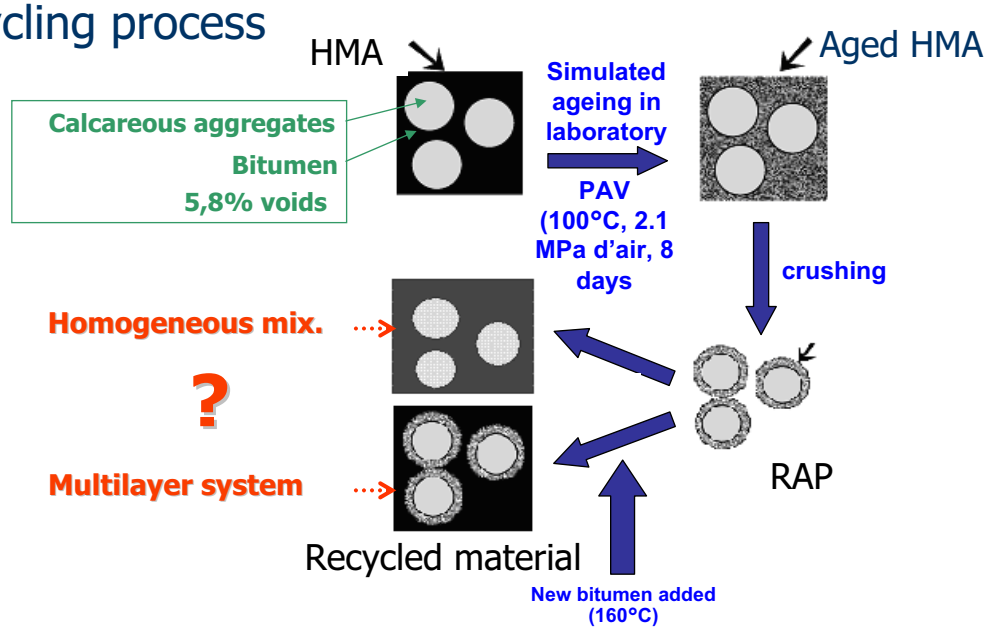


- Means:
- Laboratory research study to understand the binder's mixing mechanisms involved during hot recycling
- Observation of the distribution of chosen tracers within recycled asphalts by microscopic techniques

Chemical compatibility between new binder and old binder coming from RAP (2)

(*) PhD work of Laëtita El Bèze

- Experimental procedure: Simulation in laboratorv of hot recycling process

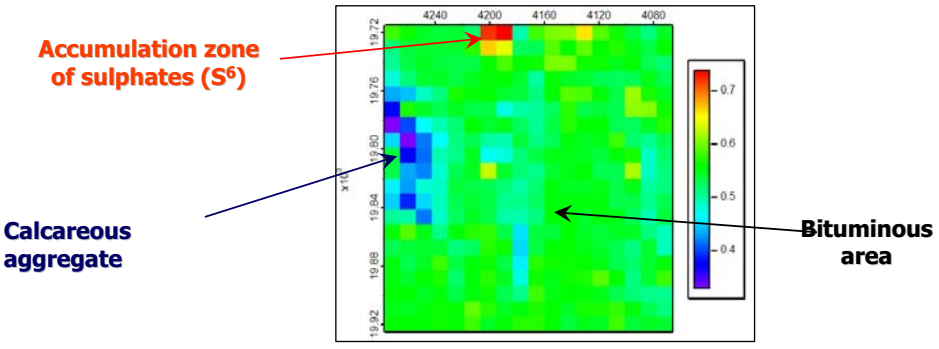


Chemical compatibility between new binder and old binder coming from RAP (3)

(*) PhD work of Laëtita El Bèze

Example of results regarding RAP coating with the added binder

- Follow up of the spatial repartition of sulphates by X-rays Fluorescence microscopy and XANES microscopy in a synchrotron

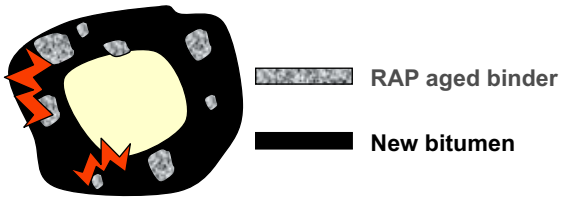


Spatial repartition of sulfates

Chemical compatibility between new binder and old binder coming from RAP (4)

(*) PhD work of Laëtita El Bèze

- Proposed model: mobilization of the aged bitumen layer leading to partial homogeneity between aged and new binder

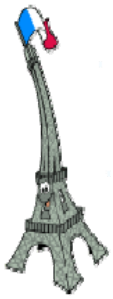


- To be confirmed on more realistic RAP

Conclusions

- RAP use in France is quite old and well known but will be speeded up a lot in the next years
- Still research needed
  - Compatibility of old and new binder (preliminary results seem to show that double coating is not the reality)
  - Durability with traffic and time
  - Mix design methodology (homogeneity of RAP)
  - Need for a global environmental assessment tool (like for other techniques)

Thank you for your attention !



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