

# IN SITU RECYCLING USING CEMENT

## THE BELGIAN EXPERIENCE

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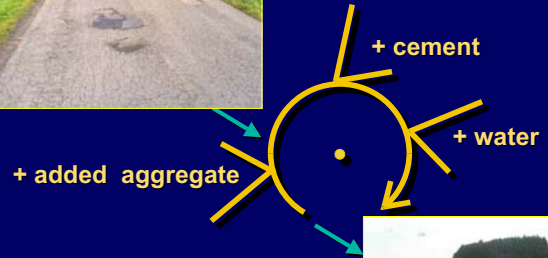
SEMINAR ON ROAD PAVEMENT RECYCLING

10 TO 11 OCTOBER 2002

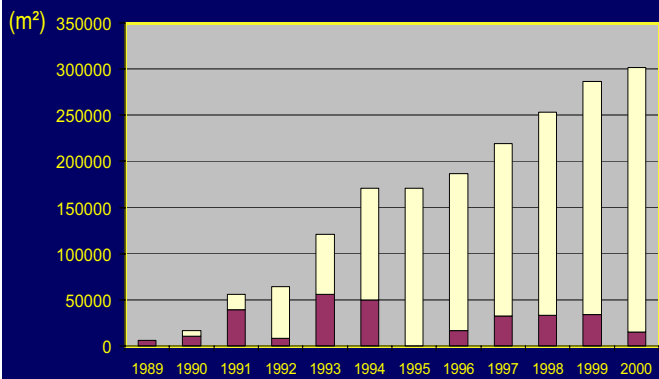
WARSAW (POLAND)



### IN SITU RECYCLING



### Evolution of Belgian realisations of in situ pavement recycling



### COMPRESSIVE STRENGTH (R'<sub>c</sub> - 90 d - on cores of 100 cm<sup>2</sup>)

- ▶ Vaux-sur-Sûre: 9,2 N/mm<sup>2</sup>
- ▶ Lavaux-Ste-Anne: 8,7 N/mm<sup>2</sup>
- ▶ Francorchamps: 13,5 N/mm<sup>2</sup> (on cores of 200 cm<sup>2</sup>)
- ▶ Philippeville: 17,9 N/mm<sup>2</sup>
- ▶ Messancy: 11,2 N/mm<sup>2</sup>
- ▶ Bierset: 12,1 N/mm<sup>2</sup> (on cubes of 20 cm)
- ▶ Waimes: 15,0 N/mm<sup>2</sup> (on cubes of 20 cm)
- ▶ Attert: 10,6 N/mm<sup>2</sup>
- ▶ Marche-en Famenne: 11,7 N/mm<sup>2</sup>



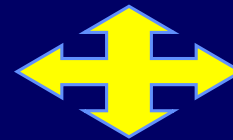
## STANDARD SPECIFICATIONS IN BELGIUM

- **Walloon Region : “RW 99”**      **detailed**  
+ GUIDELINES
- **Flemish Region : “sb250”**      **briefly**
- **Brussels Region : “TB2000”**      **only subgrade stabilisation**



TECHNICAL  
PRESCRIPTIONS

Feasibility Study



Execution

CASE STUDY

Marche-En -Famenne

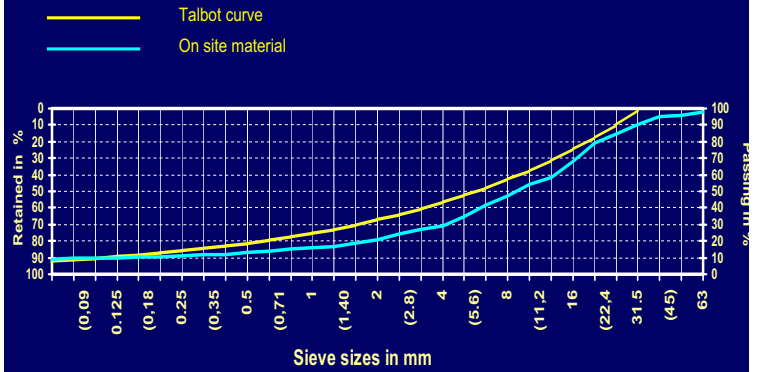


## FEASIBILITY STUDY

- Study of the history of the road & visual examination
- Cores or transverse trenches  
thickness of bituminous layer max. 1/3
- Sieve analysis  
✧ max. 10 % aggregates > 80 mm



## ON SITE MATERIAL COMPARED TO THE TALBOT CURVE



## QUICK STABILISATION TEST

Water content (%)	6	7	7,5	8	9
Compressive strength after 7 days (N/mm <sup>2</sup> )	13,0	21,0	20,8	15,5	17,5



## MATERIALS

- 6 % CEM III/A 42,5
- ADDED AGGREGATE :  
0/32 CRUSHED LIMESTONE





#### WATER CONTENT AND BULK DENSITY

	Average	Standard deviation
Water content (%)	7,19	1,21
Density (kg/m <sup>3</sup> )	2370	33

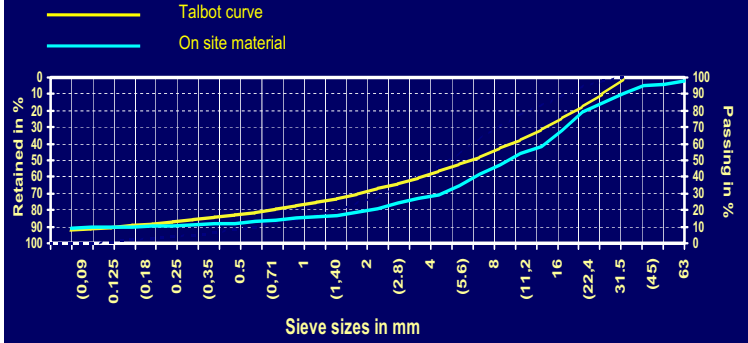


**COMPRESSIVE STRENGTH (N/mm<sup>2</sup>)  
ON CUBES 20x20x20 cm<sup>3</sup>**

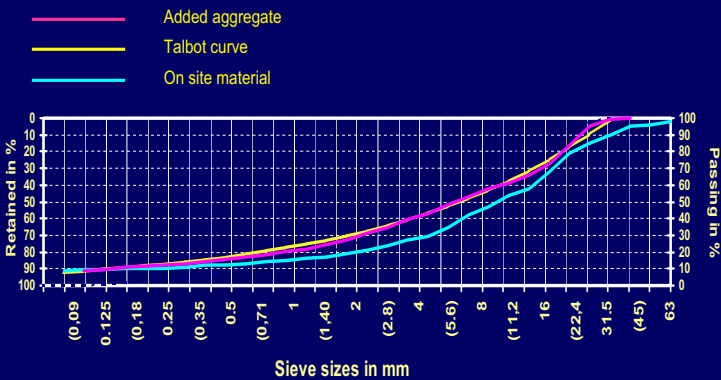
	<b>Average</b>	<b>Standard deviation</b>
<b>After 7 days</b>	<b>12,56</b>	<b>6,3</b>
<b>After 28 days</b>	<b>20,1</b>	<b>9,5</b>
<b>After 91 days</b>	<b>24,9</b>	<b>11,8</b>



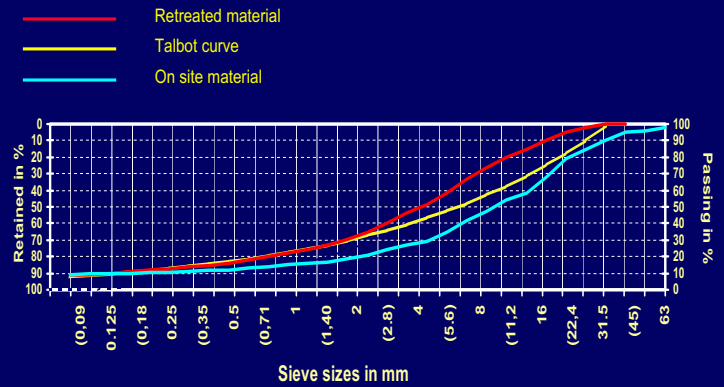
**THE ON SITE MATERIAL AND THE TALBOT CURVE**



**THE ON SITE MATERIAL, ADDED AGGREGATE AND THE TALBOT CURVE**



**RETREATED MATERIAL COMPARED TO THE ON SITE MATERIAL AND TO THE TALBOT CURVE**





**COMPRESSIVE STRENGTH (N/mm<sup>2</sup>)  
AFTER FIVE MONTHS ON CORES 100 cm<sup>2</sup>**

	<b>Average</b>	<b>Standard deviation</b>
<b>Upper parts</b>	<b>15,0</b>	<b>9,2</b>
<b>Middle parts</b>	<b>11,8</b>	<b>7,2</b>
<b>Lower parts</b>	<b>7,1</b>	<b>3,4</b>
<b>Mean of all samples</b>	<b>11,7</b>	<b>7,8</b>



**REFLECTIVE CRACKING**



**REFLECTIVE CRACKING**



## CONCLUSIONS

### RECYCLING IN SITU = MASTER **RECYCLING** TECHNIQUE

- **STANDARD SPECIFICATIONS EXIST**
- **FUTURE ?**
  - feasibility studies
  - innovating techniques - specific material
  - financial incentive ?
- **PROMOTION**
  - economical and ecological advantages

