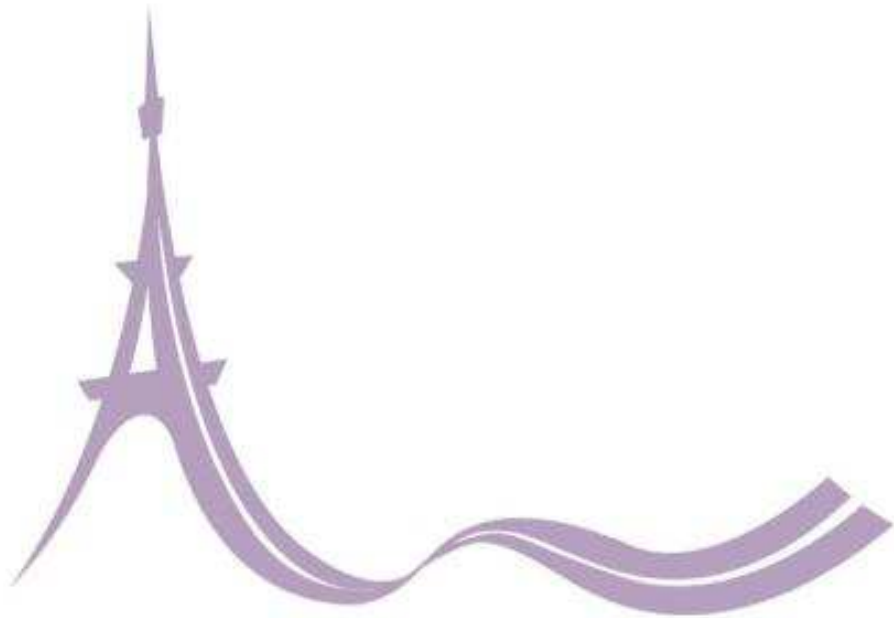


Bitumen Emulsion and High recycling



PAVEMENT PRESERVATION & RECYCLING SUMMIT

PPRS PARIS 2015
FEBRUARY 22-25

André
CLARAC
COLAS Sud Ouest



Resources

Budget constraints, needs to keep a minimum level of service drive to innovation

The road network: high potential for materials able to be recycled for a second life with bitumen emulsion



Solutions

Cold in place recycling

Cold mix with 100% RAP

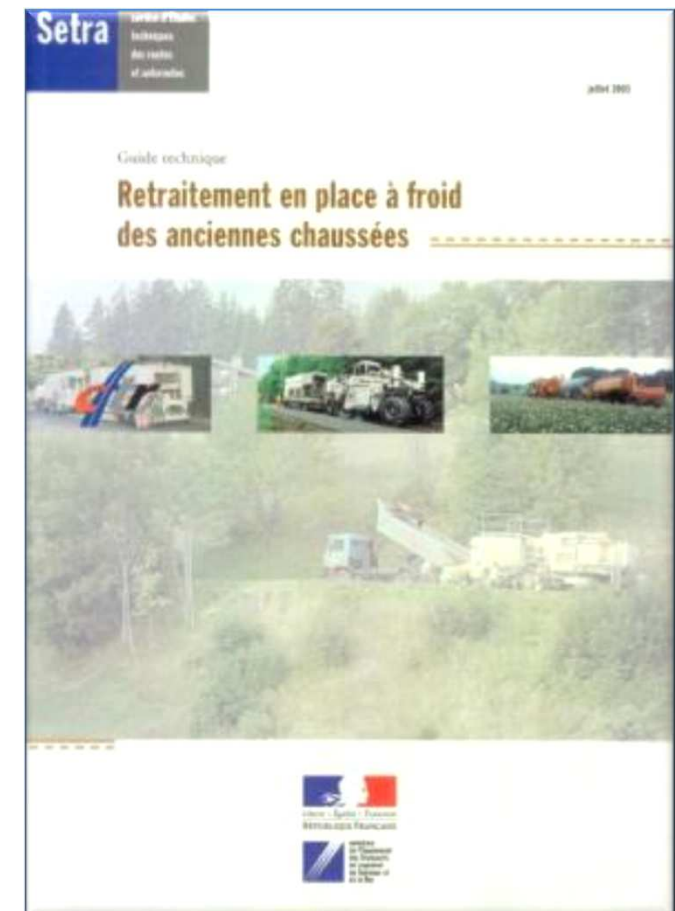
Cold in place Recycling with bitumen emulsion

For binder layer

Technique developed since 1980; thickness from 50mm to 120mm.

Currently used in road maintenance yearly program in different departments in France (Gironde, Haute Garonne, Ariège)
100 000 to 300 000 m²/yr.

More than 1M m²/yr in France.



Cold in place recycling with bitumen emulsion

Surface layer

- Calibrated RAP (d max < 12.5 mm)

Quality of the layers to be retreated
Equipment involved

- Specific bitumen emulsion.



Surface layer.

The formulation of the bitumen emulsion should give:

- A good coating
- Same performance as cold bituminous mixture
- Good workability until compaction
- Regeneration of the aged bitumen of the RAP



	Avant	Après	Gain
Bitumen			
Pénétration	12	41	29
Ring and Ball	70	56	14
FRAASS	-2	-11	9

Surface layer.

**Evolution of the characteristics
RD 125
100 HGV per day
Low mountain area**

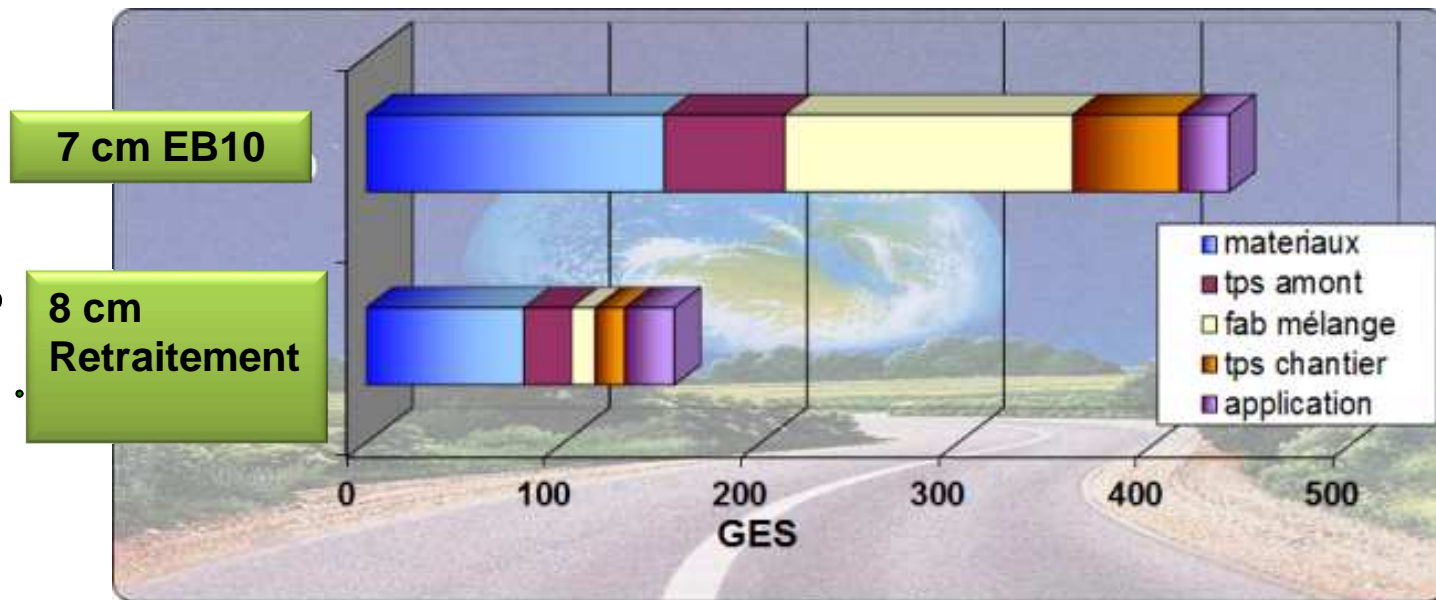


	1 mois	1 an	3 ans
Pénétration. (1/10 mm)	32	33	32
Ring and Ball (t°C)	61	57	60
Fraass point (°C)	-11	-9	-8
Compaction (%)	87	88	87
Modulus (MPa)	900	3200	3000
Macro texture (PMT)	> 0.6	> 0.5	> 0.4

Surface layer.



68%



Cold in place recycling surface layer: a still experimental technique but so promising after the first job sites

Cold bituminous mixture with bitumen emulsion and high RAP content

For surface layer

- aggregate formulation to deal with surface characteristics
 - gradation
 - Los Angeles, Micro Deval and PSV
- Bitumen emulsion designed for and with RAP

RAP

A new bypass 2X2 lanes was created and the old route constitute a strong source of recyclable materials

Ex RD 924 Aubiet bypass (32)

Adapted structure for the old route with a lot less traffic

VRS / TC5 → VRNS / TC3

Instead of 300mm 180 mm are enough

30 cm → 18 cm

So this was 20 000t of RAP available



Rehabilitation old route with high traffic when a new by pass was built

Milling on 120mm
Leveling of shoulders
Drainage trench redone

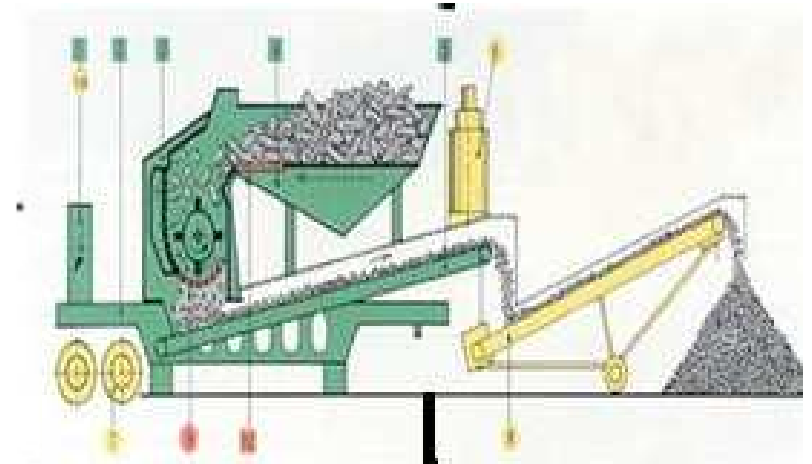
New surface layer
Micro surfacing



RAP optimization

Sizing.

**Gradation 0 to 10mm
with two fractions 0/6 mm and
6/10mm**



Characterization

Product technical data



Bitumen emulsion formulation

Coating Quality.

Emulsion chemistry for coating >90

Rejuvenation:

Goal to obtain a 70/100 pen bitumen

Mixture

100% RAP + 3.5% bitumen emulsion plus vegetal rejuvenator

	Before	Regenerated
Pénétration (1/10 mm)	: 18	90
Ring and Ball (°C)	: 64	46
Fraas point (°C)	: +4	-8

Mechanical properties

Formulation

RAP 0/10mm	: 100 %
Total water	: 7.0 %
Émulsion (vegetal rejuvenator)	: 3.5 %

Gyratory Compactor

% air voids at 60 gyrations	: 11 (5-12)*
% air voids at 200 gyrations	: 7 (<12)*

Résistance (Duriez).

Compression after air conservation (MPa)	: 4.0 (>3.0)*
immersion/compression ratio	: 0.82 (> 0.70)*

***() Following the standard NF P 98-139**

Manufacturing

Mobile cold mix plant 140t/h



Application.

Laying

- Tack coat 300g/m² residual binder.
- Mix paver applied with 50mm thickness after compaction (pneumatic and vibrating rollers)



Surface characteristics

Jobsite: RD 653
Traffic : 200 HGV/day



Macro texture (sand patch test) : 0.65
Compaction (%) : 90 – 91
Modulus (MPa – 15°C) : 1800

Smoothness threshold	Before work	After work
≤ 6	27	51 (RS: 50)
≤ 13	83	97 (RS: 95)
≤ 16	93	99 (RS: 100)

Mix at 80°C with bitumen emulsion and high RAP content

- mix manufactured in a cold mix plant (RAP + aggregates and bitumen emulsion) . The mix is then warmed in a specific equipment .
- or a fraction of the aggregates is dried in a hot mix plant and after mix with cold RAP and bitumen in a cold mix plant.

Both technologies permit the use of RAP 50% in surface layer applications.



Mix at 80°C with bitumen emulsion and high RAP content

Until 200 HGV per day

Equivalent behavior compared to hot mix

- good stability
- good cohesion at the end of compaction

Mix with high environmental advantages

- Reduction of GHG and energy demand over 50%
- No fumes emission



This pavement preservation program with 20 000t of RAP allowed.

- economy of 18 000 t of virgin aggregates**
- economy of 800 t of bitumen**

This program with the rehabilitation of the old route allowed a reduction of 20% of the cost compared with hot mix surface layers.

Bituminous mixtures with bitumen emulsion and high RAP content a consolidated technique with a good return on experiences

Solutions preserving natural resources reducing GHG emissions and strong cost reduction.

An experiment was performed in Ohio using the 100% RAP mixture as a surface.

Barrett Paving (a Colas company) and Colas Solutions

100% RAP

Screened to minus 14 mm

Recovered RAP binder was PG 82-10

3.0% bitumen emulsion containing a vegetable rejuvenator

Recovered mixture binder was PG 70-22

Air voids after 30 gyrations = 13%

**The trial was performed
September 2014.**

**Mobile cold mix plant
Paver
Steel wheel and pneumatic
rollers
Placed 5 cm thick over
tacked surface**



Condition before paving









Thank you for your attention