Substainable development: Low Energy/Warm Mix RAP Recycling Technology

AAPA Australia Asphalt Pavement Association

14° INTERNATIONAL FLEXIBLE PAVEMENTS CONFERENCE

Sept . 26th 2011

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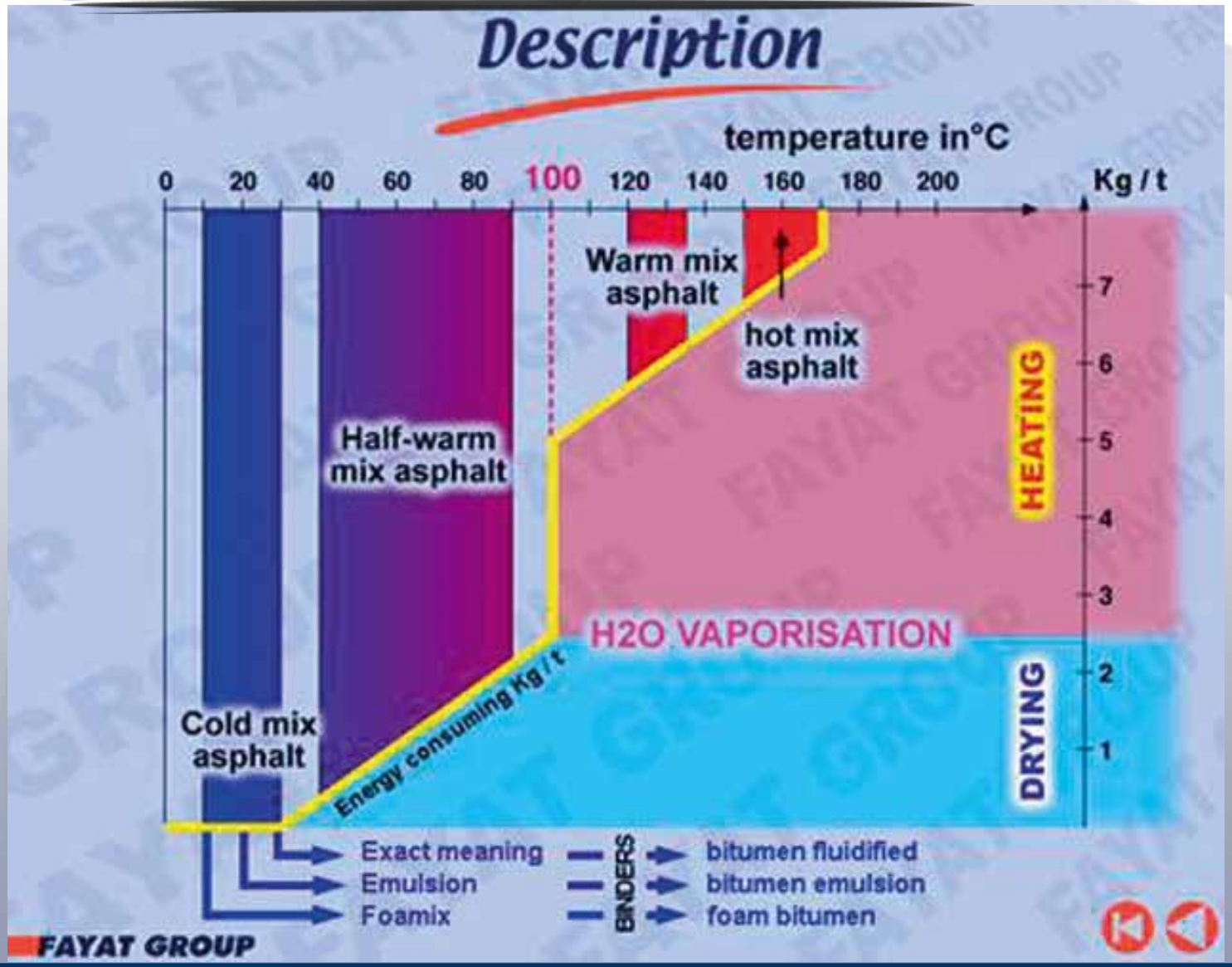
ENERGY CONSUMPTION (REDUCTION OF)



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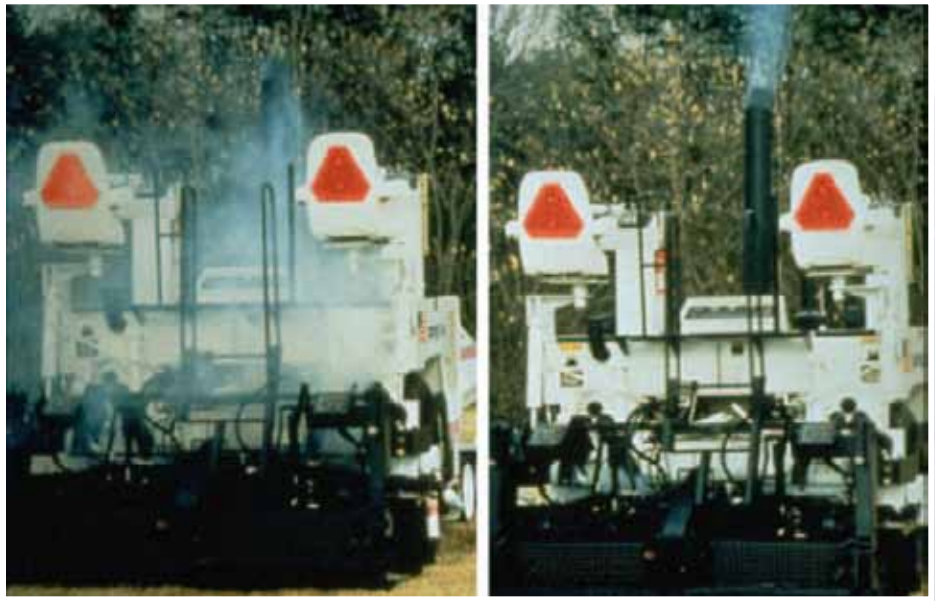
WARM ASPHALT TECNOLOGY
‘ Mix Fumes ‘



THE LOW MIX TEMPERATURE REDUCES THE MIX FUMES EMISSION

VOC EMISSION REDUCTION

MORE CONFORTABLE ENVINRONMENTAL CONDITIONS

REDUCED BITUMEN AGEING

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WARM ASPHALT TECNOLOGY

BETTER ENVIRONMENTAL AND WORKING CONDITIONS

Main technique known:
- **Aspha-Min: Eurovia Services GmbH**
- **Sasobit: Sasol Wax International**
- **Acquablack**
- **WAM-Foam: Shell**
- **EBE: Fairco /Leaco**

PRACTICAL PLANT PROCESS HAVE STARTED IN EUROPE IN THE YEAR 2000

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SOLID ADDITIVES

ASPHA-MIN

EUROVIA

Addition in the mixer of hydrated aluminum silicate **(Zeolite)** in crystalline powder form, in a quantity equal to roughly **0,3% of the total weight of the mix**

The crystals contain water, up to 21% of their weight. Water is released above **85 ° C**, generating a foaming effect in the bituminous mix.

Production temperature can be decreased by 15 ° C

The production plant must be modified with an additional storage and metering of **Zeolite**

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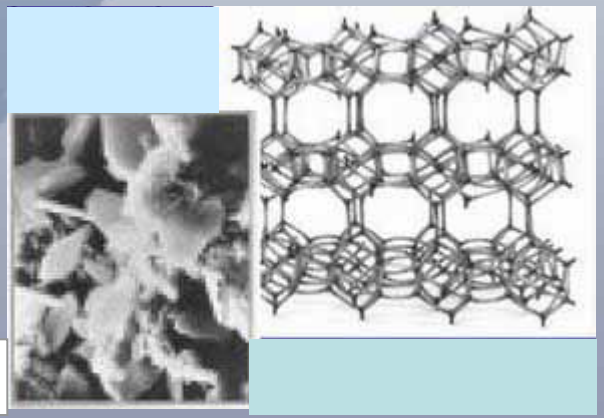


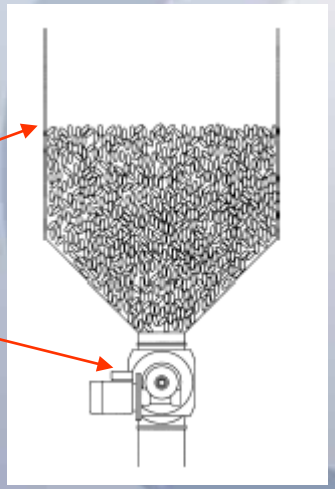
Zeolite crystals

ASPHA-MIN

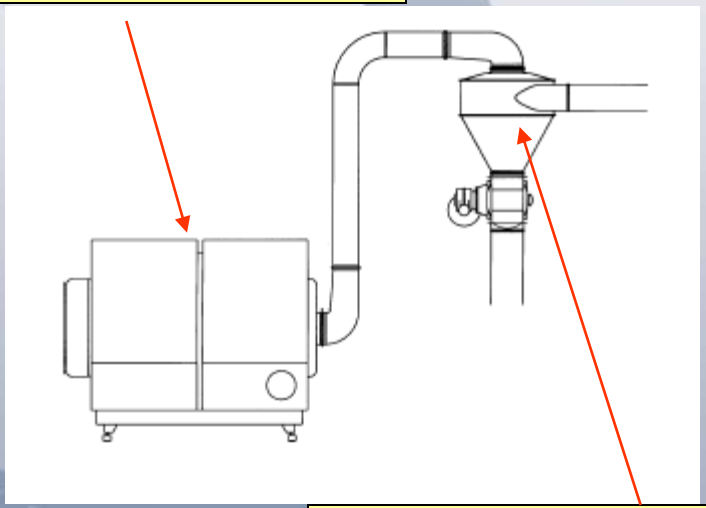
EUROVIA

ASPHALT PLANT must be fitted with an adittional storing and dosing system for the Zeolite powder (dosing item similar to the VIATOP) plus a "compressor/blower" (it could be either a vacuum device)

Compressor/Blower



Zeolite metering + Rotating valve extractor



Cyclone to separate air + Dosing into the mixer

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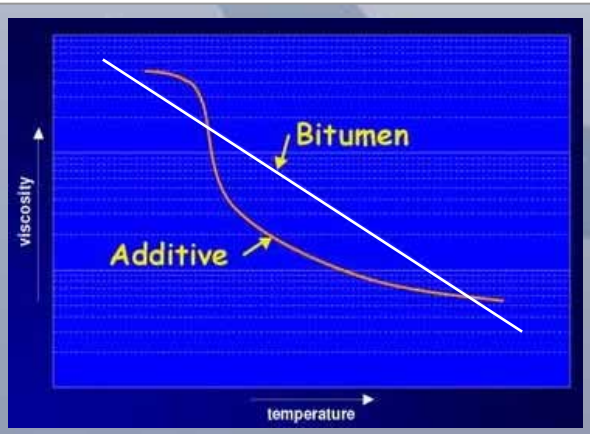
Solid additives

SASOBIT

Additive (Sasobit) for bitumen, created from the distillation of carbon, available in powder or pellets. It is a kind of paraffine completely soluble in bitumen above 115 ° C

Added up to **3% of the weight of the mix,** it reduces the viscosity of the bitumen, therefore allowing its mixing at a temperature lower by 15 to 18 ° C respect the standard production temperatures

The production plant must be modified with an additional system to allow for the storage and metering of the additive.



SASOBIT

ASPHALT PLANT should be modified adding a SASOBIT storage and dosing apparatus.
Sasobit product is delivered in bags to be added directly into the bitumen tank/s (equipped with stirrer or recirculation pump).
Alternatively Sasobit is fed into an hot oil heated melting tank and subsequently dosed into the bitumen storage tanks.

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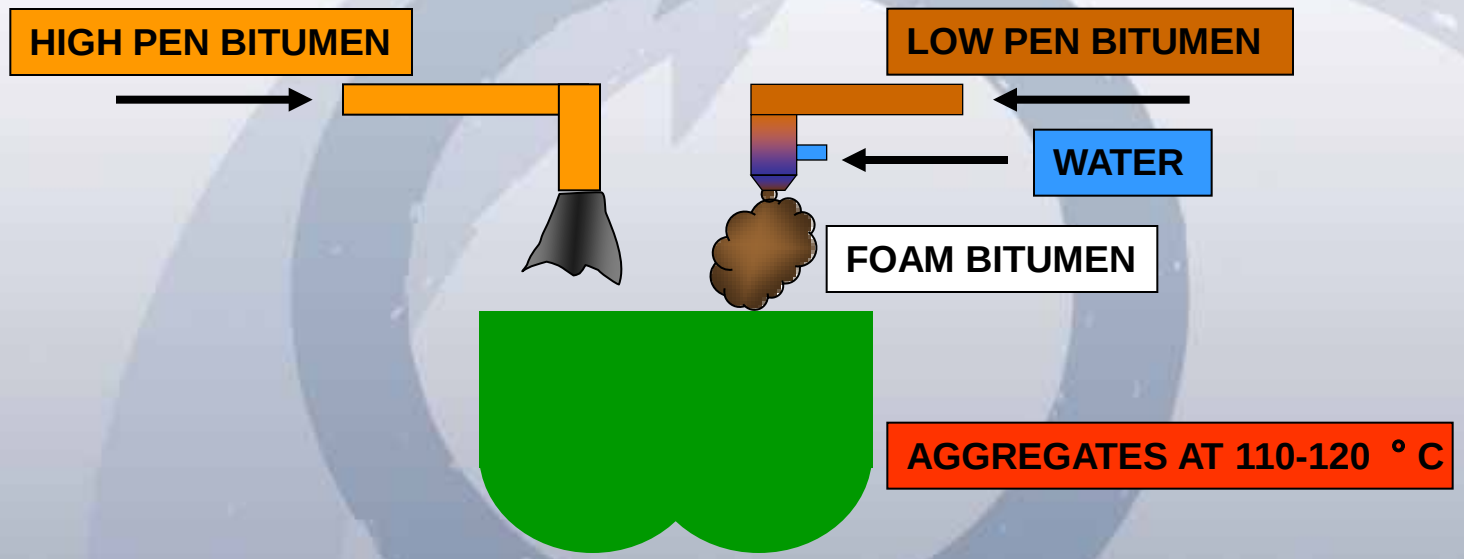
WAM FOAM - SHELL ®

MIXING IN TWO STAGES (1- 2)



1- USING HIGH PENETRATION BITUMEN (PEN >200) AT 130-135 ° C

2- USING LOW PENETRATION BITUMEN (PEN < 50) AT A 160-165 ° C

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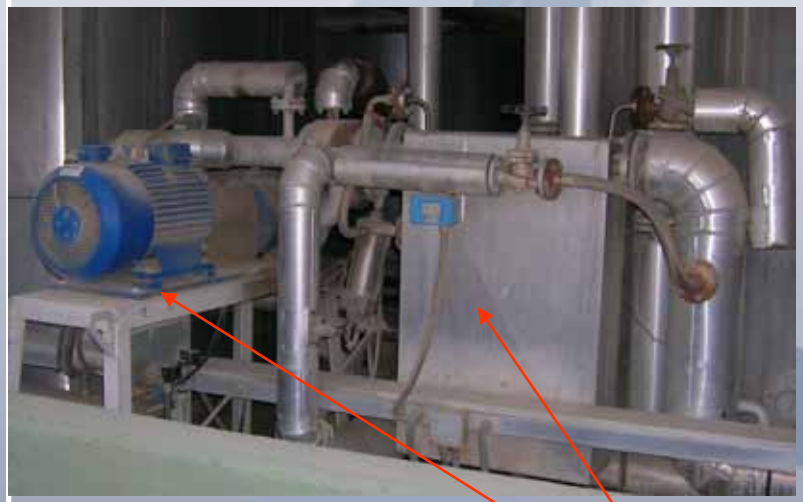
WAM FOAM - SHELL ®

ASPHALT PLANT has to be modified adding an “Hard” bitumen foaming ramp and one additional “ soft” bitumen feeding and dosing line .
To be checked also the necessity to store “soft” and “hard” bitumen tanks and to supply them if necessary.

Water dosing system



“Hard” bitumen feeding pump + massic metering

“Soft” bitumen dosing/weighing system

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Sustainability

- AquaBlack®,
  - **a new solution for foaming coming from USA**
  - **an agreement with MAXAM**

- **3 points:**
  - **PLC**
  - **Foam gun**
  - **Flow meter, heating system**

Sustainability

- AquaBlack®,
  - **Batch / Continuous**
    - **1st step in France (RF)**
      and China (Beijing, Bices, Marini)

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Half Warm (low energy) mix EBE®

FIRST PHASE

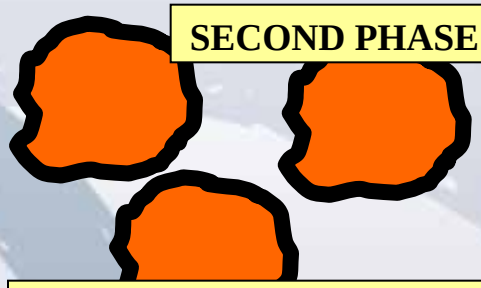
120 ° /150 ° C

170 ° C

Hot bitumen

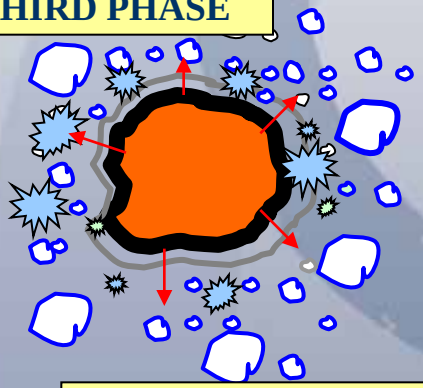
Drying of ‘coarse’ aggr.

SECOND PHASE



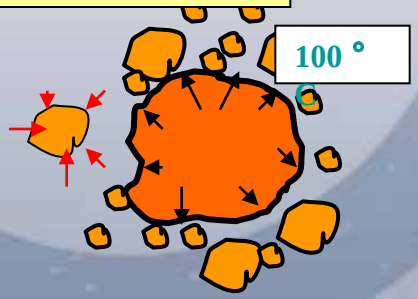
Coarse Aggreg.are covered by the bitumen. A thin film is created around aggr. surface

THIRD PHASE



WET SAND is fed into the mixer to create bitumen expansion like a “Bitumen Foaming” effect

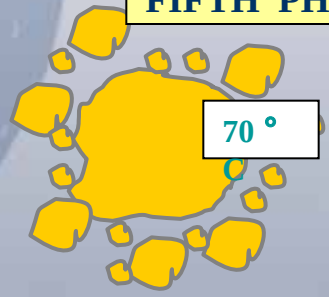
FOURTH PHASE



100 ° C

Bitumen expansion will facilitate the sand cover and the sand temperature increase

FIFTH PHASE



70 ° C

A THERMIC equilibrium is reached between aggregates/sand.
The WORKABILITY of the final MIX of moisture and bitumen **REMAINS OK AT LOW TEMPERATURE**

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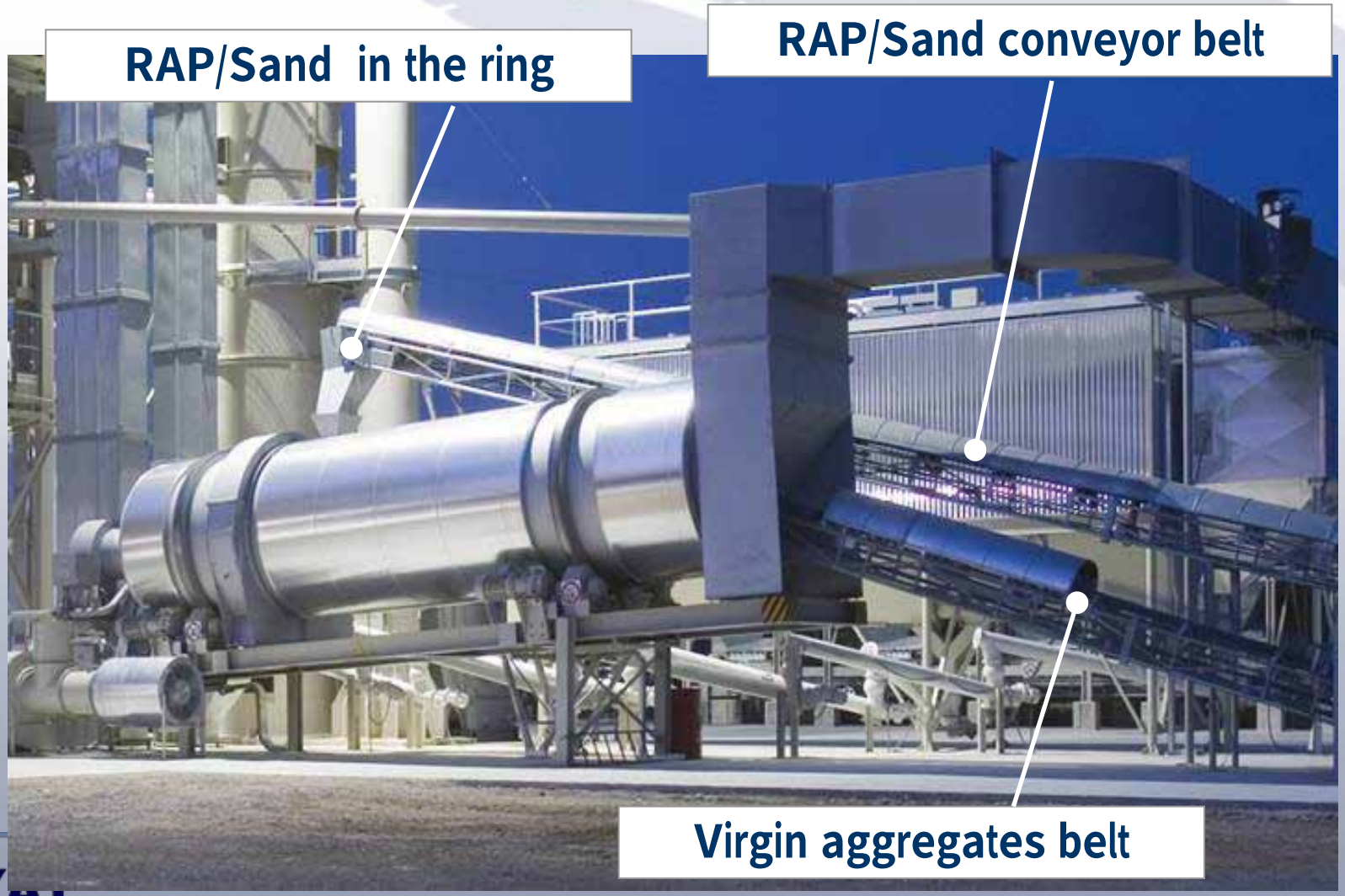
Sand in the recycling ring



Wet sand in the recycling circuit (2)

4 Taking advantage of the existing equipment

RAP/Sand in the mixer

Usual Hot elevator

Dedicated RAP/Sand elevator

RAP/Sand conveyor belt

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Asphalt plants are ready

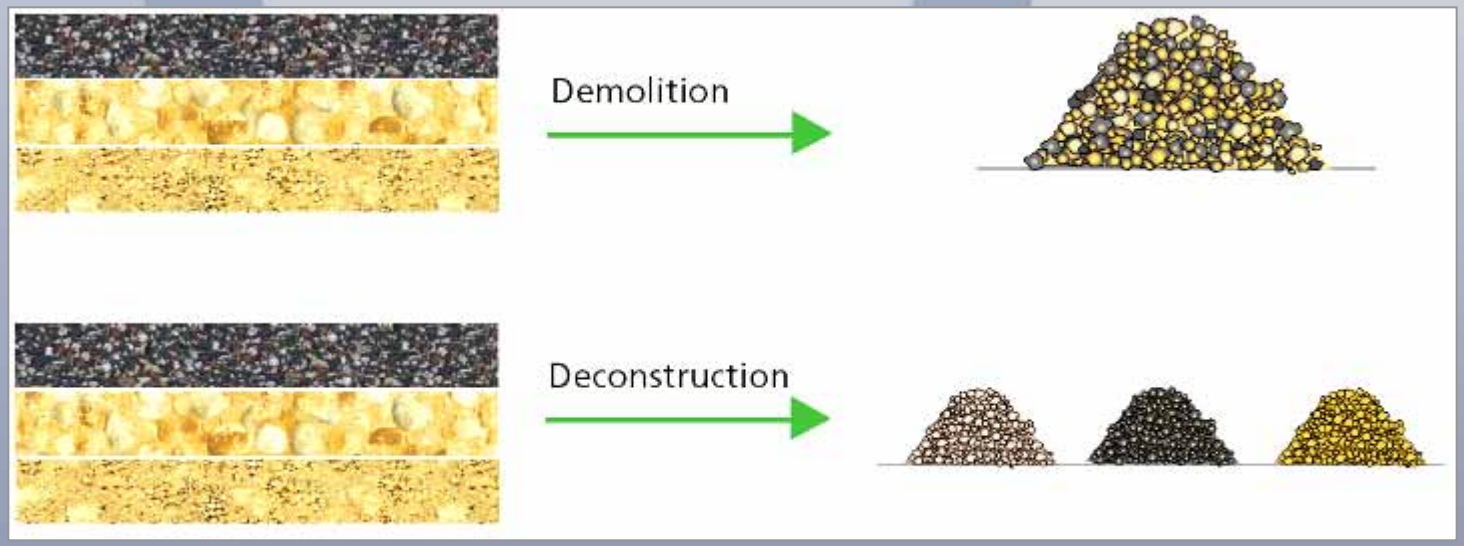
- **Asphalt plants are ready for warm mixes (beside special mixes)**
- **Environment means also Recycling of existing RAP pavement for which any solution/recycling method is available**
- **Beyond the mechanical parts : software & control syst. are ready/adapted**
- **If you can already do RAP recycling, you can easily produce warm mixes**

Recycling and Sustainable development

4 Recycling is not optional anymore

- 4 Pollution control
- 4 Increasing cost of energy
- 4 Scarcity of natural resources (aggregates, oil)
- 4 Savings on the jobsites (traffic, energy, resources, time)

4 New behaviours are necessary / The road itself is a quarry



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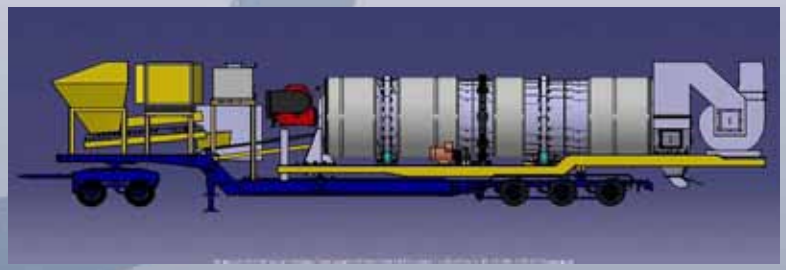
Recycling techniques

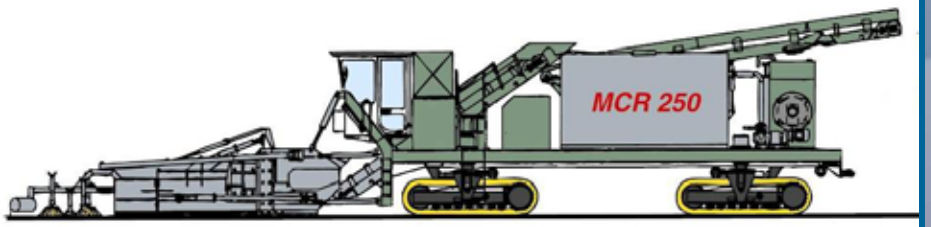
4 Recycling of asphalt pavements

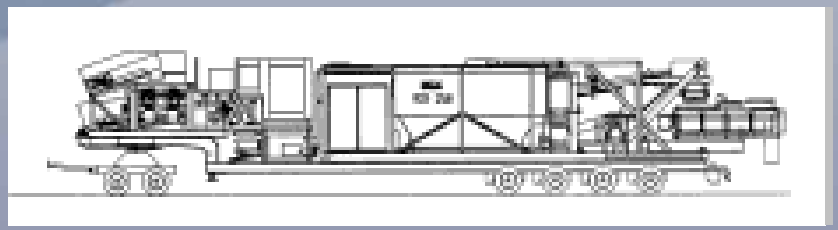
4 4 main recycling types

- **In-Plant Recycling**
  - **Hot and Cold**
    - Ä **Reclaimed materials (RAP) are transported to the plant, treated, and sent back to the jobsite for paving.**

- **In-Place Recycling**
  - **Hot and Cold**
    - Ä **The plant goes to the jobsite to**



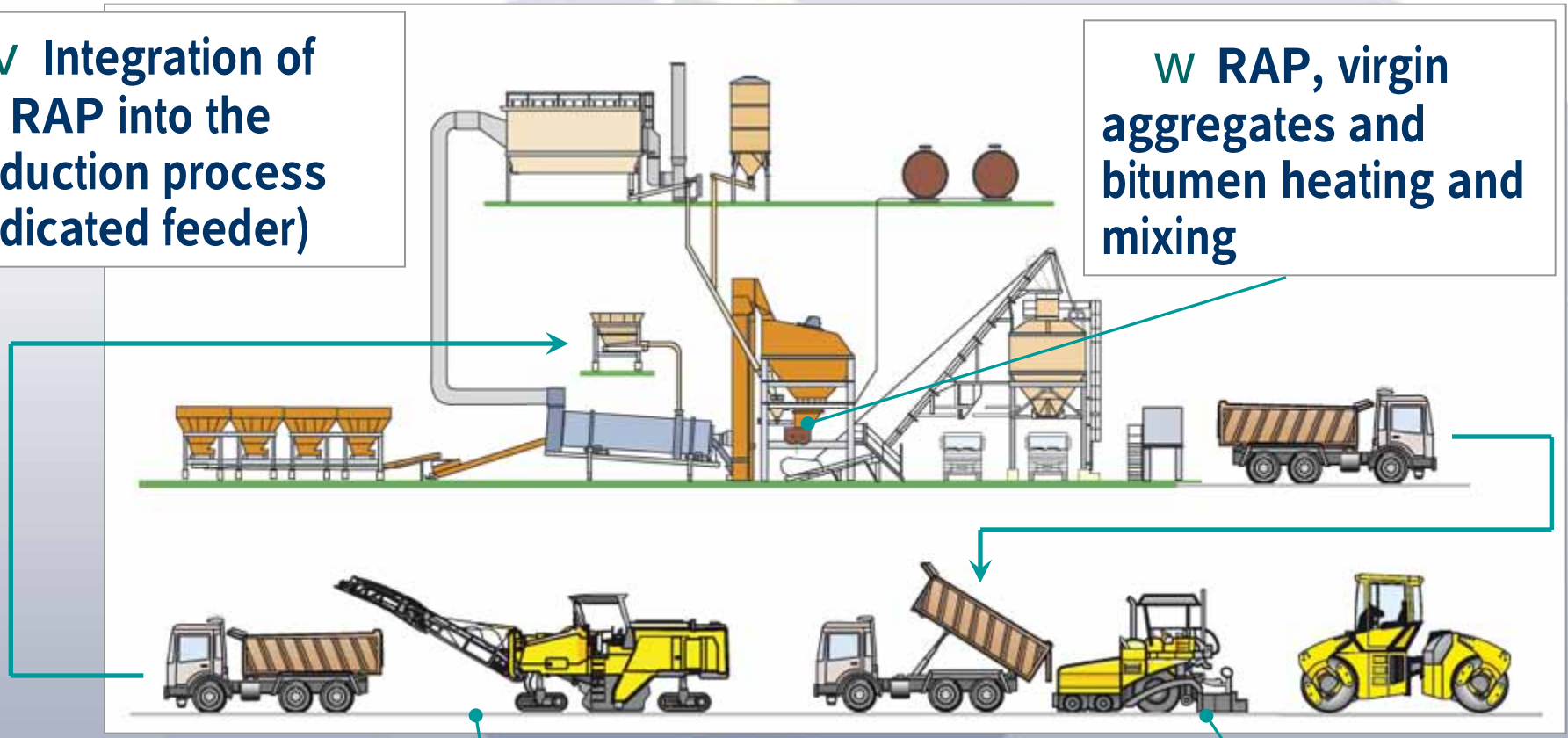




Recycling activity: The process in plant

v Integration of the RAP into the production process (dedicated feeder)

w RAP, virgin aggregates and bitumen heating and mixing



u Pavement milling and transportation of RAP to the HMA plant

x Truck loading, transportation to the jobsite, paving, compaction

Recycling Rates

- **% of RAP in the final mix depends on :**
  - Type, source and knowledge of the reclaimed material
  - ***Type of plant and technical recycling solution chosen***
  - Working conditions (temperature, moisture, …)

- **RAP Quality/Knowledge**

Knowledge on the RAP	Recycling Rate
No information (grading, bitumen content)	5% to 10%
RAP *properly* identified	15% to 25%
RAP perfectly known and controlled	30% to 50%

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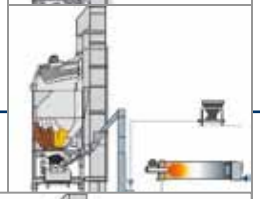
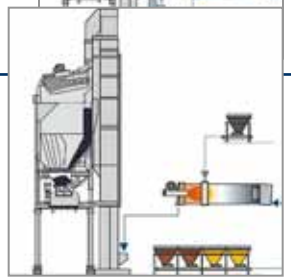
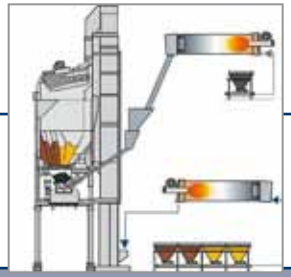
Recycling Rates Batch

4 Type of plant and recycling methods available

Type of plant	Method		Recycling Rate	Comments	Investment (% referred to the plant cost)
Batch	RAP directly at the foot of the hot elevator		10%	The least expensive on an ad hoc basis	5%
Batch	RAP directly into the mixer		25% (*)	Technical solution, limited investment	15%
Batch	RAP into the drum recycling collar		35%	Recommended on an ad hoc basis from 10 to 35%	8%
Batch	***RAP into mixer + RAP into the drum recycling collar***		***50 %***	*Combining (*) + (**)*	***20%***
Batch	Parallel drum		50%	Sophisticated solution, demanding clients, high outputs	50%

The most effective/flexible proposal

- **The best solution is the one which:**
  - Minimize investment costs
  - Offer the maximum of flexibility (max % of RAP used) in connection with the quantity of RAP *available* though minimizing operating cost
  - Maximize the % of RAP in each formula (maximum saving on purchasing cost of new aggregates and bitumen)
  - Savings on the jobsites (traffic, energy, resources, time)

- **Combined Recycling Solution / Saving on 100.000 t - 600.000 €uro with average 40% RAP**

Recycling Rates Continuous

4 Type of plant and recycling methods used

Type of plant	Method	Recycling Rate	Comments
Continuous	Dryer drum mixer Parallel flow	25%	Economical, high outputs, single formulas
Continuous	Rétroflux, Counter flow	35% to 50%	Economical, perfectly ecological, optimum outputs
Continuous	2 parallel drums	70%	With an independent continuous mixer

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Conclusion

Asphalt plants are equipped and ready to contribute to reduce environmental impact/(or to contribute to sustainable development) :

- Being the road itself ‘a quarry’ RAP is an option that should be always considered
- Producing Low/Warm energy mixes
- Producing mixes containing various % of RAP material. Among the full range of technologies available and well experimented/tested, the user could always choose the most conveneint solution to reduce to the minimum energy consumption and the capital investment .

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Thanks for your attention

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