AV'15 | KONFERENCE ASFALTOVÉ VOZOVKY 2015

FIELD EXPERIENCE of LONG-TERM EVOLUTION of SBS POLYMER MODIFIED BINDER

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EPFL / LAVOC (Switzerland) : A. DUMONT, M. PITTET

Presented by A.BRUNON

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DURABILITY : Highway field experiment

The stakeholders:

- The Swiss Road and Transportation Association
- The Valais Canton
- The University of Lausanne – EPFL / LAVOC

Valais test sections in Switzerland: from 1988 to 2002 / 2007

Durability study : Field experience of long-term evolution of SBS polymer modified binder
S. Dreessen, T. Gallet, A-G. Dumont, M. Pittet, Eurobitume & Eurasphalt congress, Istanbul 2012

Site conditions

Traffic pressure

- 24000 vehicles per day between 1988 and 2007
- Heavy goods vehicles : 6% of the overall traffic

Climate

- Specific weather station near the sections since 1992
- Temperature sensors placed at the different depth of the structure
- Humidity sensor
- Radiometer measures visible and infrared solar radiation
- Typical weather of the alpine valleys :
  - Long periods of sunshine (270 days per years and T° over 30°C on a regular basis)
  - Cold conditions, under -10°C and days with very quick cooling-down speeds (5°C/h)

Road surface structure

- Standard bituminous concrete 16S, 4cm thick
- Binder content and thickness of the wearing course are identical for all products
- Heavy goods vehicles : 6% of the overall traffic

LAVOC Field validation study from 1988 to 2002/ 2007

16 comparative test sections of 300 m length each on CH-N9 highway (repaved in 2002)
1 complementary test section of 4 km with Styrelf 13/80 (repaved in 2009)

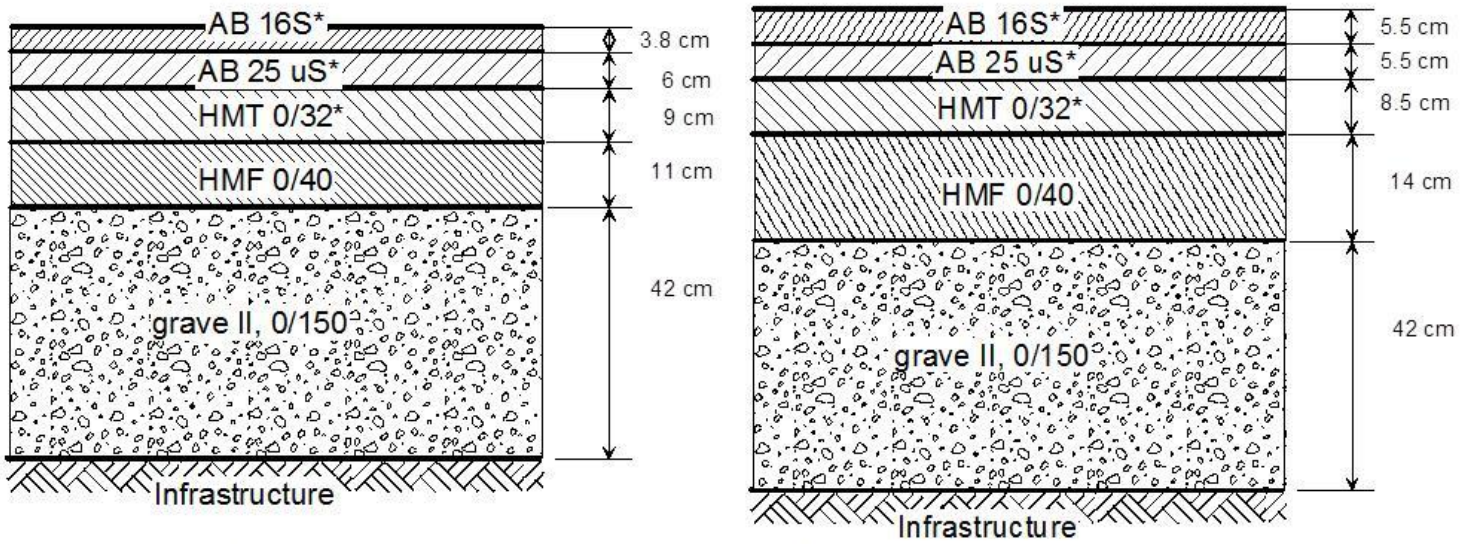
Comparative test section structure
1988 - 2002
Lot 342 between Jonction Vétroz–Conthey and Ardon (Switzerland)

Section 11
Styrelf® 13/80

Section 15
B 80/100

Complementary test section structure
1988 - 2007
Jonction Sion – Ouest / Jonction Vétroz–Conthey (Switzerland)

Section11bis
Styrelf® 13/80



Structure and foundation of the highway (test and complementary section)

Field validation: Observations after 14 years

Cracked !

Un-Cracked !

LAVOC field results

Monitoring of the evolution of binders and asphalt mixes during the pavement life

On site inspection of the surface layer durability: Cracking

Rutting not an issue

- **Observations made after 4, 7 and 10/14 years of traffic**

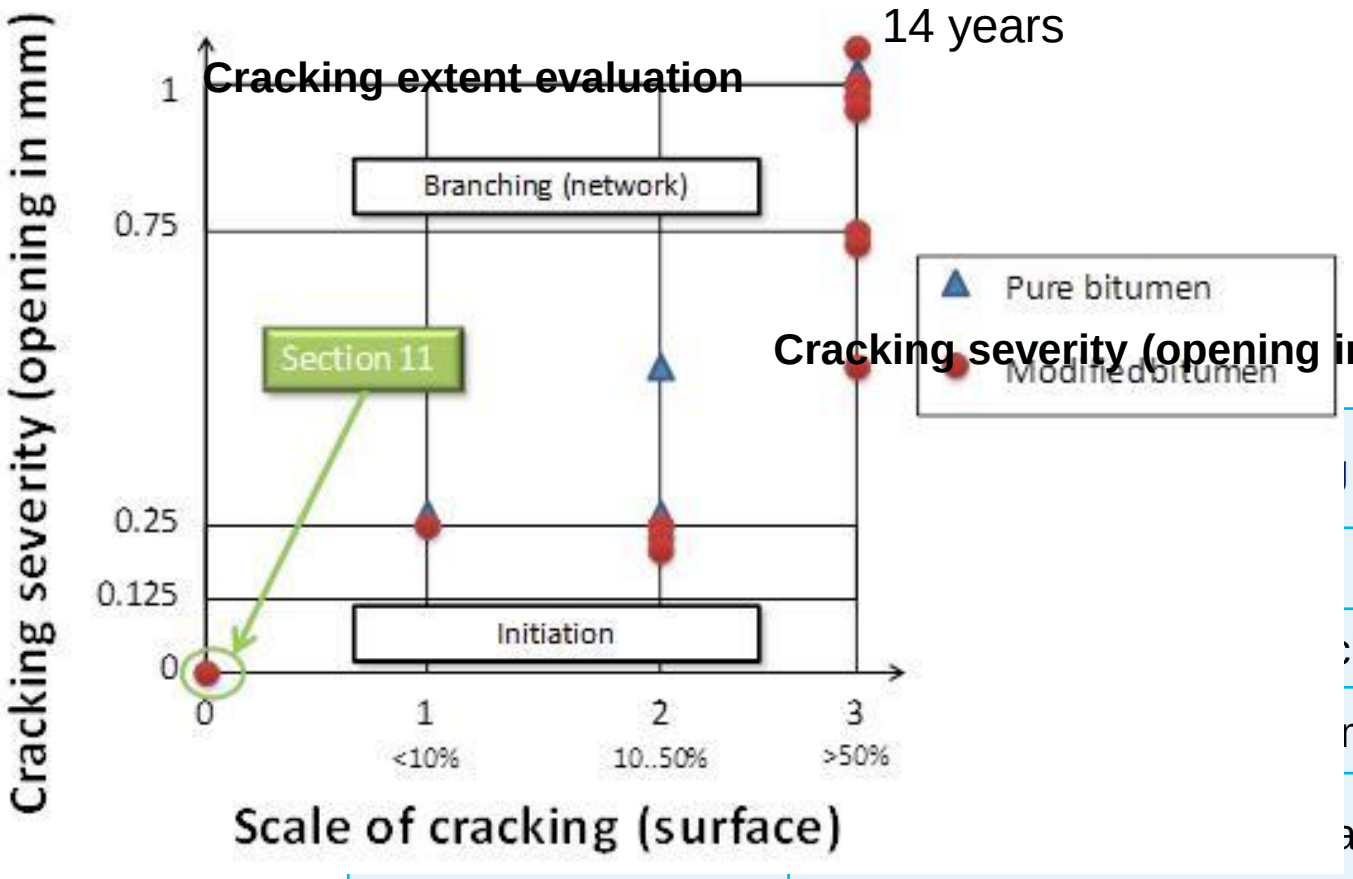
Binder extraction and analysis ⇒ Aging

- **Binder extraction according to SN 670 401a and EN 12697-3:2005**
  - Recovery of 150g residual asphalt by toluene – optimized method
- **Classical characterization (Pen, R&B, Viscosity, Elastic Recovery)**
- **Low temperature behavior: Fraass brittle point, BBR**
- **Chemical analysis: Gel permeation chromatography, Oxidation degree by FTIR-spectroscopy (CO and SO-Index)**

LAVOC Field results : CRACKING AMPLITUDE INDEX

On site inspection of the surface layer durability: Cracking

- Observations made after 4, 7 and 10/14 years of traffic



LAVOC Field results : BINDERS PROPERTIES

Samples

- Section 15 (80/100), Section 11 (Styrelf 13/80) and Styrelf 11bis (Styrelf 13/80)
- After 2 years, 8 years, 14 years and 19 years (11 bis)

Binder extraction and analysis ⇒ Aging

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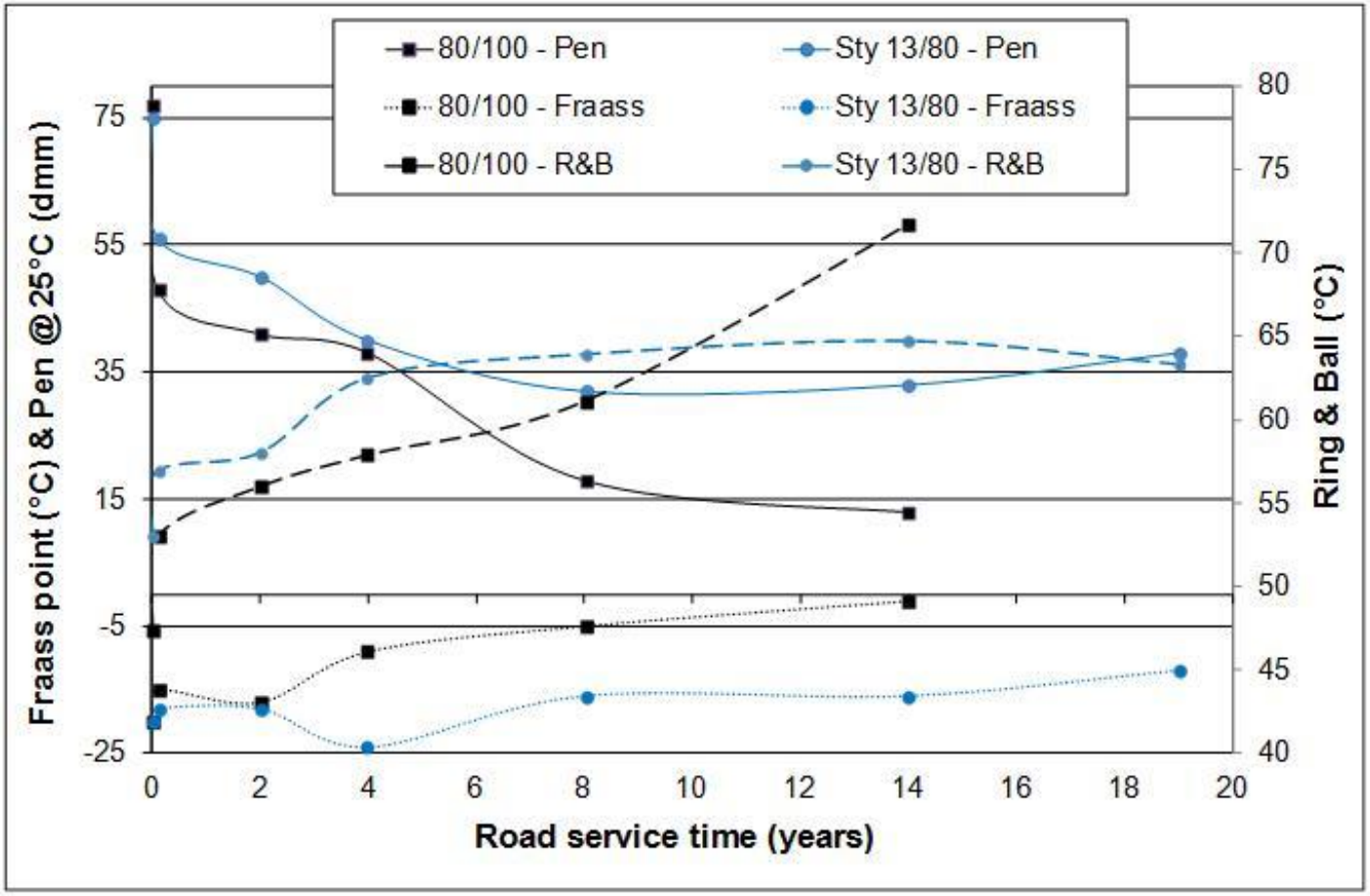
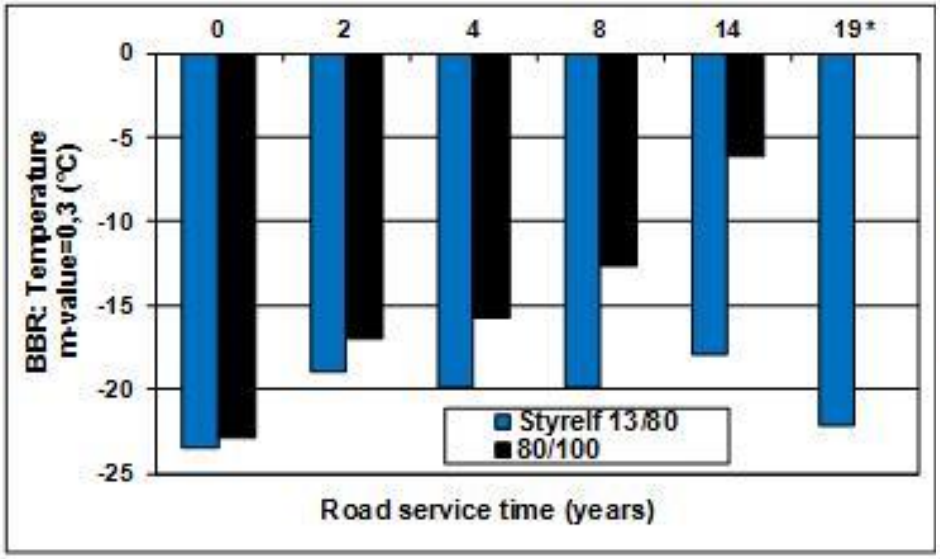
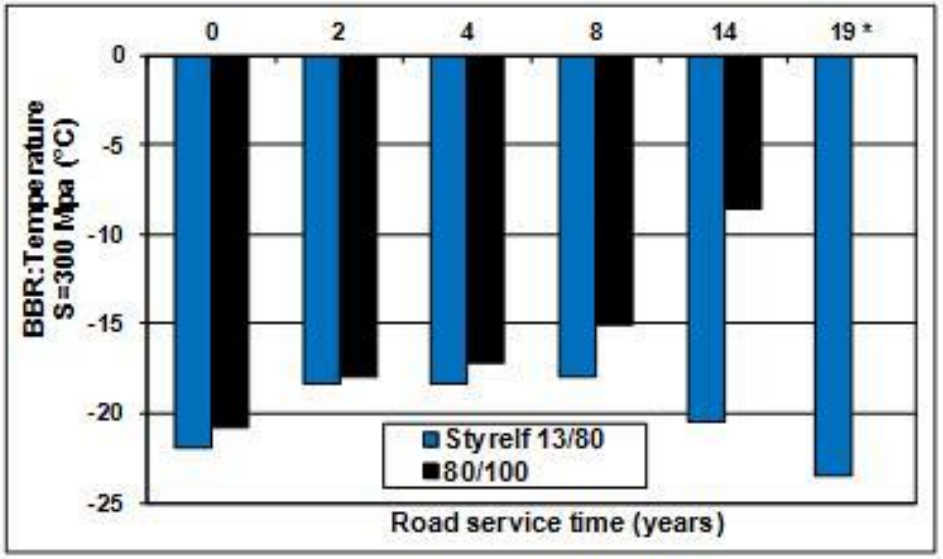
LAVOC Field results : BINDERS PROPERTIES



- Constant evolution of the pure bitumen during road service
- The PmB evolution stabilizes afetr 8 service years

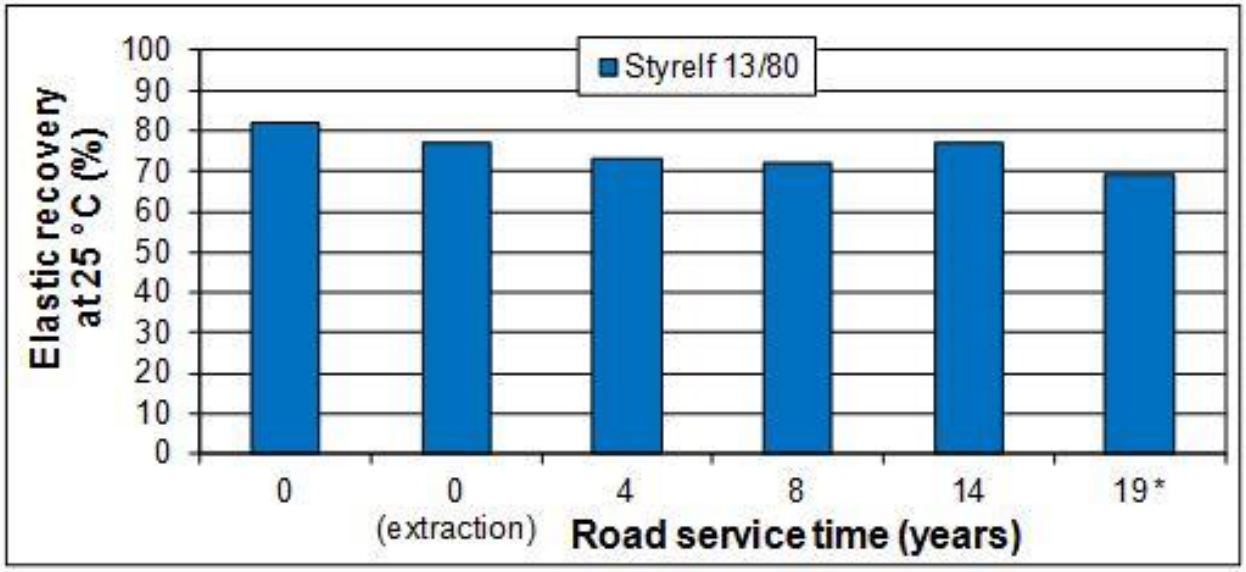
LAVOC Field results : BINDERS PROPERTIES





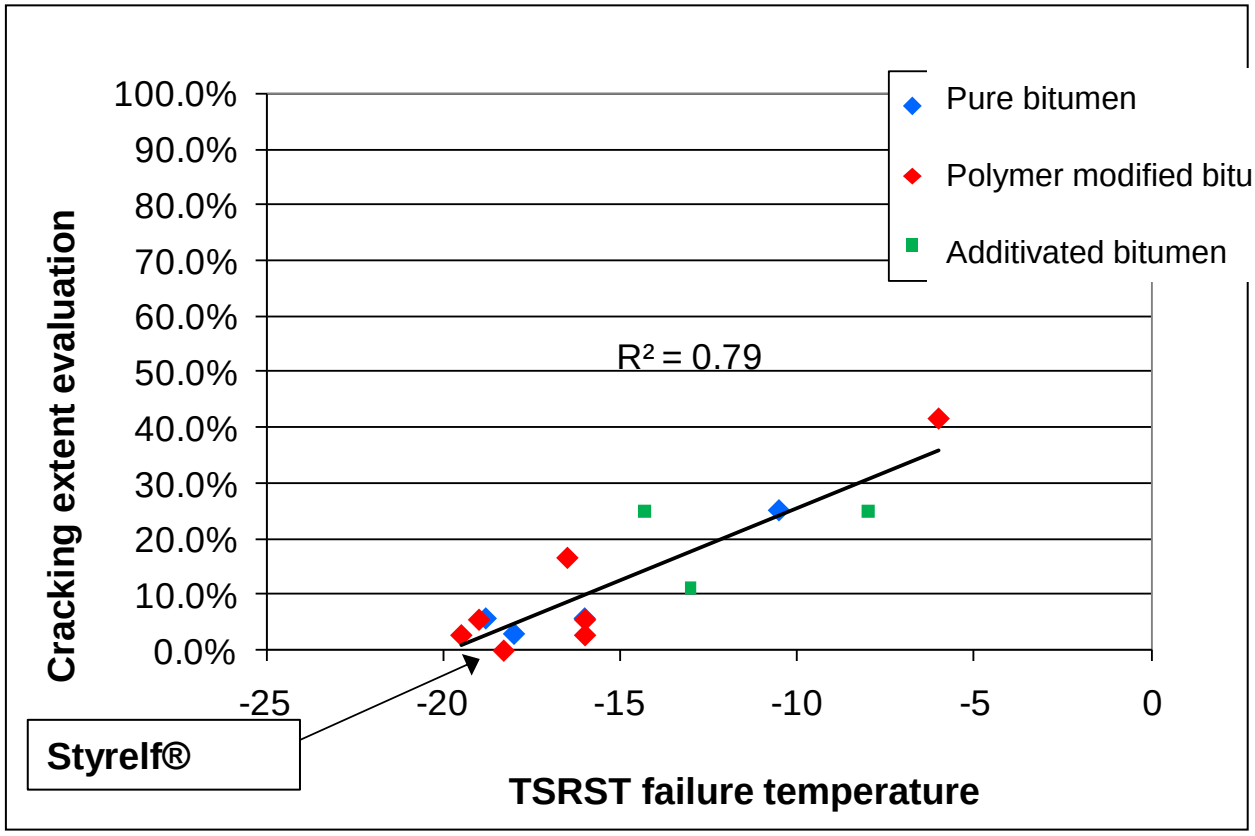
- Same tendency for BBR results.
- The increase in the temperature at which the stiffness is 300 MPa is limited to only 4 °C for the PmB, as opposed to 12 °C for the asphalt
- The limiting m-value temperature evolves more than the iso-stiffness one for the neat asphalt
- This result indicates a lower cracking risk for the PmB

LAVOC Field results : BINDERS PROPERTIES



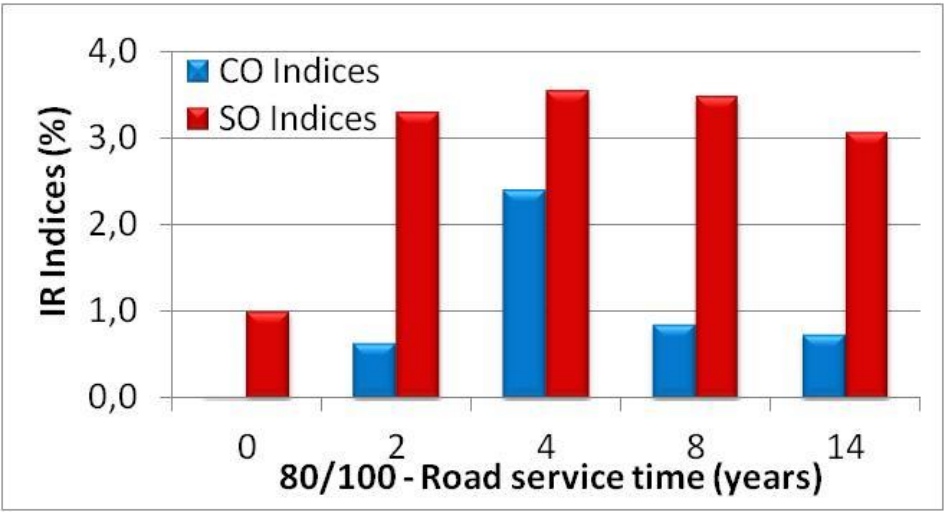
- **The PmB elastic recovery remains at a high level even after 19 service years (only 13 % loss) showing a good and durable relaxation ability at 25°C**

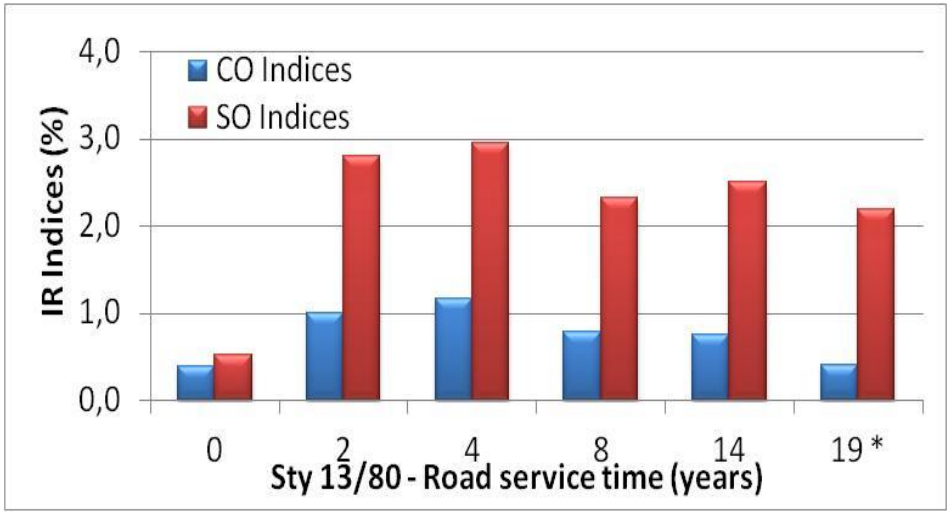
LAVOC Field results : MIX PROPERTIES vs ROAD OBSERVATIONS



- TSRST test on samples after one year on the road
- Correlated with the degradation of the road after 10 years of service

EVOLUTION OF THE CHEMICAL COMPOSITION





- The CO and SO indexes reach a peak after 4 years before decreasing slightly up to 19 years
- **The chemical stability for PmB reflects that of the performances.**

CONCLUSIONS

- Field ageing affected the pure asphalt much more than the polymer modified binder Styrelf 13/80
  - **Lower ageing sensibility of crosslinked PmB**

- Confirmation of visual observation by binder characterization
  - **Zero low temperature cracking on the section 11 and 11bis**

- Globally, the long term behavior of the crosslinked PmB used in this study presents a high and outstanding performance level
  - **Polymer effect reduced but still present, even after 19 years in service**

- **Good performance at the lab (binder and mix characterizations) reflected the very good onsite behaviour**

➔ Very good durability of motorway with Styrelf 13/80

THANK YOU FOR YOUR ATTENTION

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