WARM MIX ASPHALT in COLAS

OUTLINE

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- Greener solutions
- Cost of energy

New incentives

National agreement MEEDAT + road industry

RAP ↑ 60 % 2012
GHG ↓ 33 % 2020

DEFINITIONS

HOT MIX > 160°C

WARM > 100°C – 140°C

Without H_2O or For a transient period

100°C

HALF WARM 60°C - 100°C

With H_2O

COLD MIXES UP to 60°C

MORE THAN 8 SOLUTIONS

- WAM-Foam
- Sasobit
- Evotherm
- Aspha-Min
- Low Emission Asp
- Double barrel
- Rediset WMX
- Cecabase RT

- Sasol
- MEADWESTVACO
- EUROVIA
- Lea Co
- AKZO NOBEL
- ceca ARKEMA GROUP

WARM MIX - DEVELOPMENT FOR COLAS

2002 2004 2007 2008 2010

First Trial

RN 157

Colas Additive First trial

FOAM trials North America

SPECIFICATIONS FOR WARM MIXES

- Mechanical performances: Warm Mix ≥ Hot Mix
- Preference for solutions: without water
- Ability to produce and pave any kind of Mixes
- Suitability for all kind of mixing plants
- Temperature reduction: 30 - 40°C

SINCE 2008

Development to Pmb, RAP

FOAM WMA Colas NA

Existing Foam production systems evaluation in progress

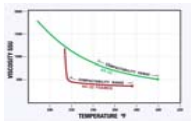
ASTEC Double Green

MAXAM Aquablack

GENCOR Ultra foam

FOAM WMA Colas NA

Principle



Foamed binders' facilitates coating

Mix Workability increased

But …

Behaviour of foam in the mix after mixing ?

Cost : Investment.

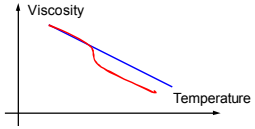
No need for additives. But foaming ability differs from binders

US Market Mainly PG 64-22 (Pen 50/70 bitumen). Softer than France (Limits of this process ?)

Chemical Additives

Used From 2005 to 2007

Principle : Reduction of the viscosity of the binder



- Performance of Mixes → ok
- Effect of the additives on binders : Increase of TBA and G*
- Limits of this process
  - Cost of the additive
  - Impact of the additive on the Environmental benefit of the process

Process stopped in 2007

Liquid Chemical Additives

Principle

Effect of the additive at the interface Bitumen/ Aggregate

- Performance of Mixes → ok
- No modification of the binder
- Investment reduced
- Solution adapted for all kind of mixes
- Cost of the additive reduced compared to solid additives
- First trial in 2007. Now more than 1 000 000 t of Warm mix paved

Liquid Chemical Additives — Mechanical Performances

	EME CCB	EME 3E CCB
Binder Content	5.21 %	
% RAP	20 %	20%
Temp (°C)	180°C	140°C
Complex modulus **% voids** **E* 15°C 10Hz (MPa)**	 3.3 16220	 3.4 16436
fatigue **% voids** **ε6 10°C 25Hz**	 3.3 130	 3.4 127

No difference between Warm and Hot

Liquid Chemical Additives A 75 New Motorway

RAP 25 % in base course / 20 % in surface layer

Very Thin Alsphat Layer
Rugosoft on 225 000 m²

Warm High Modulus Asphalt
RAP 25 %

Liquid Chemical Additives

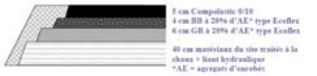
Last Trials : High RAP content. 2009 RN 2 LAON
Base course 40% RAP / Batch Plant

	Hot Mix	Hot Mix RAP 40%	Warm Mix RAP 40%
Binder content (%)		4.4	
Temp (°C)	160	160	120
% voids at 100 gir.	4.1	5	4.8
Water Resistance	0.78	0.86	0.86
Rutting % void content % rut after 30000 cy.	 7.3 4.5	 7 3.1	 8.7 4.1
Modulus 15°C10Hz(MPa)	10852	12114	12187
Fatigue resistance 6 µdeft	89	95	91

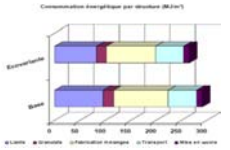
On site : No difference in void content and in mechanical performances

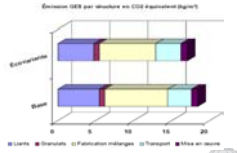
Liquid Chemical Additives Racing track

Warm mixes in base and binder courses
RAP 20%



Energy saving and GHG reduction ~ 10 %





Continuous warm mix production for 1 week

Liquid Chemical Additives Energy saving

Measurements 2007 - 2008

		Energy saving measured	
RD 906	Ecolastic M DB	17 %	50 MJ/t
Malauzat	BBSG 0/10 3E	18 %	84 MJ/t
RN 333	BBMc 3E	- 15 à -20 %	31 à 40 MJ/t
A 75	GB 3E +R / GB	- 1.1 l /ton	61 MJ/t

Results coherent with previous ones
and with Ecologiel

Environmental Aspect

Improvement of working conditions : significant fumes reduction

Temperature reduced - less steam

Also for inhabitants

Environmental Aspect

Campaigns conducted with external partners

Significants measurement point selected

Difficult to give a precise figure for reduction
- quantites detected extremely low on control mixes
  (sometimes under detection threshold of available equipement)
- sensitivity to environment
  (road trafic, influence of worksite, cigarette smoke)

International Development

•
• 2008 Romania, UK, Czech Republic, Belgium
• 2009 Poland,Denmark, Hungaria, Croatia, Canada (Alberta, Alaska..)
• 2009 Morocco, Réunion Island,

Other Benefit

mixes produced at «usual temperature »

• Improvement of workability - facilitate specific jobs (bridges)
• Ability to haul the mix on longer distances and still have workability to place and compact (exemple Nouvelle Calédonie)

Conclusion

• Now more than 1,500 000 t for COLAS
• Spreading of our solutions
  • All products
  • All kind of Jobs
  • All countries
• No failure up to now
  (Respect of manufacturing temperatures, compaction procedure,..)
• … But we still have a look to other possible solutions