Niet gespecificeerde additieven voor bitumen toegepast op Nederlandse wegen.

CROW Infradagen Rotterdam

10 November 2022

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Q8Research, Boskalis QRS

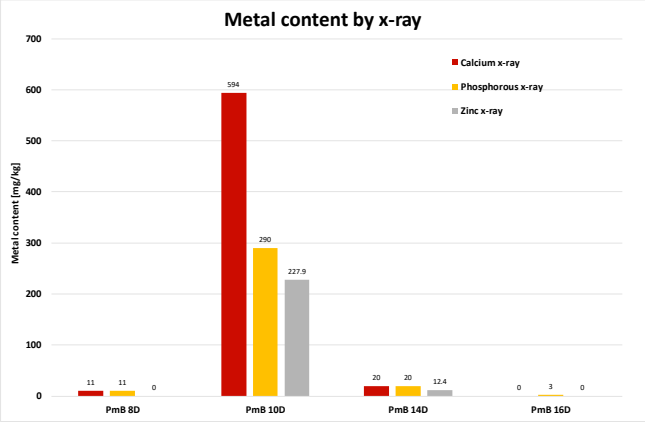
Asphalt issues Dutch road, 2019

Unworkable asphalt mix with PmB binder

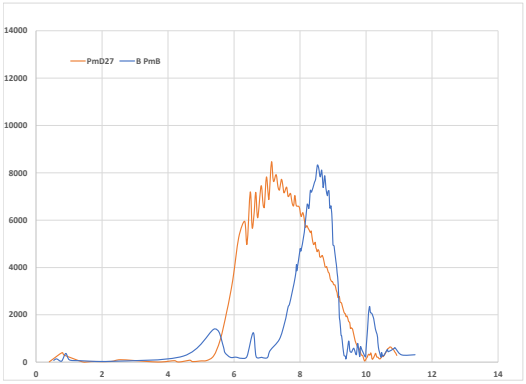
Asphalt with poor adhesion with PmB binder

Fume during asphalt laying

Dilution of bitumen, 2019

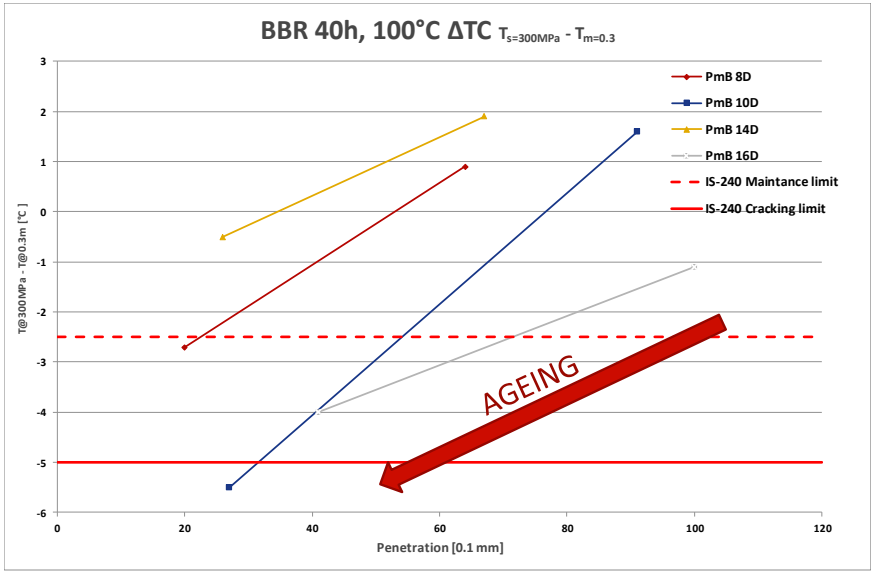


Elements - Ca, Zn, P, - content



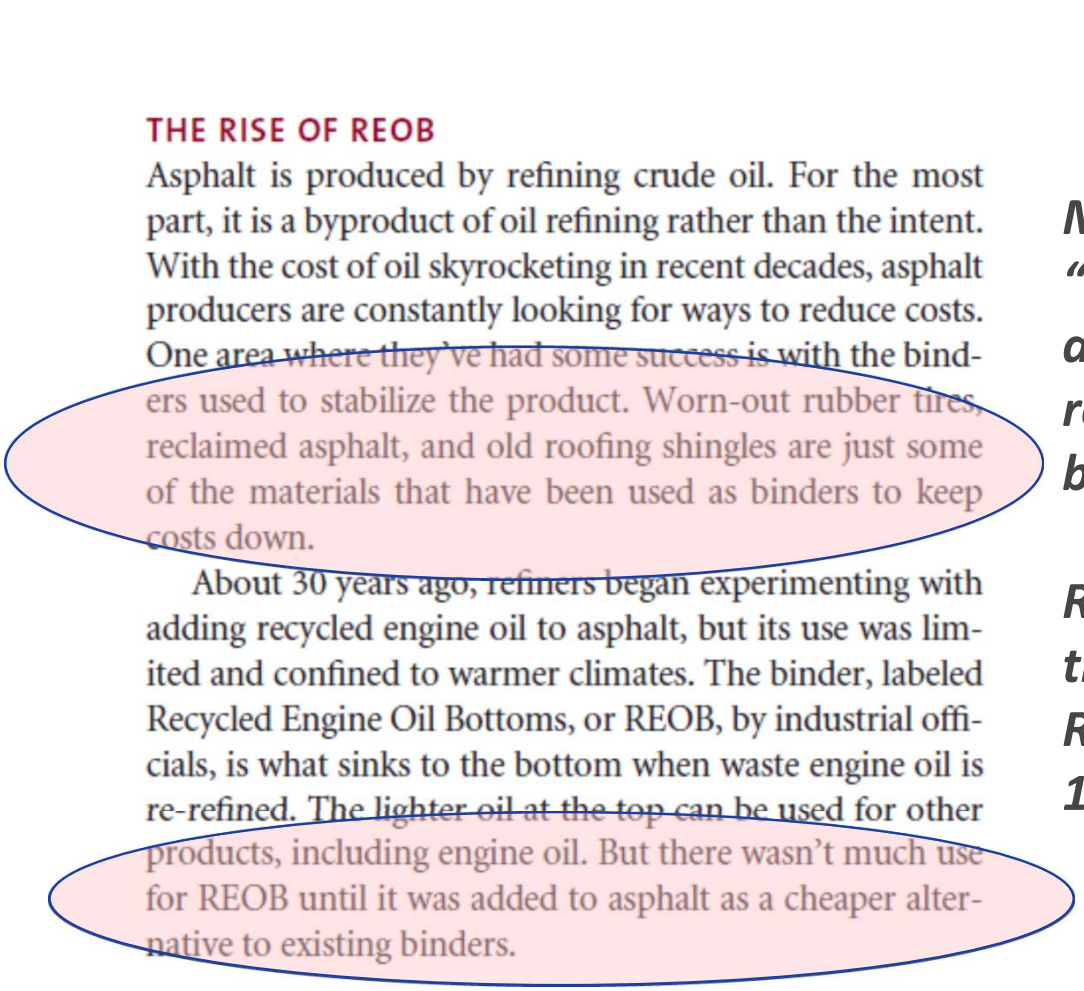
SimDis

Delta Tc vs Penetration 25°C, before/after 2x PAV ageing



Start “Leerruimte” RWS/Boskalis

Common Wealth Magazine, Fall 2014



THE RISE OF REOB

Asphalt is produced by refining crude oil. For the most part, it is a byproduct of oil refining rather than the intent. With the cost of oil skyrocketing in recent decades, asphalt producers are constantly looking for ways to reduce costs. One area where they've had some success is with the binders used to stabilize the product. Worn-out rubber tires, reclaimed asphalt, and old roofing shingles are just some of the materials that have been used as binders to keep costs down.

About 30 years ago, refiners began experimenting with adding recycled engine oil to asphalt, but its use was limited and confined to warmer climates. The binder, labeled Recycled Engine Oil Bottoms, or REOB, by industrial officials, is what sinks to the bottom when waste engine oil is re-refined. The lighter oil at the top can be used for other products, including engine oil. But there wasn't much use for REOB until it was added to asphalt as a cheaper alternative to existing binders.

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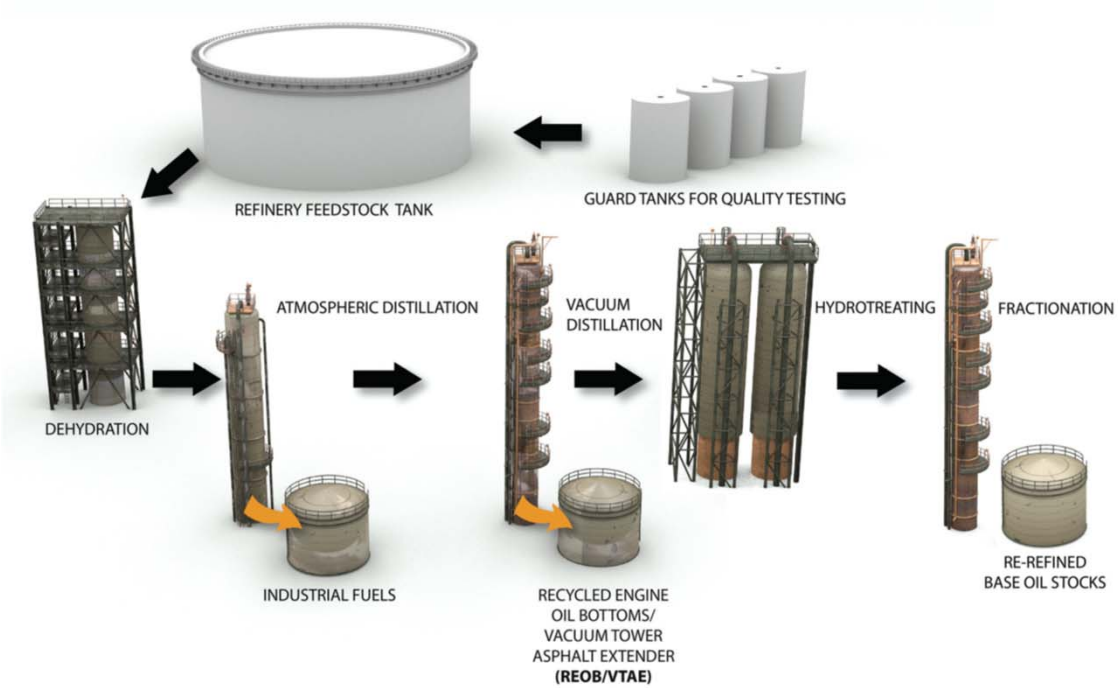
More hard "additives" in asphalt requested softer bitumen grades.

REOB/VTAE in the US: 1985
REOB in Europe: 1970

ReOB/VTAE, simplified production process



Asphalt Institute IS-235, The use of REOB/VTAE in asphalt, 2016

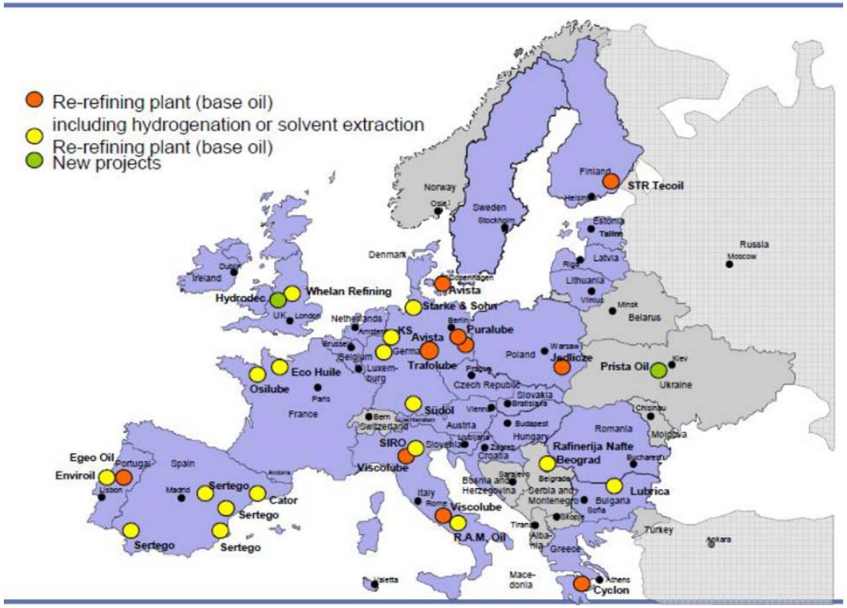
USA: registered CAS number 12893_17_0
Europe: "Bitumen"

- History
  - Initial Technology from Europe
  - Established in North America in the 1980's
  - 'VTB's' used in asphalt ≥ 1.7 MM tons since 1990
- Paving
- Roofing
- Industrial

10/23/2014 PRI Asphalt Technologies, Inc. 23

Rocky Mountain user/Producer group, Idoha Oct 2014

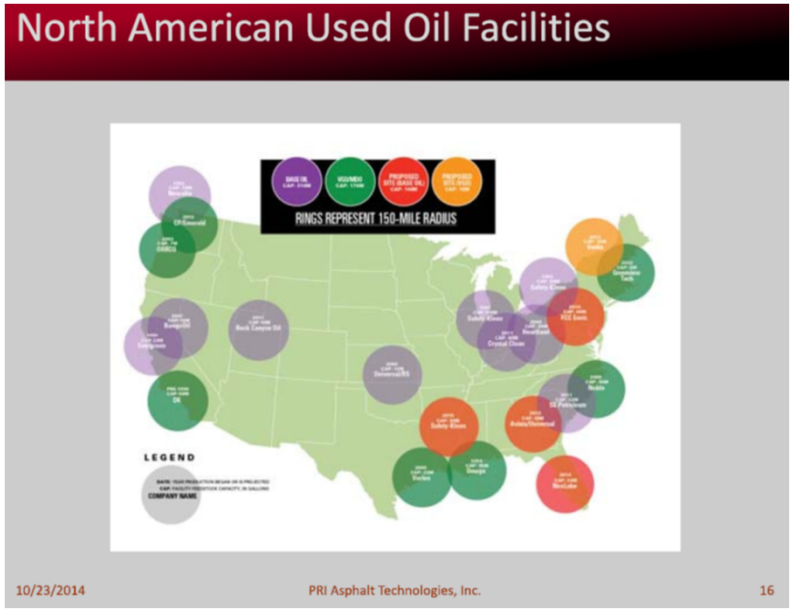
ReOB/VTAE, US and Europe



Capacity ≈ 2 Mton Oil (≈ 400 kton ReOB)

GEIR website

Capacity ≈ 1.5 Mton Oil (≈ 300 kton ReOB)



Rocky Mountain user/Producer group, Idoha Oct 2014

ReOB in Europe sold as Flux oil

For years this is forbidden in "Bunker Fuel". ISO 8217, *Petroleum Products – Fuels (class F) - Specification for marine fuels*, clearly state: free of Used Lubricating Oil:

Table 2 (*continued*)

Characteristic	Unit	Limit	Category ISO-F-											Test method reference
			RMA	RMB	RMD	RME	RMG				RMK			
			10[a]	30	80	180	180	380	500	700	380	500	700	
Aluminium plus silicon	mg/kg	max.	25	40	40	50	60				60			see 7.9 IP 501, IP 470 or ISO 10478
Used lubricating oils (ULO): calcium and zinc; or calcium and phosphorus	mg/kg	—	The fuel shall be free from ULO. A fuel shall be considered to contain ULO when either one of the following conditions is met: calcium > 30 and zinc > 15; or calcium > 30 and phosphorus > 15											see 7.10 IP 501 or IP 470 IP 500

[a] This category is based on a previously defined distillate DMC category that was described in ISO 8217:2005, Table 1. ISO 8217:2005 has been withdrawn.

[b] 1 mm^2/s = 1cSt.

[c] The purchaser shall define the maximum sulfur content in accordance with relevant statutory limitations. See 0.3 and Annex C.

[d] Due to reasons stated in Annex D, the implementation date for compliance with the limit shall be 1 July 2012. Until such time, the specified value is given for guidance.

[e] See Annex H.

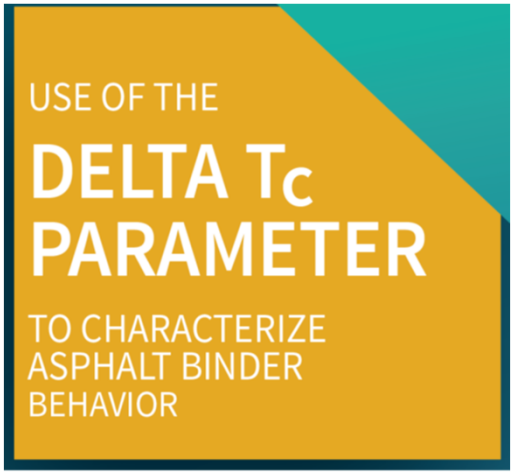
[f] Purchasers shall ensure that this pour point is suitable for the equipment on board, especially if the ship operates in cold climates.

Asphalt Institute, IS-235 - 2014

This document is careful to define REOB/VTAE as the non-distillable residuum from a vacuum tower in a used oil re-refinery. Other re-refined products derived from used oil not meeting this definition are not addressed herein, and the extent of their use in asphalt is unknown. REOB/VTAE has been used as a blending agent to soften binders. The demand for softer binder grades has grown due to higher levels of RAP and RAS being used in mixtures. The use of higher concentrations of hard oxidized binder from RAP and RAS require a softer virgin binder to meet the combined blend requirements. This factor has led to a heightened use of softening agents, which include non-asphalt blending stocks such as REOB/VTAE.

Some research indicates REOB/VTAE has an adverse effect on the aging characteristics of the asphalt binder and in turn the cracking resistance of in-service pavements. Other research indicates REOB/VTAE blended asphalt has equivalent or better asphalt mixture performance relative to mixtures with neat asphalts of similar stiffness. The literature is largely inconsistent; with various authors suggesting that REOB/VTAE may be innocuous while others suggest its usage may be detrimental to performance. Further, there is data indicating that the performance of binders and mixtures containing REOB/VTAE is dependent on the REOB/VTAE dosage, the REOB/VTAE source and the binder source.

Quality measurement, ΔTc (IS-240)



Delta T_c (ΔT_c) is a derived asphalt binder property that has been gaining attention for the last decade. It has become a topic of focus to both researchers in the asphalt binder technical community and user agencies seeking physical property parameters that will improve hot mix asphalt pavement performance. It is generally accepted that ΔT_c targets cracking behavior that is affected by asphalt binder durability related to aging of the binder in an asphalt mixture. More specifically, ΔT_c provides insight into the relaxation properties of a binder that can contribute to non-load related cracking or other age-related embrittlement distresses in an asphalt pavement. It is a calculated value using the results of the bending beam rheometer test determined on laboratory-aged asphalt samples or samples recovered from pavements. At the time this document was developed (mid-2019), ten user agencies have or soon will implement ΔT_c as part of their purchase specification, with two more expecting to do so in the near future. In addition, several national level research projects are actively considering ΔT_c as part of their studies. In fact, ΔT_c was first hypothesized via a research project led by the Asphalt Institute.

According to the original purpose of this study, an in-place asphalt sample could be extracted and evaluated for ΔT_c. If that sample indicated a ΔT_c of about 2.5°C, then it is likely that the pavement would need a preventive maintenance treatment because cracking would be imminent. Likewise, if the sample indicated a ΔT_c of 5°C or greater, then the pavement was likely already exhibiting cracking and thus, a maintenance treatment more targeted to this condition would be necessary.

ΔTc in US, IS-240

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➢Unmodified, Polymer-modified, ReOB-modified, SDA, PPA-modified, Biophalt, Oxidized, Airblown, Visbroken.

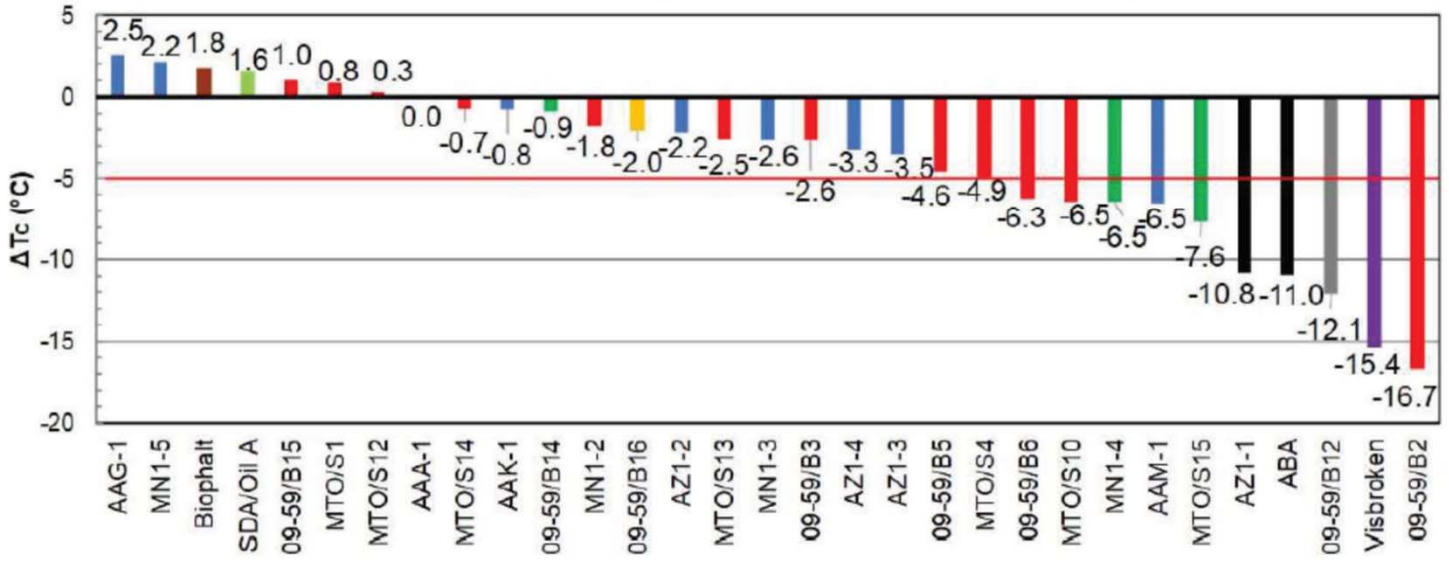
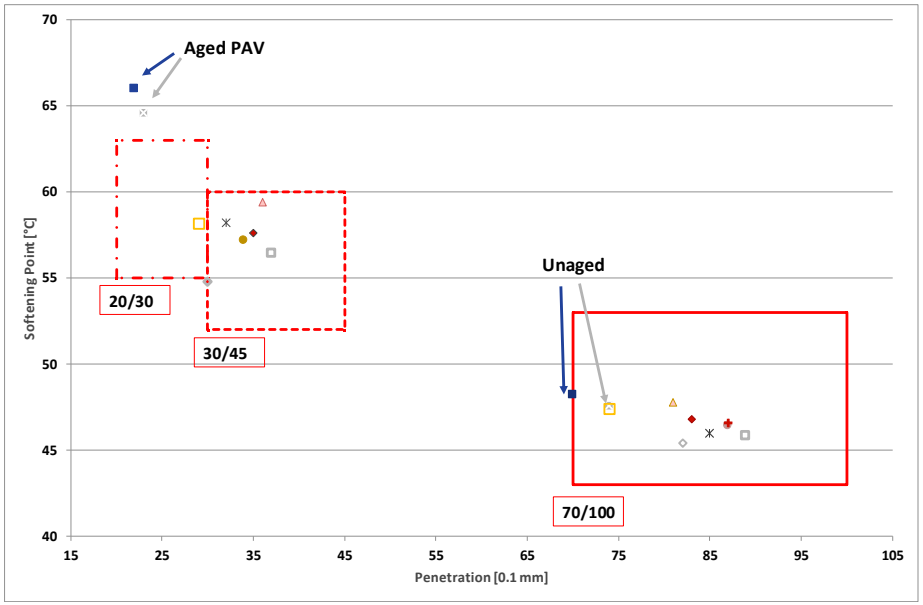


Figure 12. ΔTc (PAV40) of Various Binders from NCHRP 9-60 Research Project Database (4)

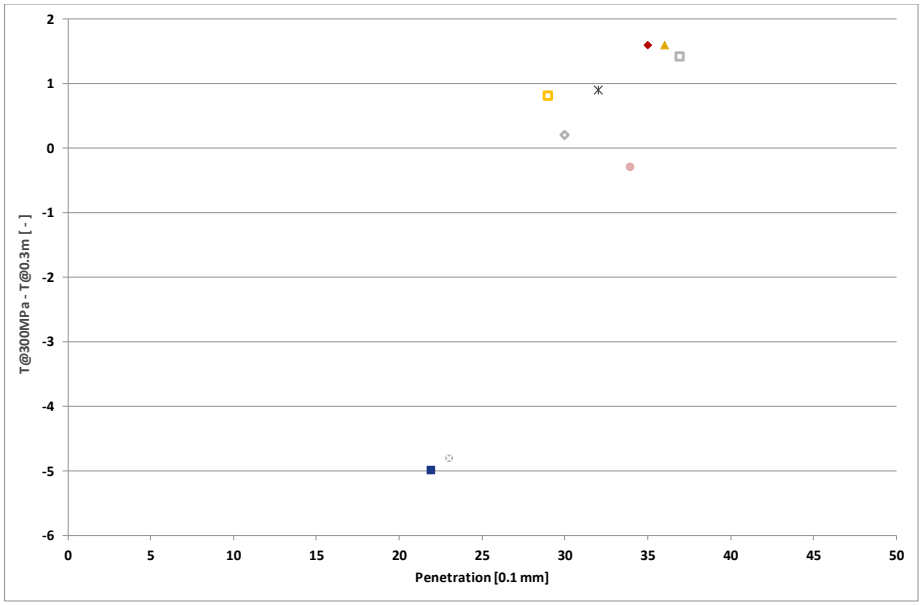
Delta Tc the Netherlands, 70/100 bitumen, 2017

Three suppliers: each three delivered bitumen

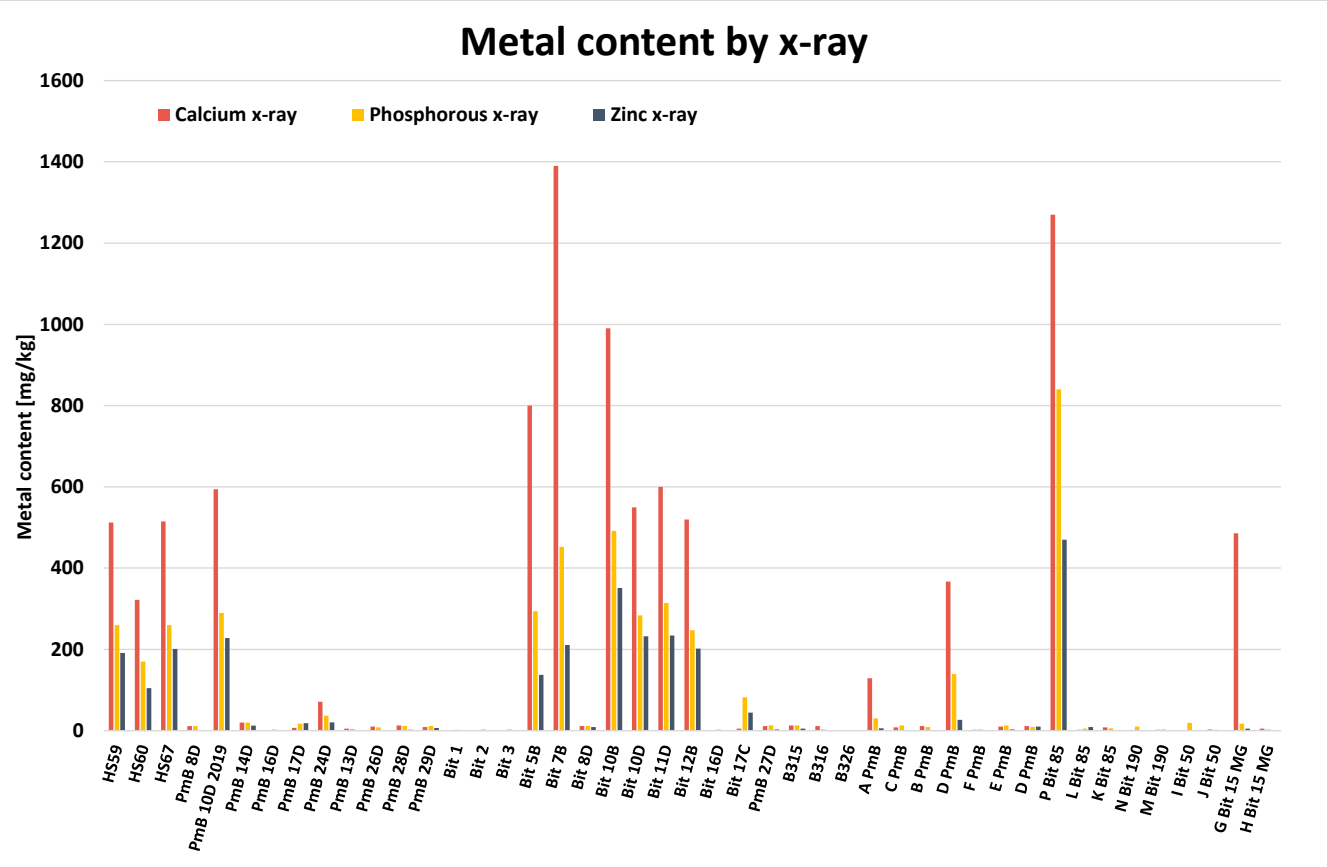


Softening Point vs Penetration 25°C, before and after RTFOT/PAV ageing

Delta Tc vs Penetration 25°C, after RTFOT/PAV ageing



VTAE used in the Netherlands

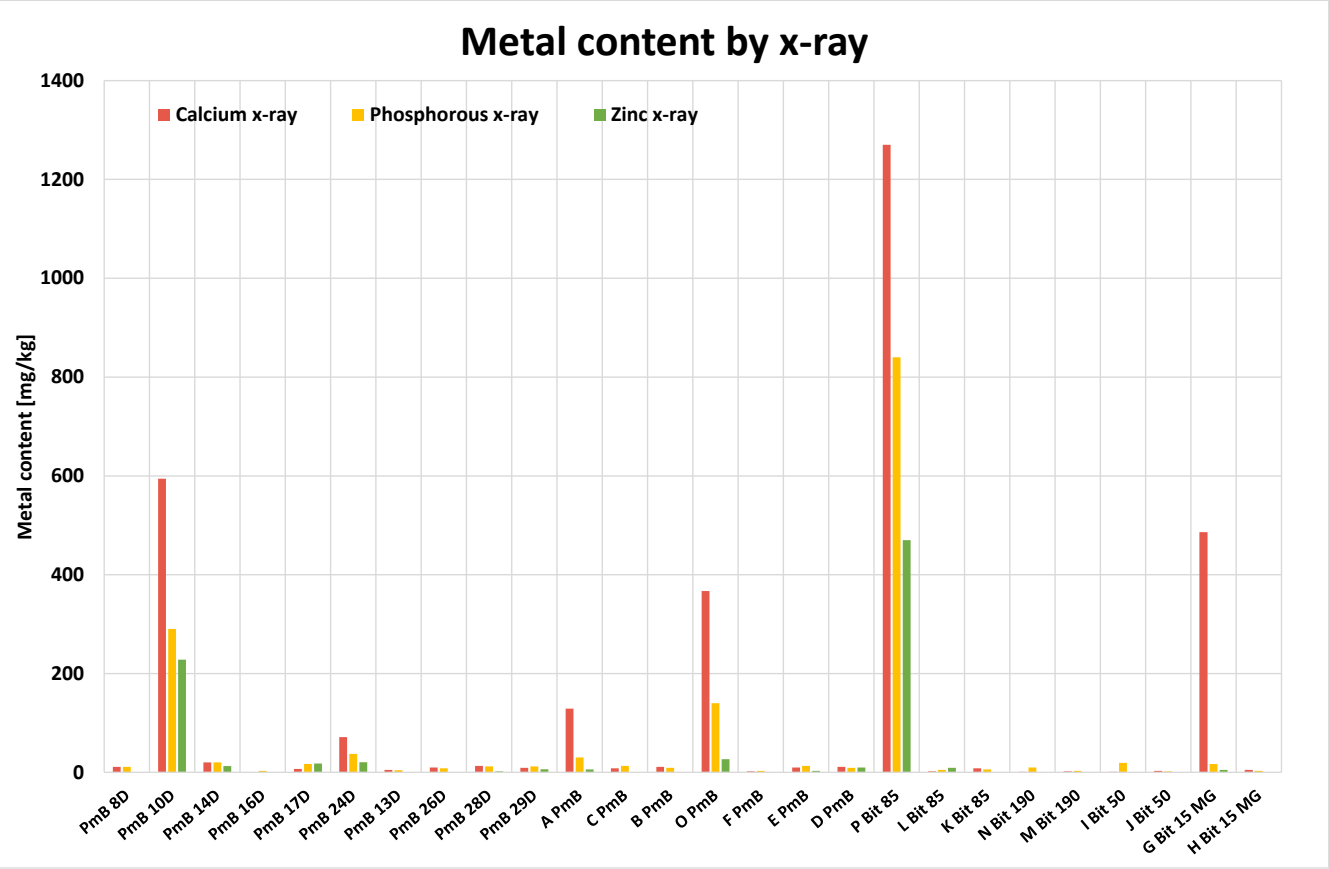


Remember:
ISO 2017 demands free of ULO.

Ca < 30 ppm
P < 15 ppm
Zn < 15 ppm

Clearly REOB is used.
But is it a problem?

VTAE used in the Netherlands



Remember:
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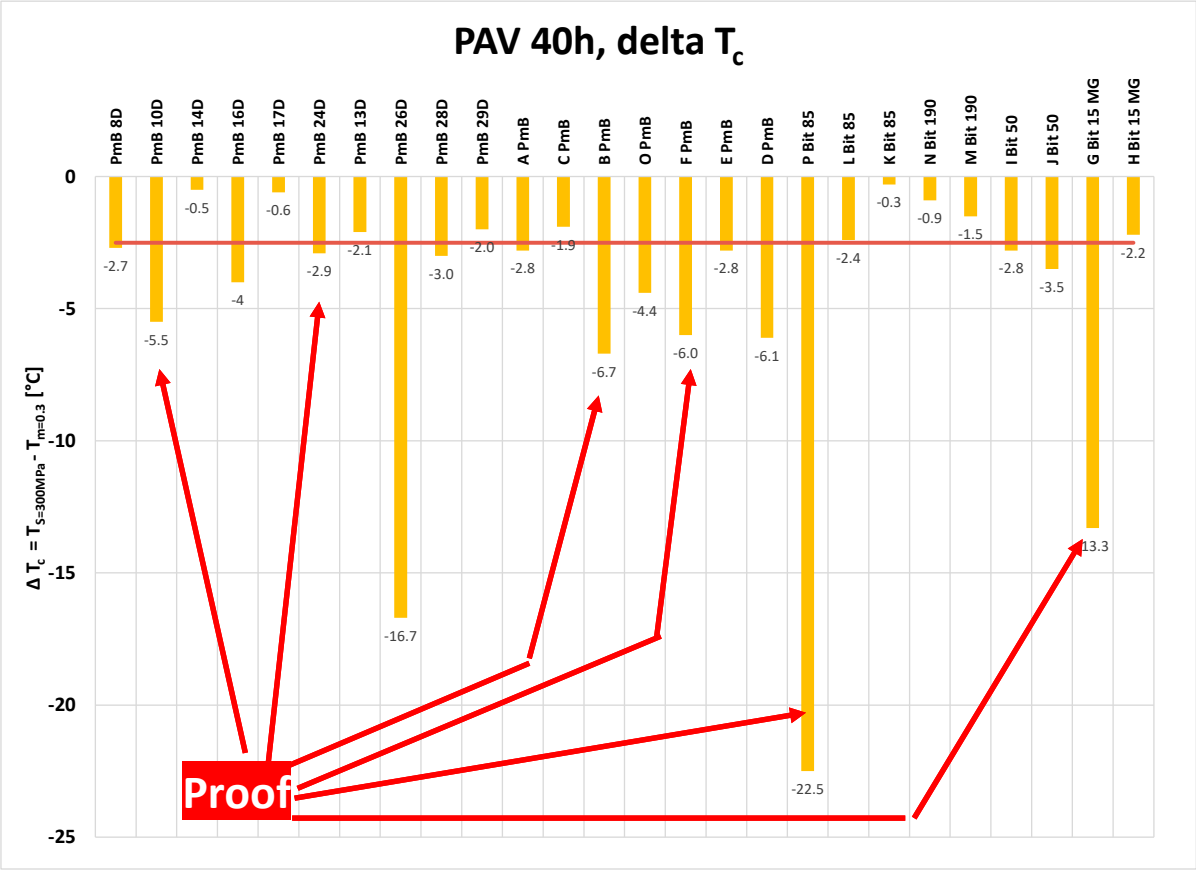
6 Binders with high content of one or all off the ISO 2017 components.

Is VTAE a problem



Proof of 6 binders:

Delta Tc

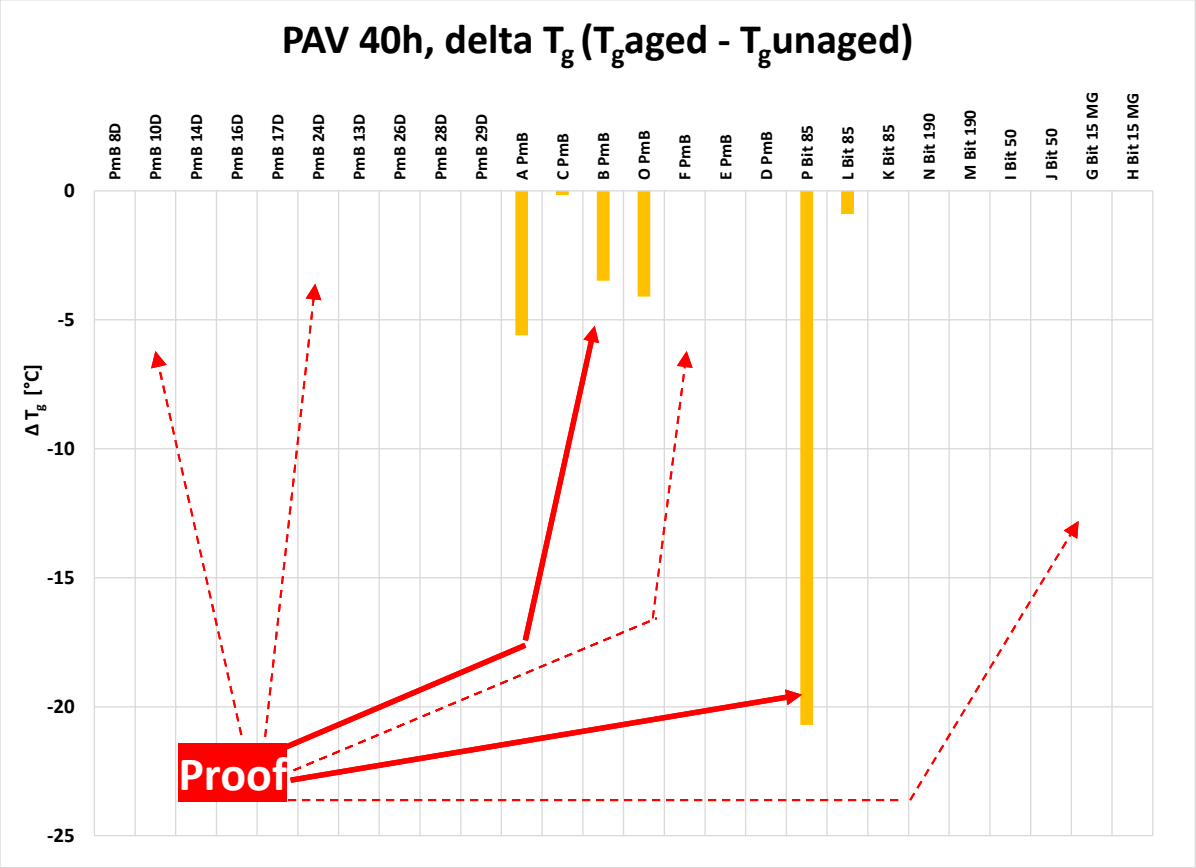
DSC – Tg value

Cross-Over Temperature

And the others?

PmB 8D; PmB 16D; PmB 26D; PmB 28D; A PmB; O PmB; E PmB; D PmB; I Bit 50; J Bit 50

VTAE used in the Netherlands



Proof of 6 binders:

Delta Tc

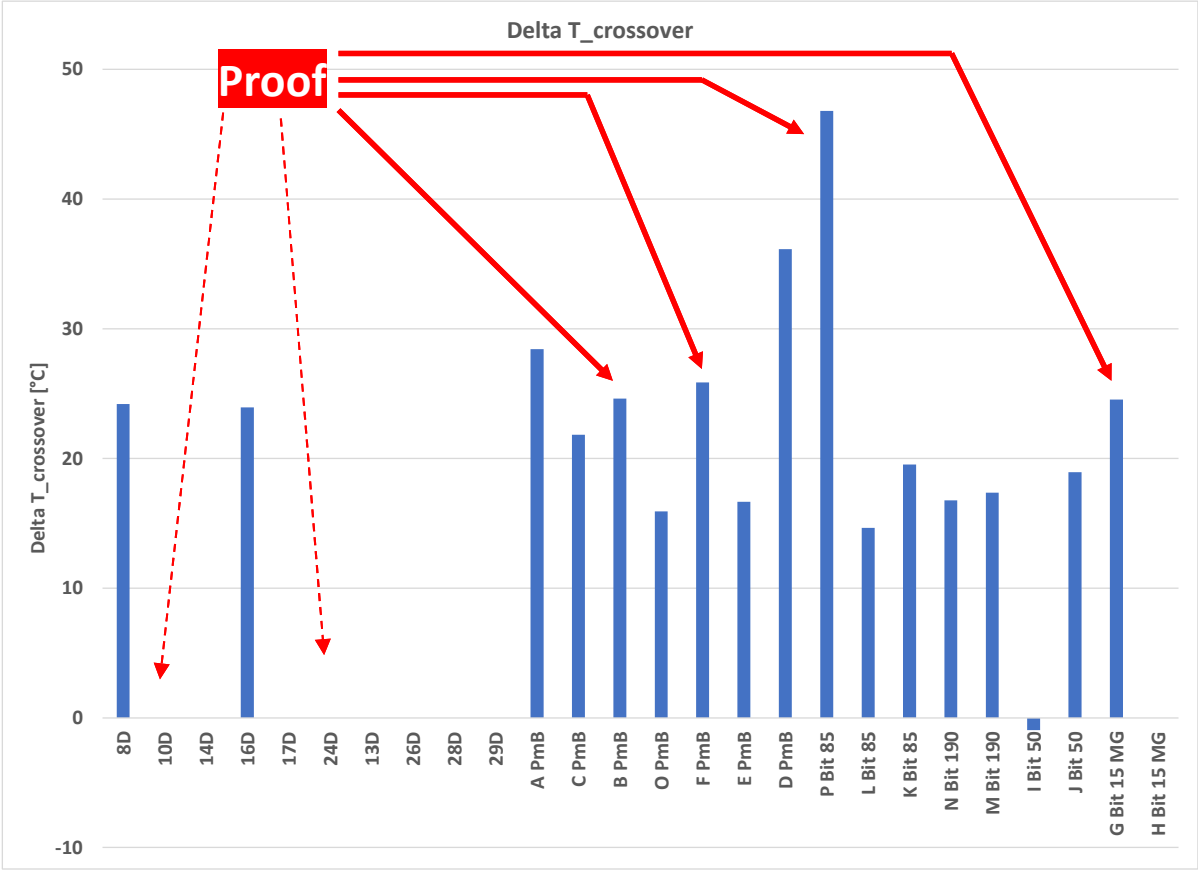
DSC – Tg value

Cross-Over Temperature

And the others?

PmB 8D; PmB 16D; PmB 26D; PmB 28D; **A PmB; O PmB;** E PmB; D PmB; I Bit 50; J Bit 50

VTAE used in the Netherlands



Proof of 6 binders:

Delta Tc
DSC – Tg value
Cross-Over Temperature

And the others?
PmB 8D; PmB 16D; PmB 26D; PmB 28D; **A PmB; O PmB;** E PmB; D PmB; I Bit 50; J Bit 50

Continuation of project Leerruimte

In Canada, they use special stickers to slow cars.

In the Netherlands we use 3D techniques

Grip op asfalt:
Start in September 2022 till December 2023.

Discussion WG1:
****Ban "used oil" ?***
****Introduce ΔTc ?***

Thank you for your attention.

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