



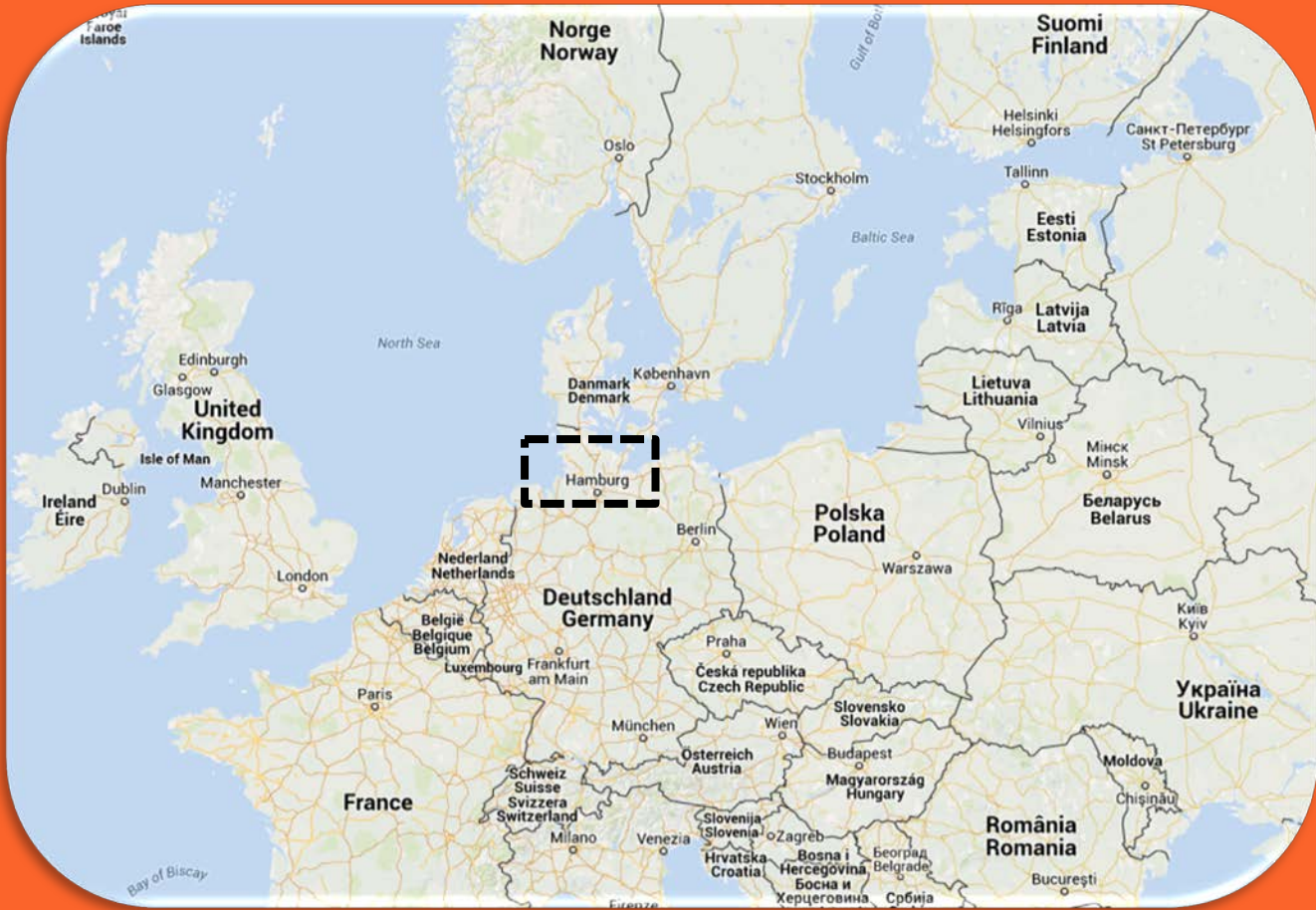
PMB AND RECYCLING

EXPERIENCES FROM GERMANY

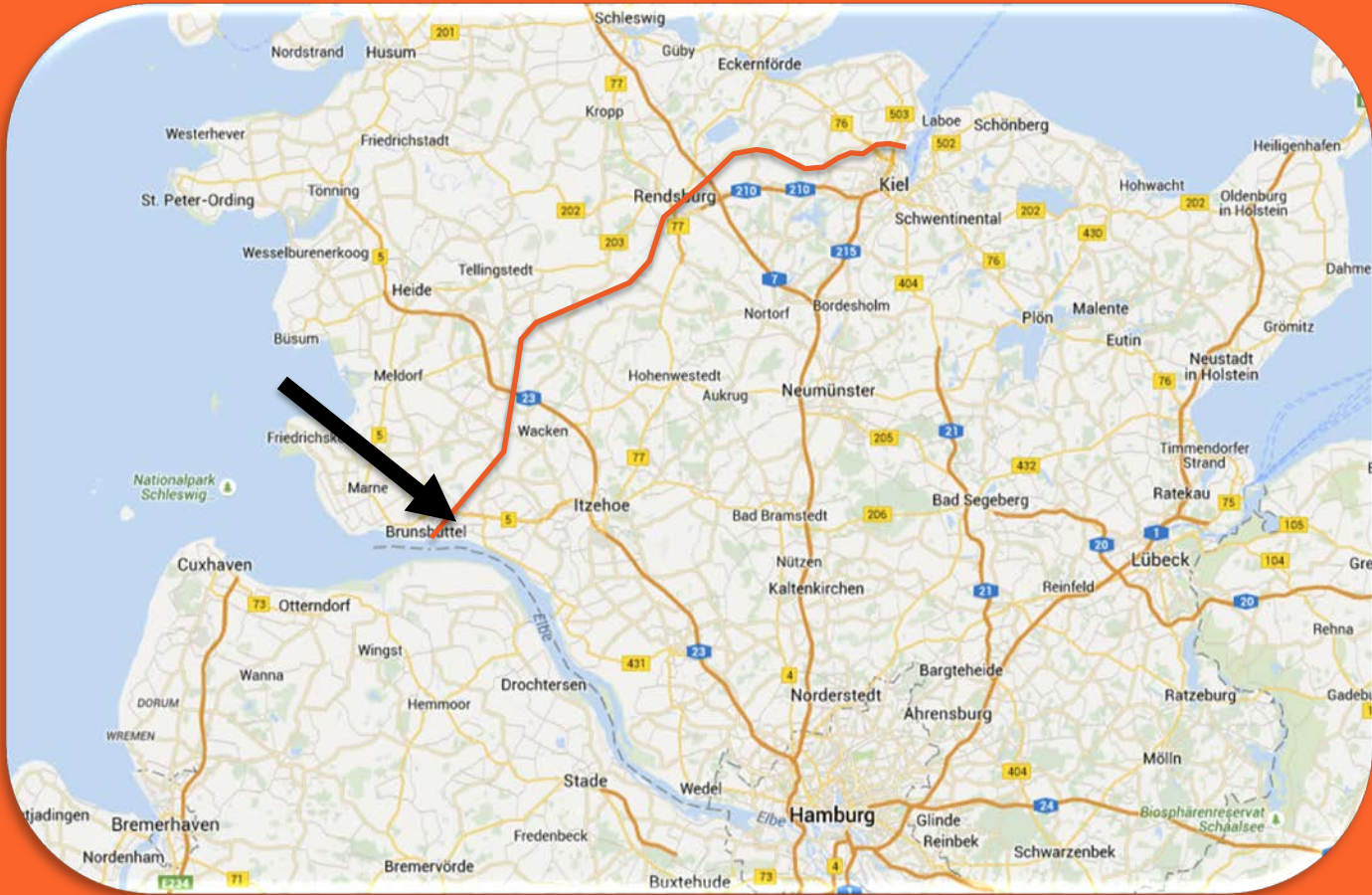
Thomas Sandmann

TOTAL Bitumen Deutschland GmbH
Industriegebiet Süd
25541 Brunsbüttel

Location of TOTAL Bitumen Deutschland (TBD)



Location of TOTAL Bitumen Deutschland (TBD)



TBD in 1928



TBD today



Some facts about TBD



continuous supply via **pipelines** directly connected to biggest German crude oil deposit **Mittelplate**.



crude oil processed to **Distillation bitumen** used for road construction, processed to **polymermodified Bitumen** or to **Oxidation bitumen**



Transport mainly done by road tankers, railtank wagons or ship. **Packed Bitumen** in blocks or in granular form

Delivery Forms

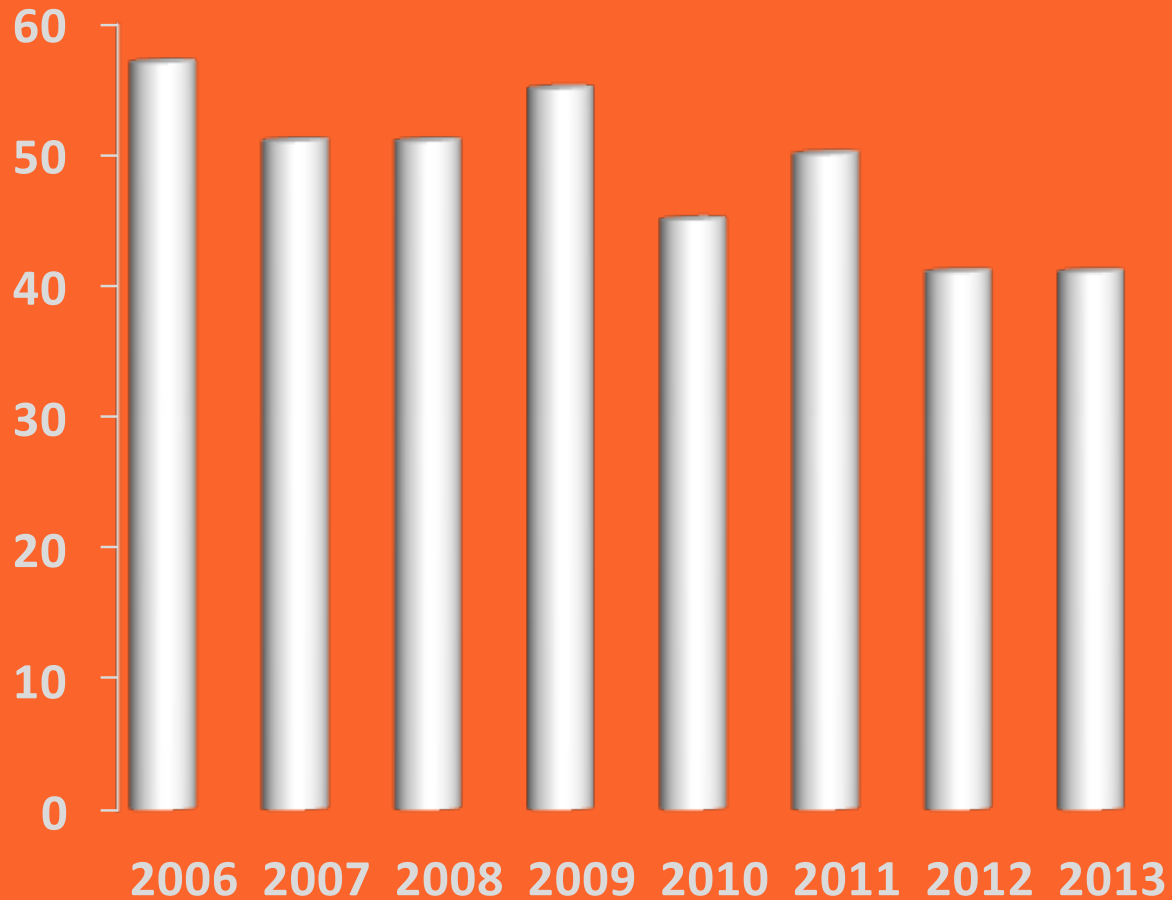


Bitumen Production



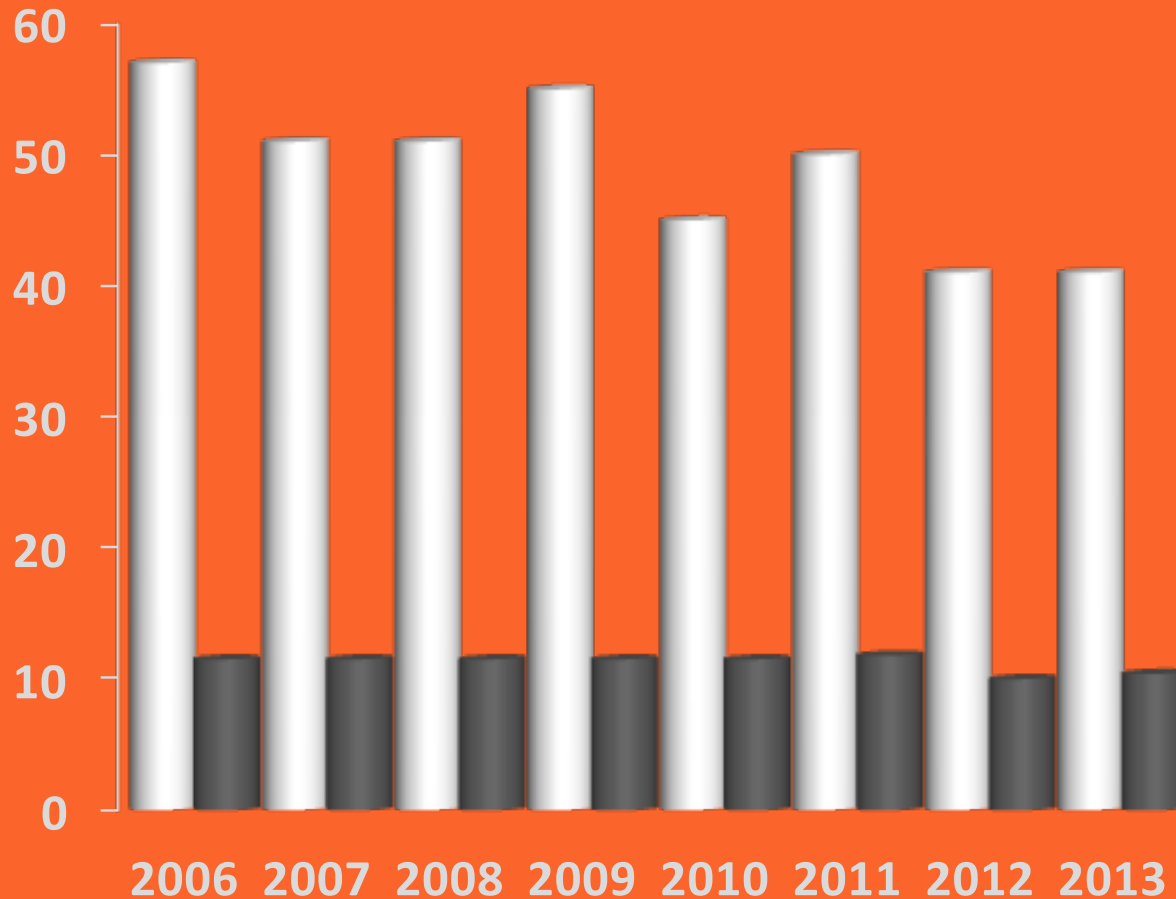
Asphalt production in Germany [Mio. t]

Quelle: EAPA; Asphalt in Figures

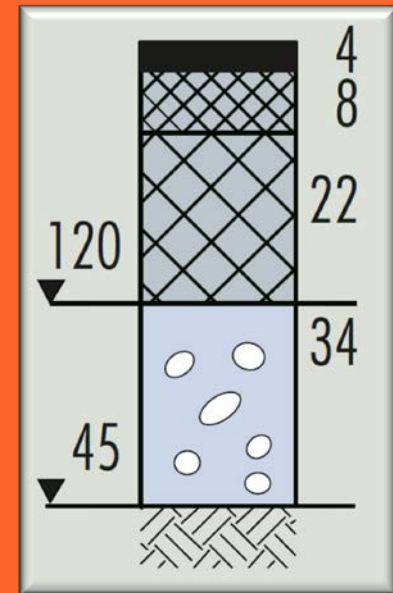
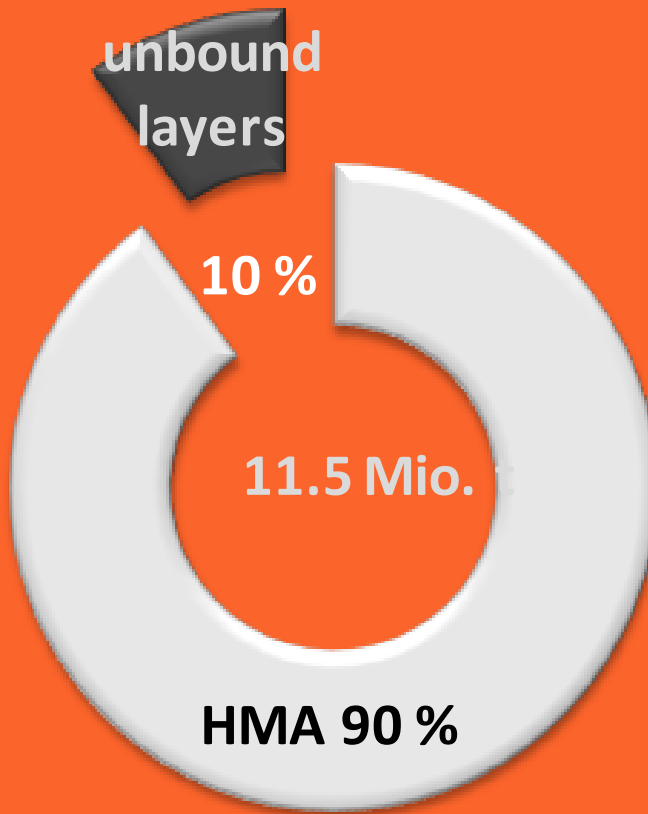


RAP used in hot and warm recycling [Mio. t]

Quelle: EAPA; Asphalt in Figures



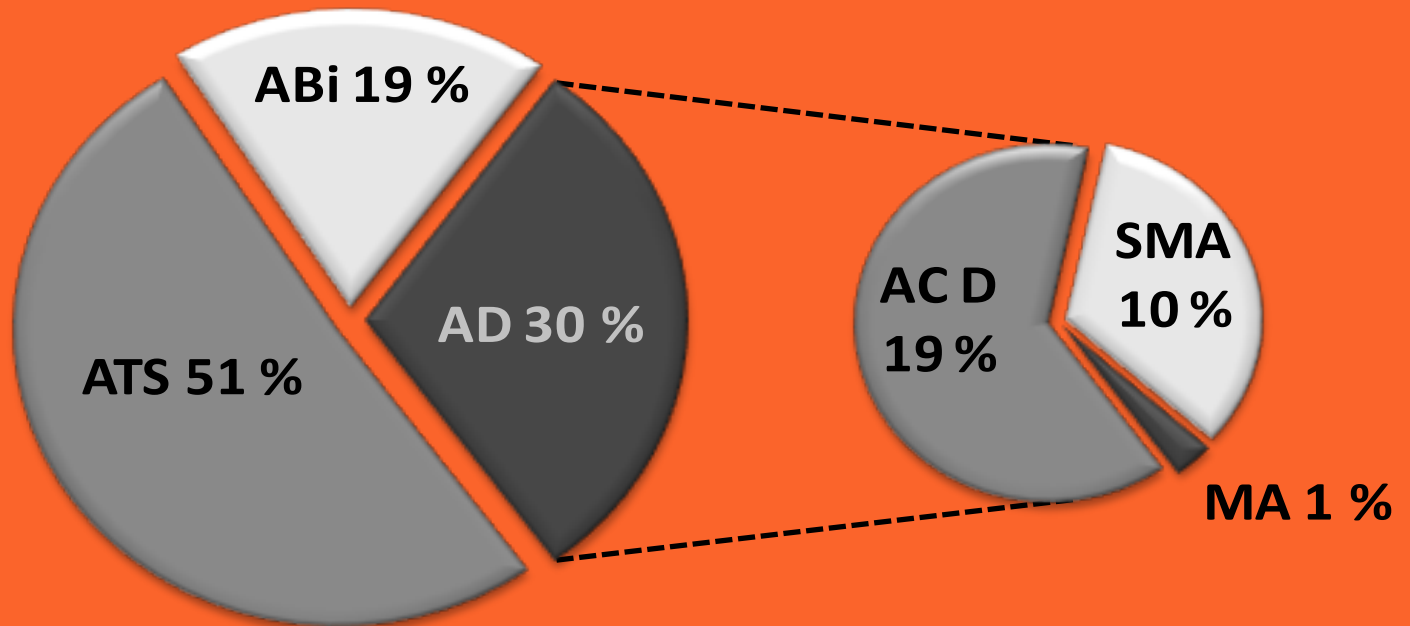
Recycling of Asphalt in Germany



Quelle: DAV; Ausschreiben von Asphaltarbeiten

Quelle: EAPA; Asphalt in Figures 2013

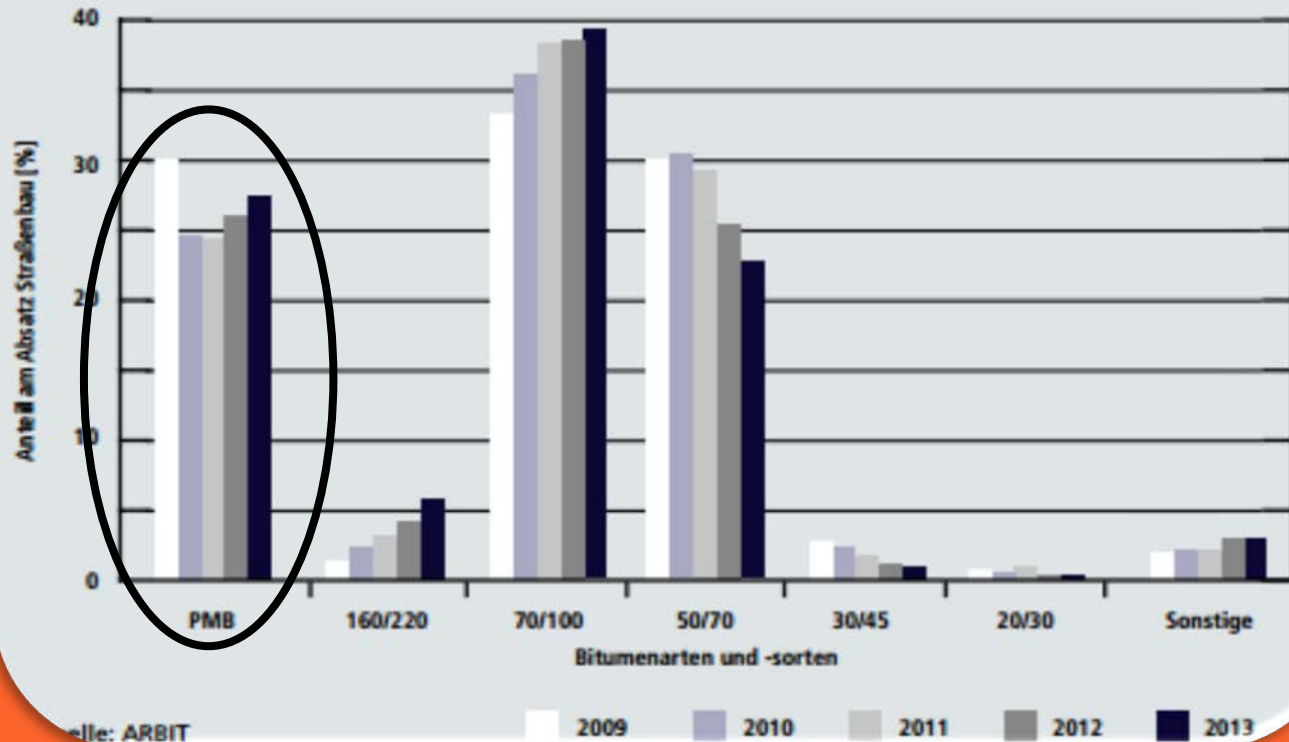
Asphalt Production [%]



Quelle: EAPA; Asphalt in Figures 2013

PmB in Road Construction

Bitumenabsatz im Straßenbau



Quelle: www.arbit.de

Recycling of Asphalt in Germany

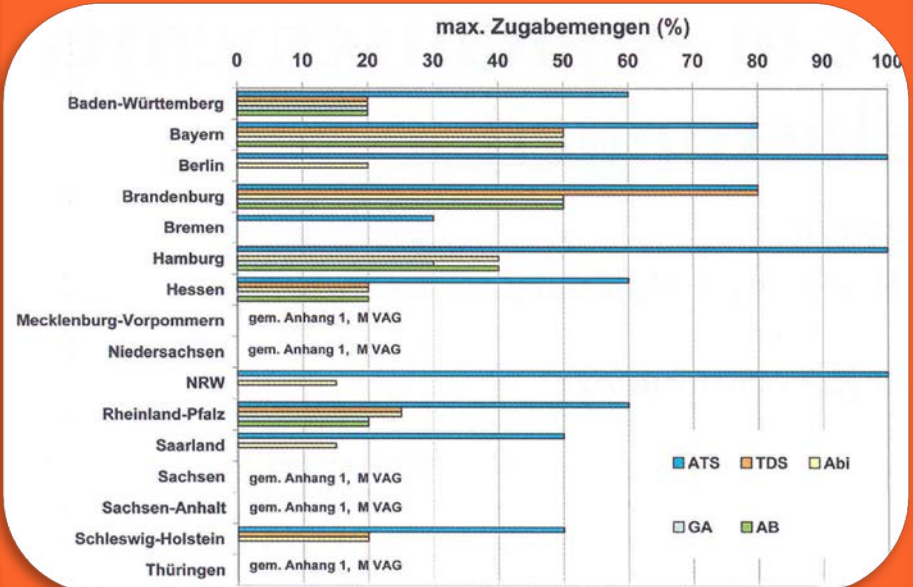
Experience with RA in Germany since more than 30 years

binder courses with PMB with the requirement of an equivalent binder in the complete mixture

since 1996 < **20** % share of RA

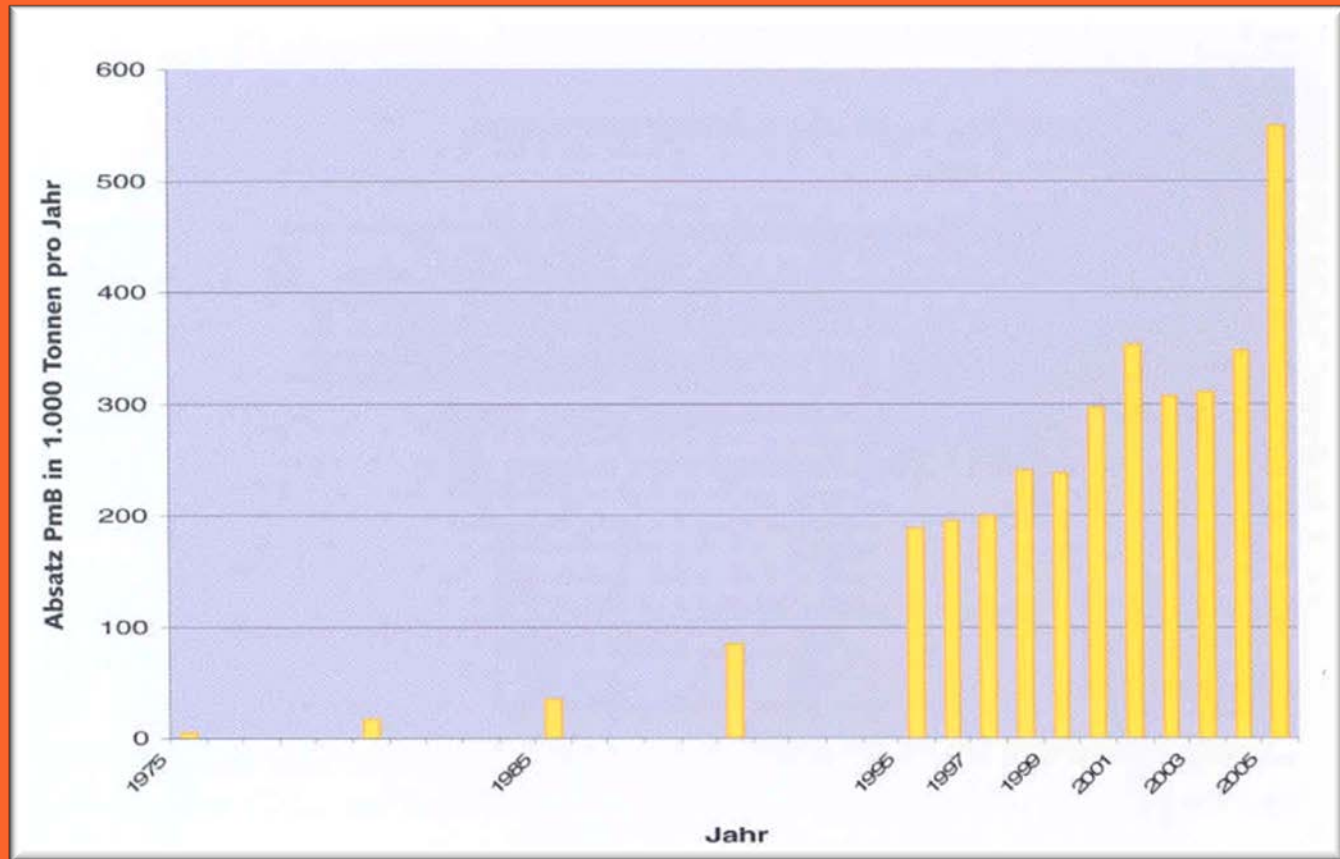
since 2005 < **40** % share of RA

new hotmix production that contains reclaimed material ~ 97 % (in 2012)



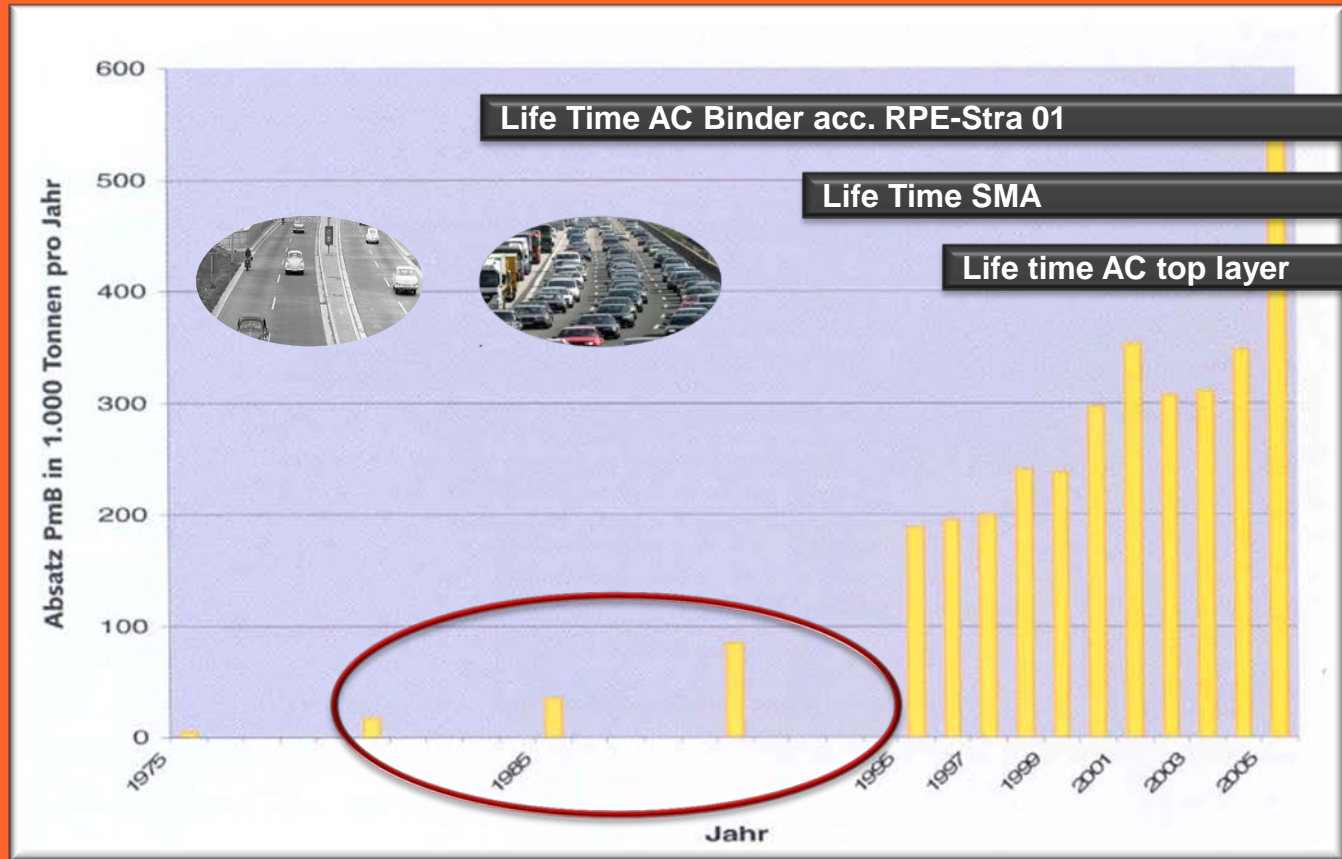
Need for PmB RC

Quelle: ARBIT; 75 Jahre ARBIT

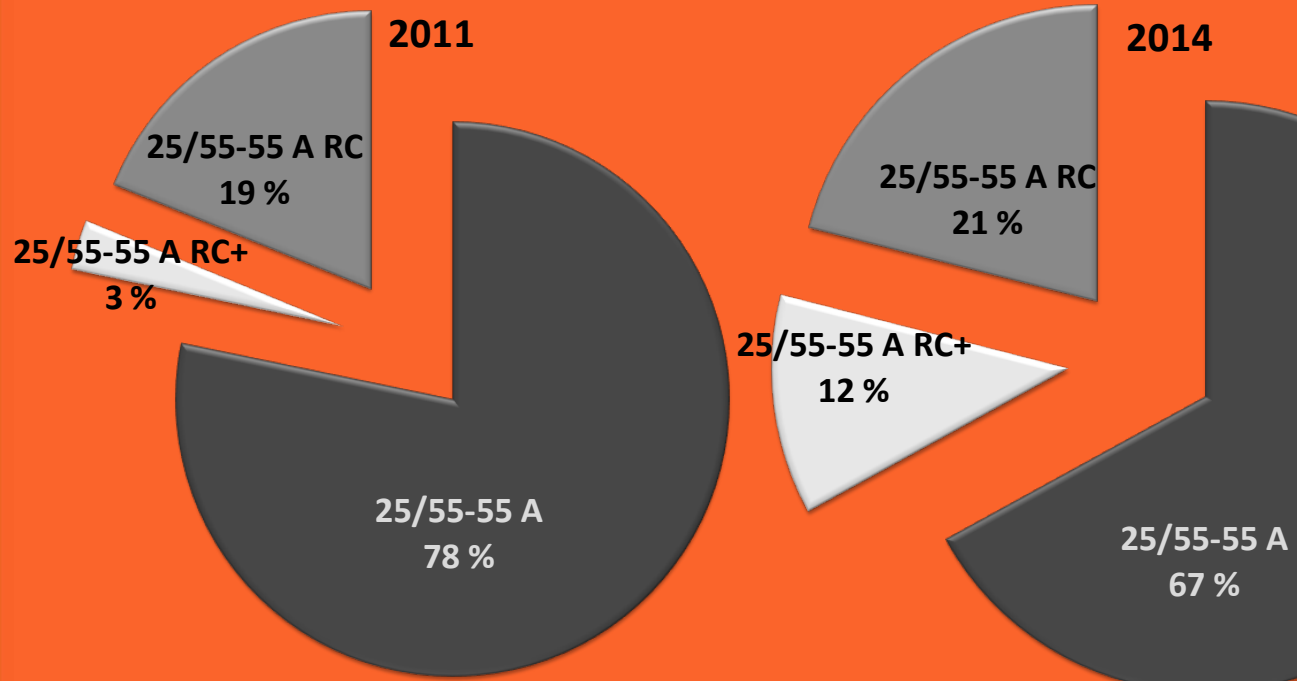


Need for PmB RC

Quelle: ARBIT; 75 Jahre ARBIT



Evolution of PmB RC production



PmB for Recycling

binder in the mixture (product and binder of RA) must fulfill the national specifications for a PMB

product must fulfill the national specifications for a PMB

binder of RA must have a elastic recovery > 50% (equal to origin binder)

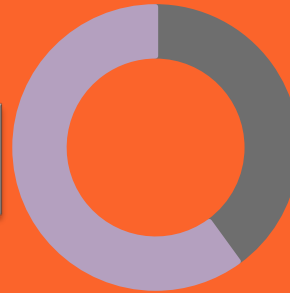
product must make a high share of RA possible

Authorities Demand



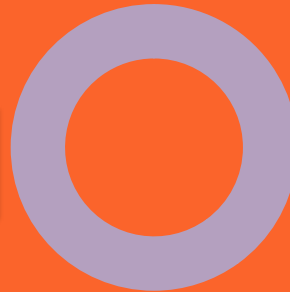
Asphalt with 100 % PMB

Clients wish



Asphalt with PMB and high share of RA

TOTAL Result

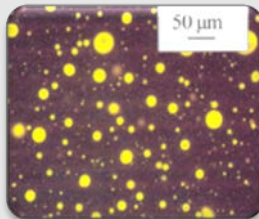


Asphalt with 100 % STYRELF

Production of PmB



Polymer modification

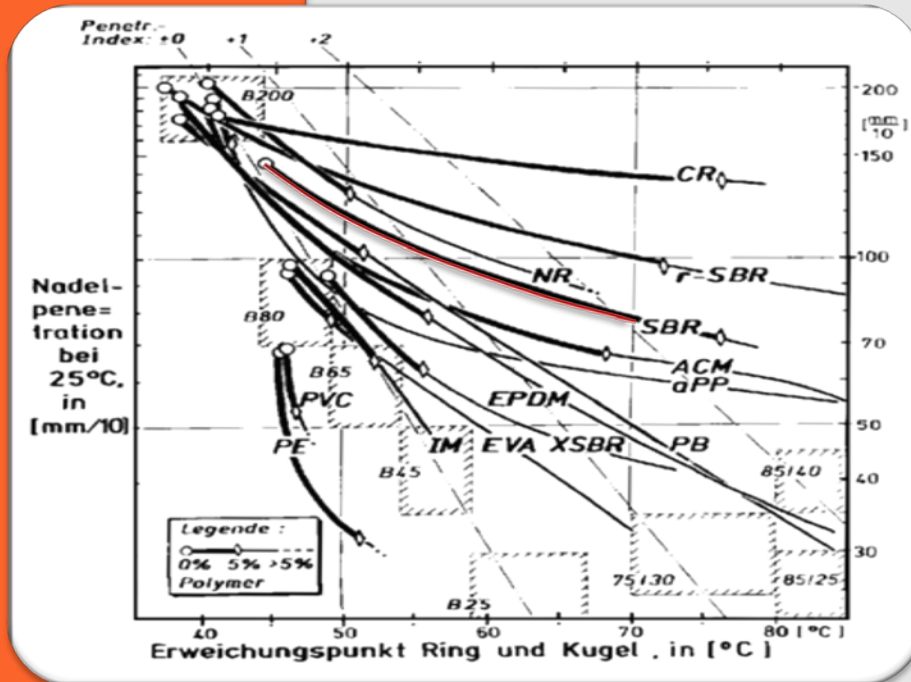


+ spez. Pen Grade Bitumen
+ Styrol-Butadien-Polymer
= physical mixture of
Bitumen and Polymer



+ Cross linking agent
= chemical cross-linked
polymermodified Bitumen

Polymer content

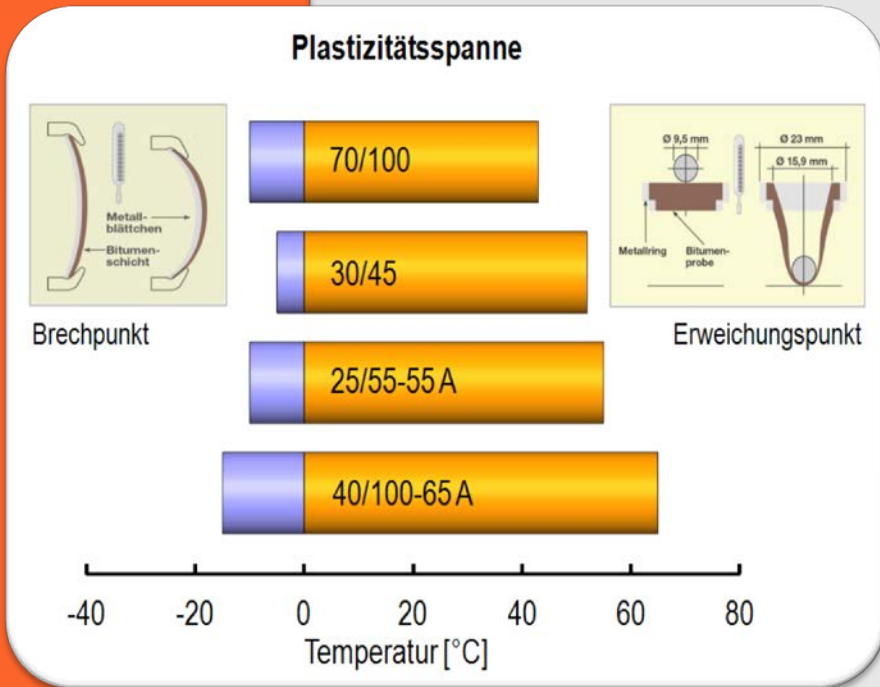


! Influence of variable polymers

! Excessive polymer content -> phase inversion

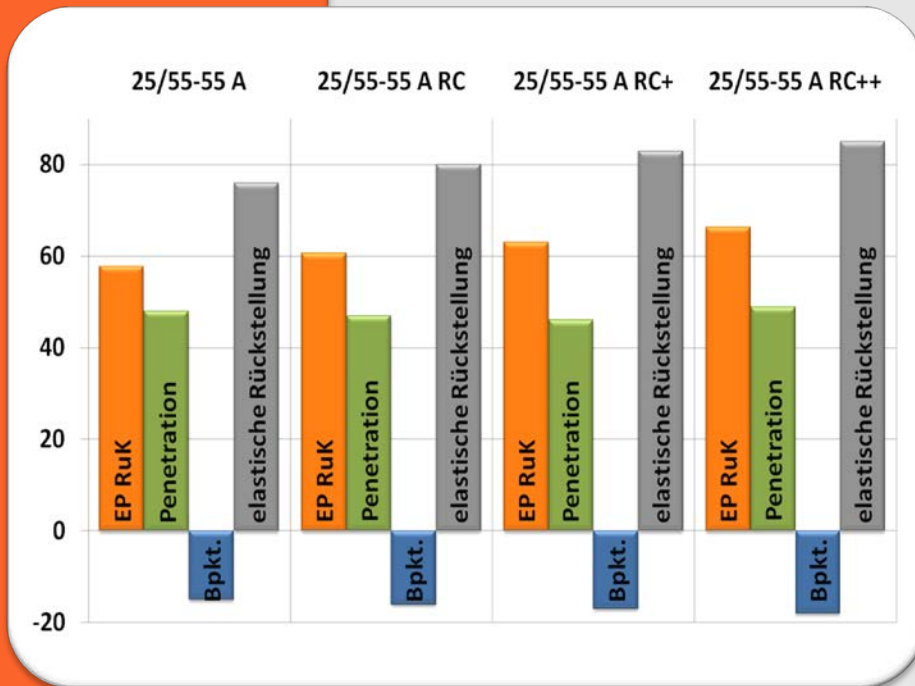
Quelle: Die Asphaltstrasse 1/85

Effects of modification



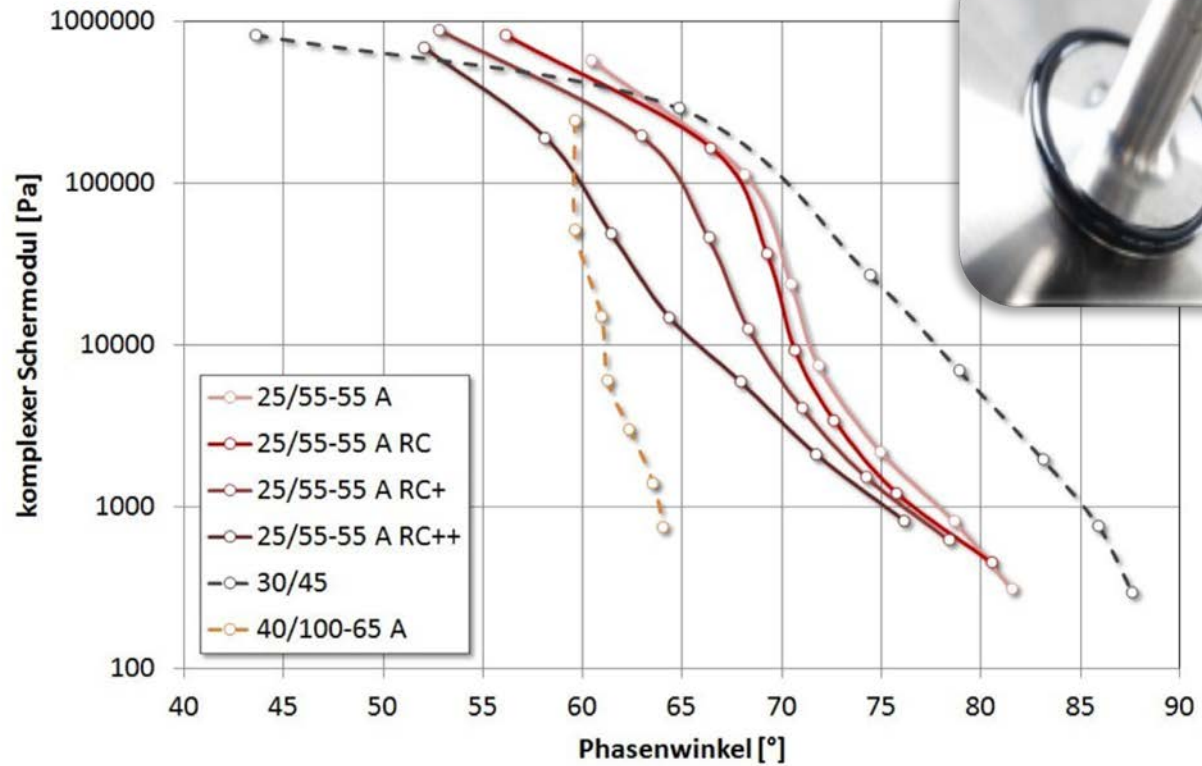
- + extended plasticity range
- + improved elasticity
- + better cohesion

Effects of modification



- + SP R&B increasing
- Needle Penetration not changing
- Breaking Point decreasing
- + Elastic Recovery increasing

BLACK-Diagramm



Technical Regulation



TL Bitumen-StB 07
**Minimum value for
Softening Point R&B**

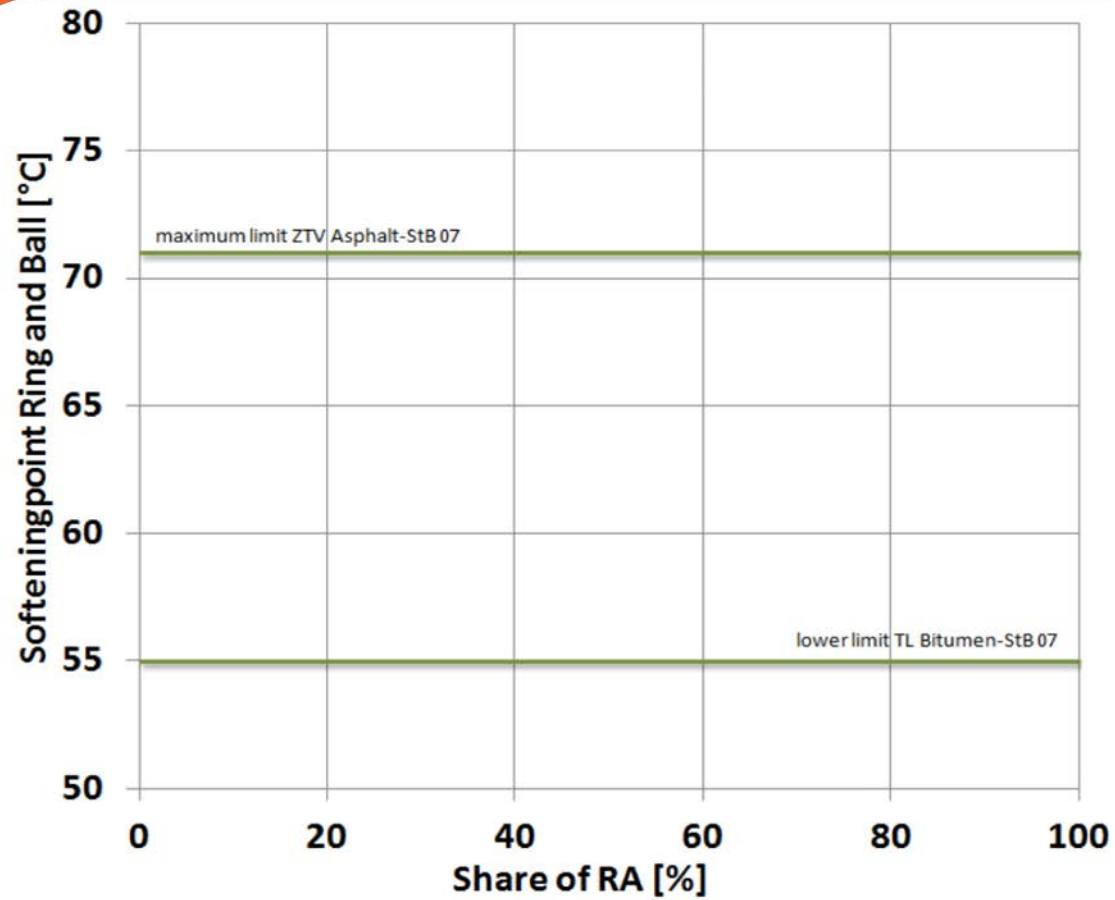


TL Asphalt-StB 07
**Calculation of SP R&B when using
RAP**

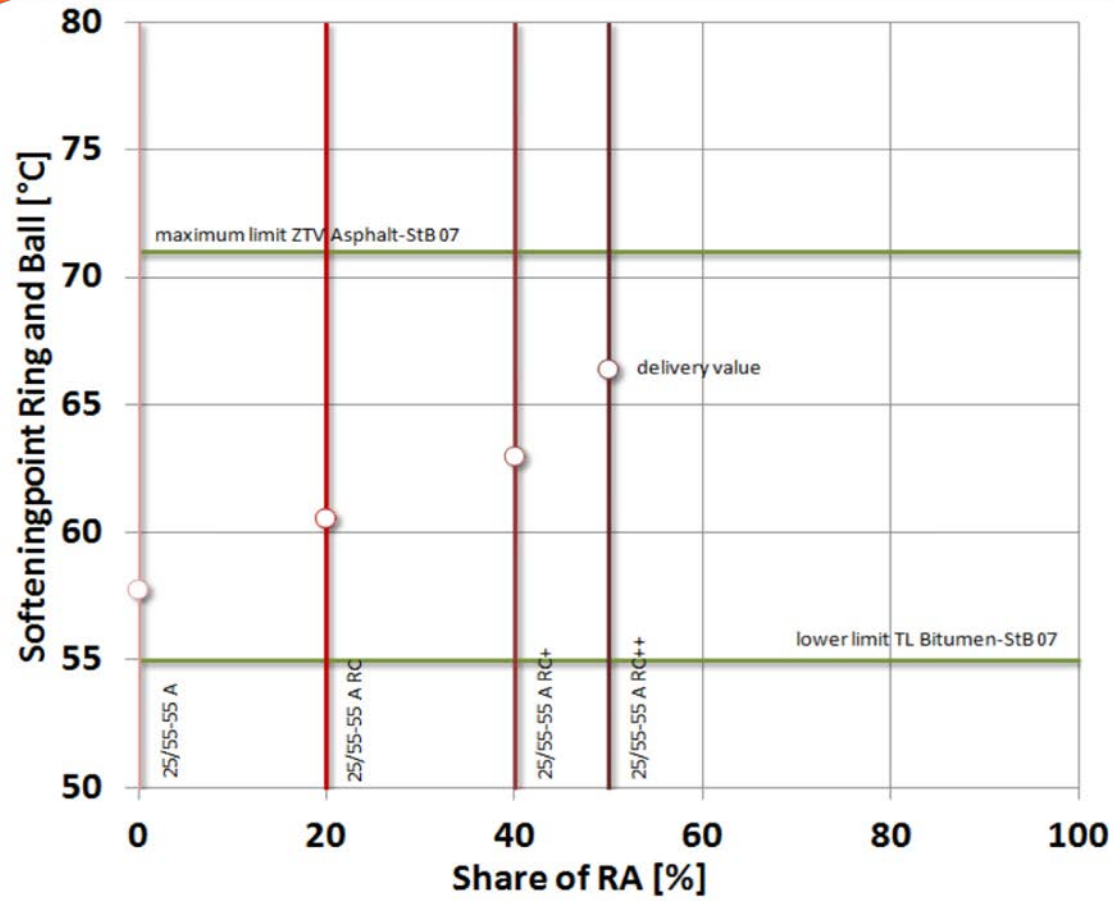


ZTV Asphalt-StB 07
**Requirement for SP R&B and Elastic
Recovery (recovered binder)**

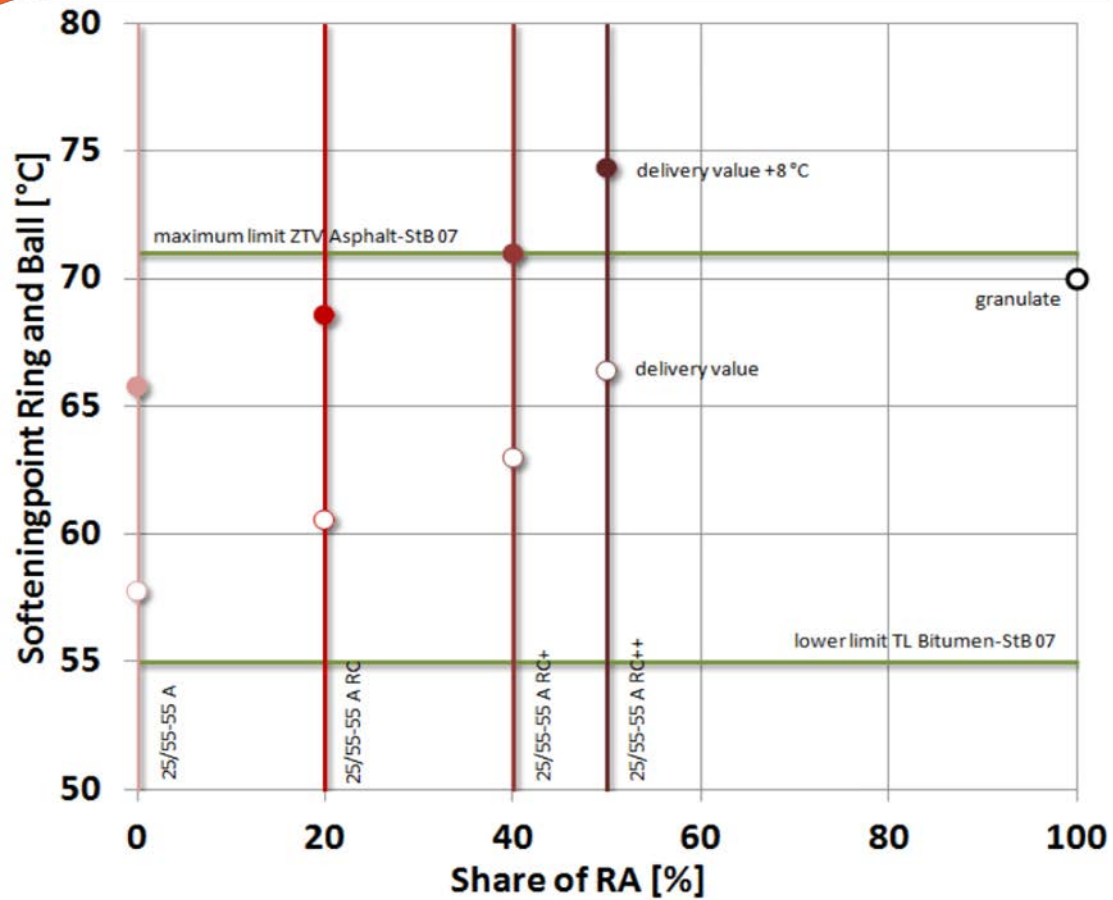
Consequence of Technical Regulation



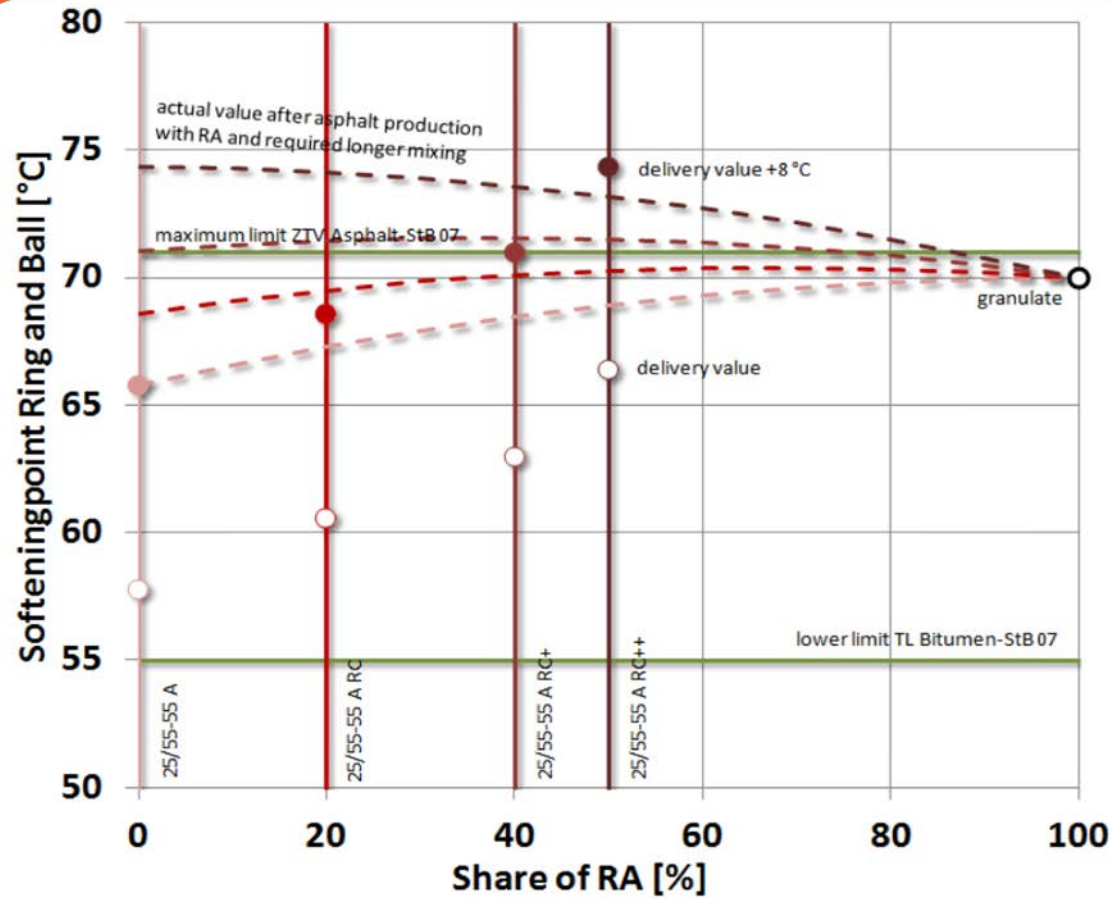
Consequence of Technical Regulation



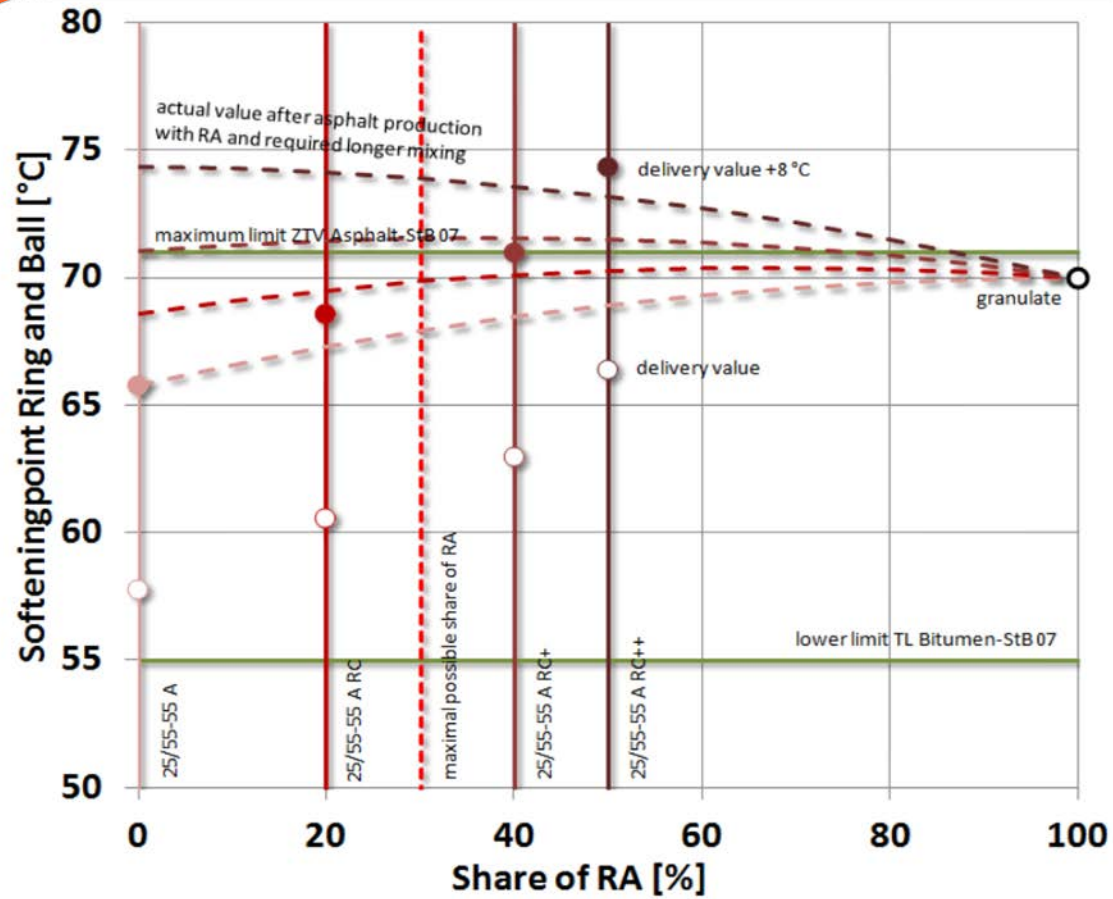
Consequence of Technical Regulation



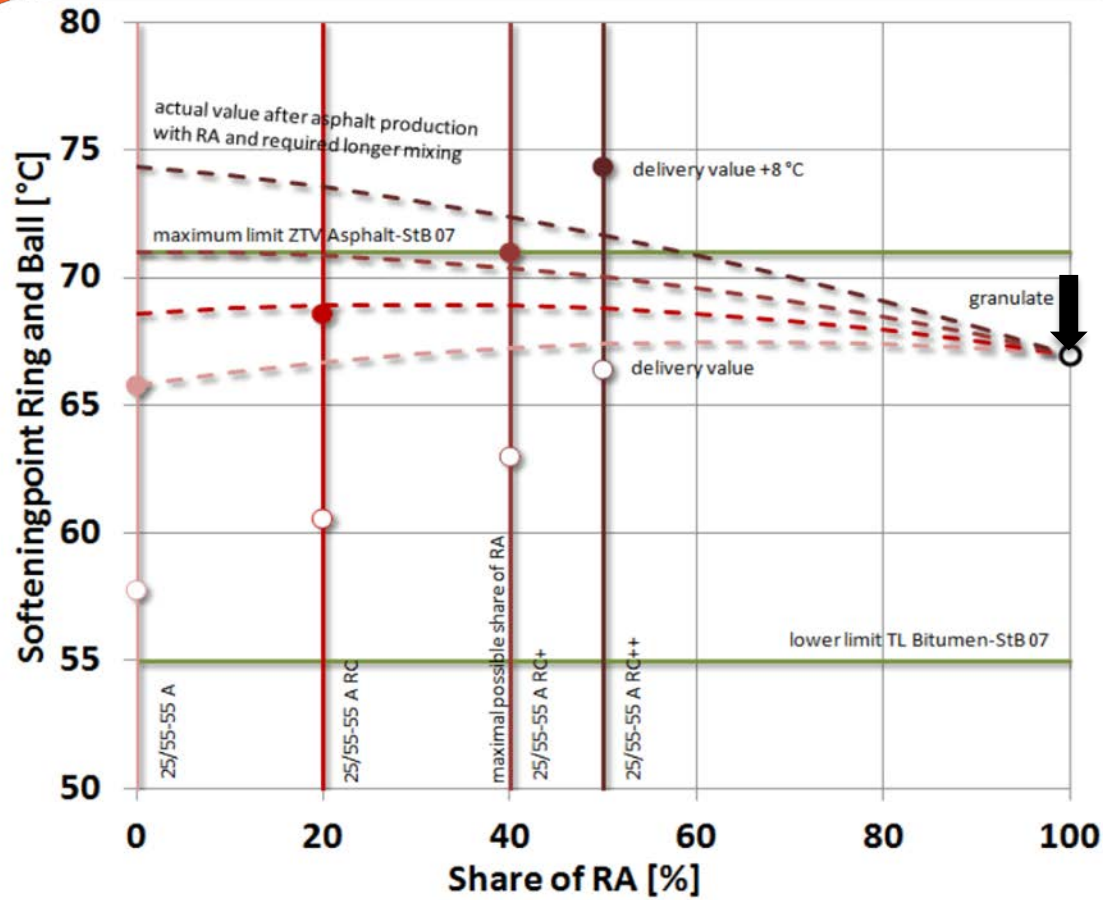
Consequence of Technical Regulation



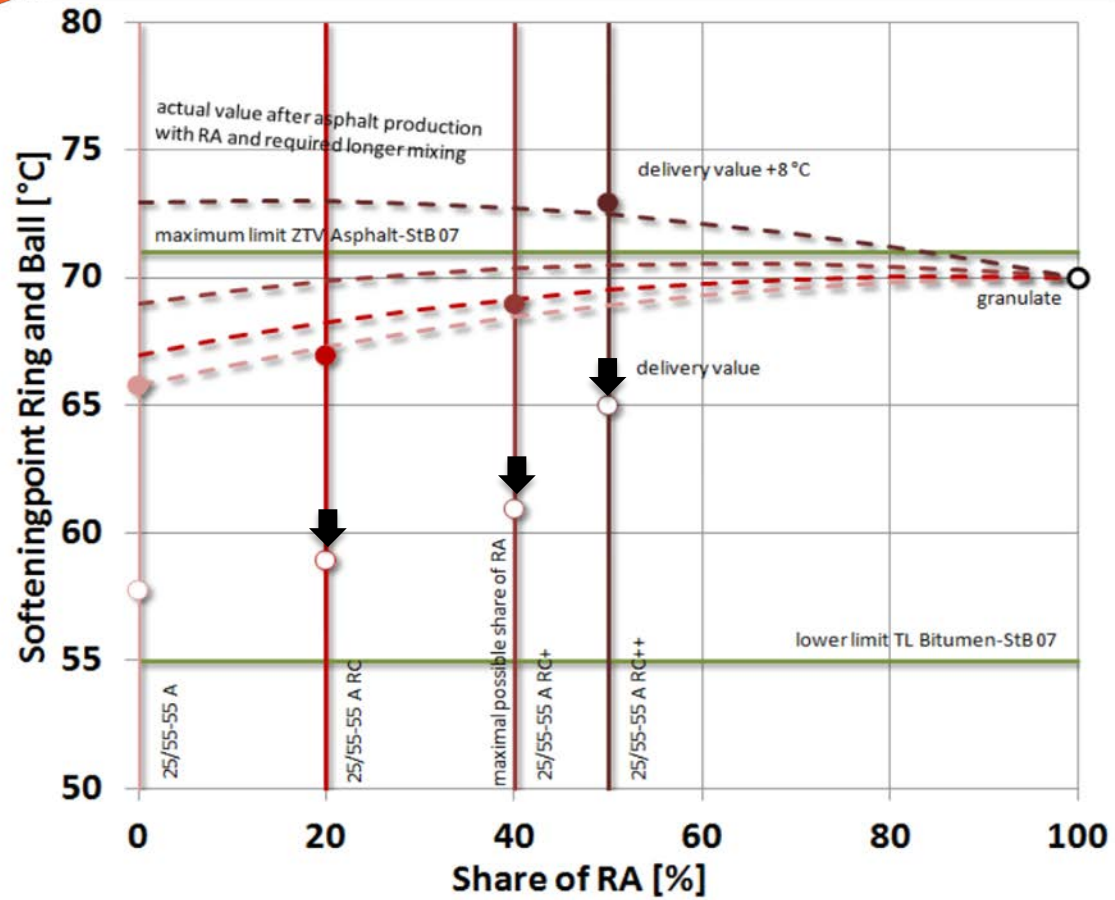
Consequence of Technical Regulation



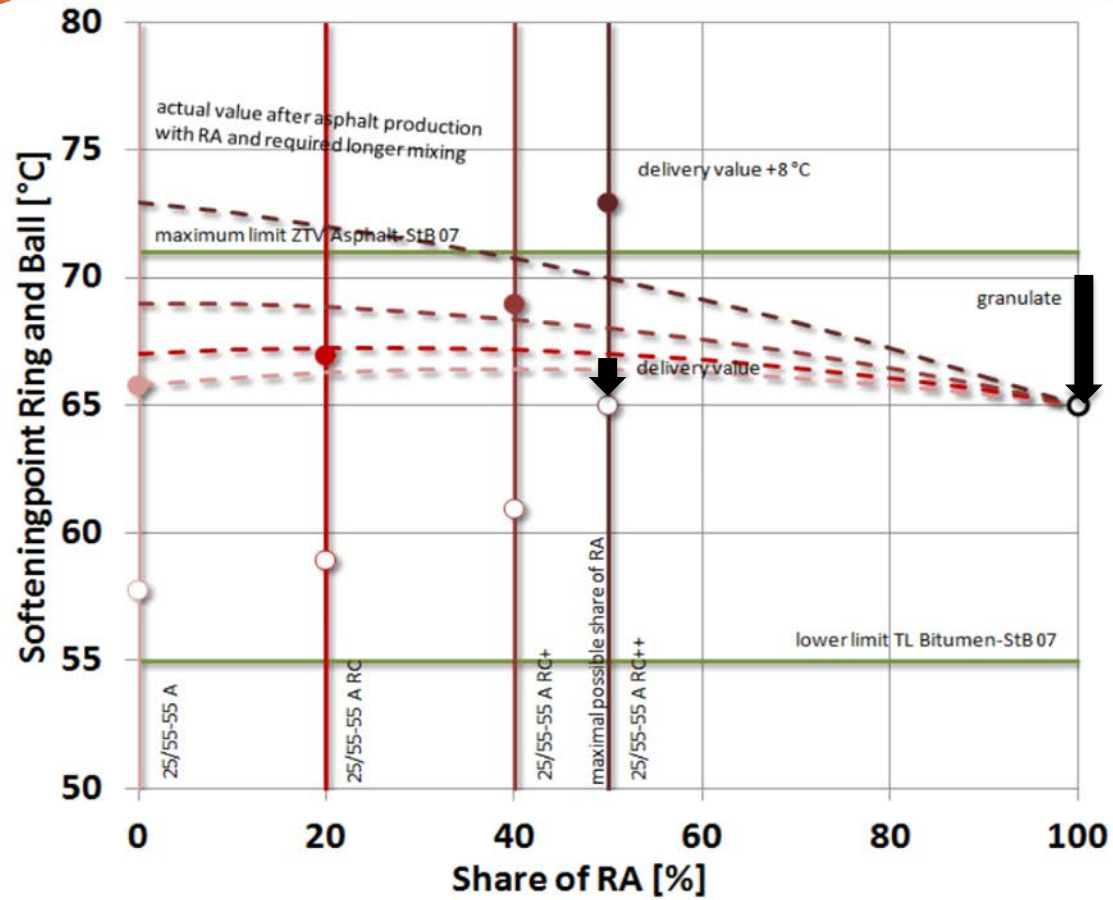
Decrease of R&B granulate



Decrease of R&B binder



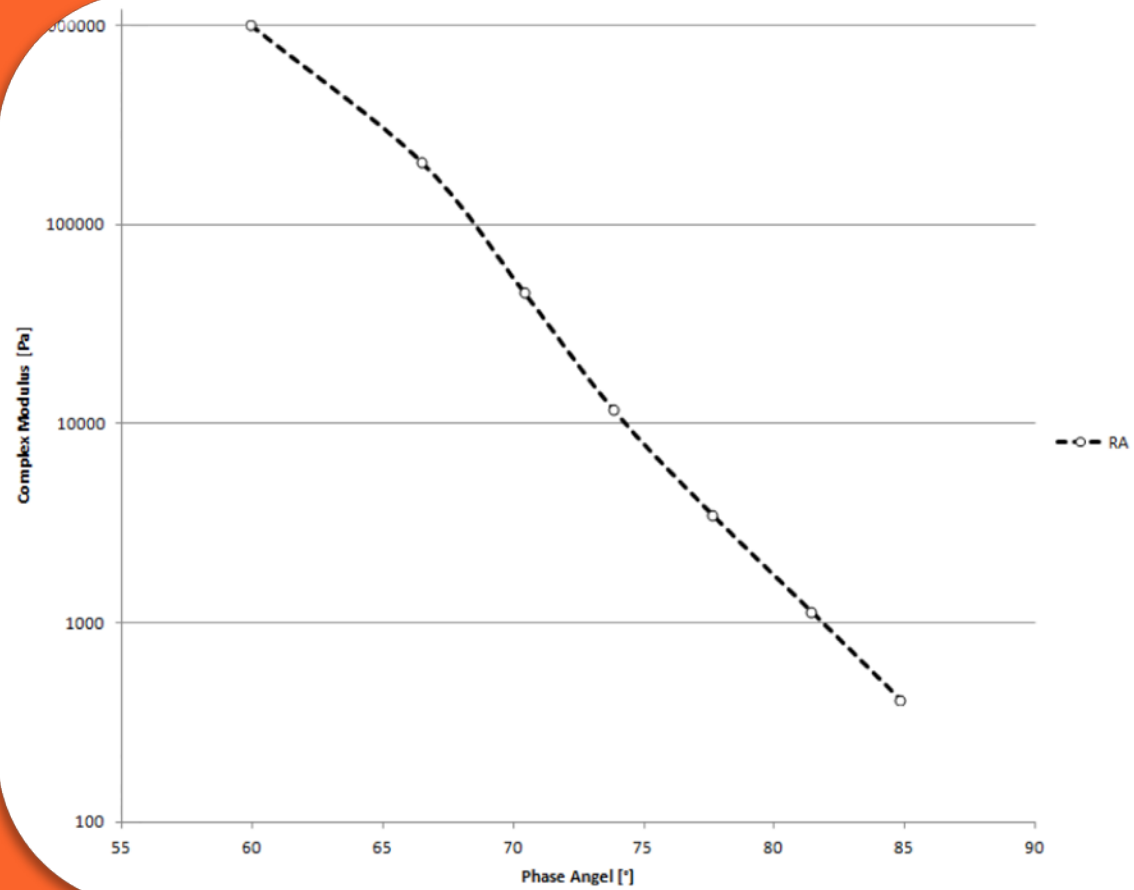
Decrease of R&B binder & granulate



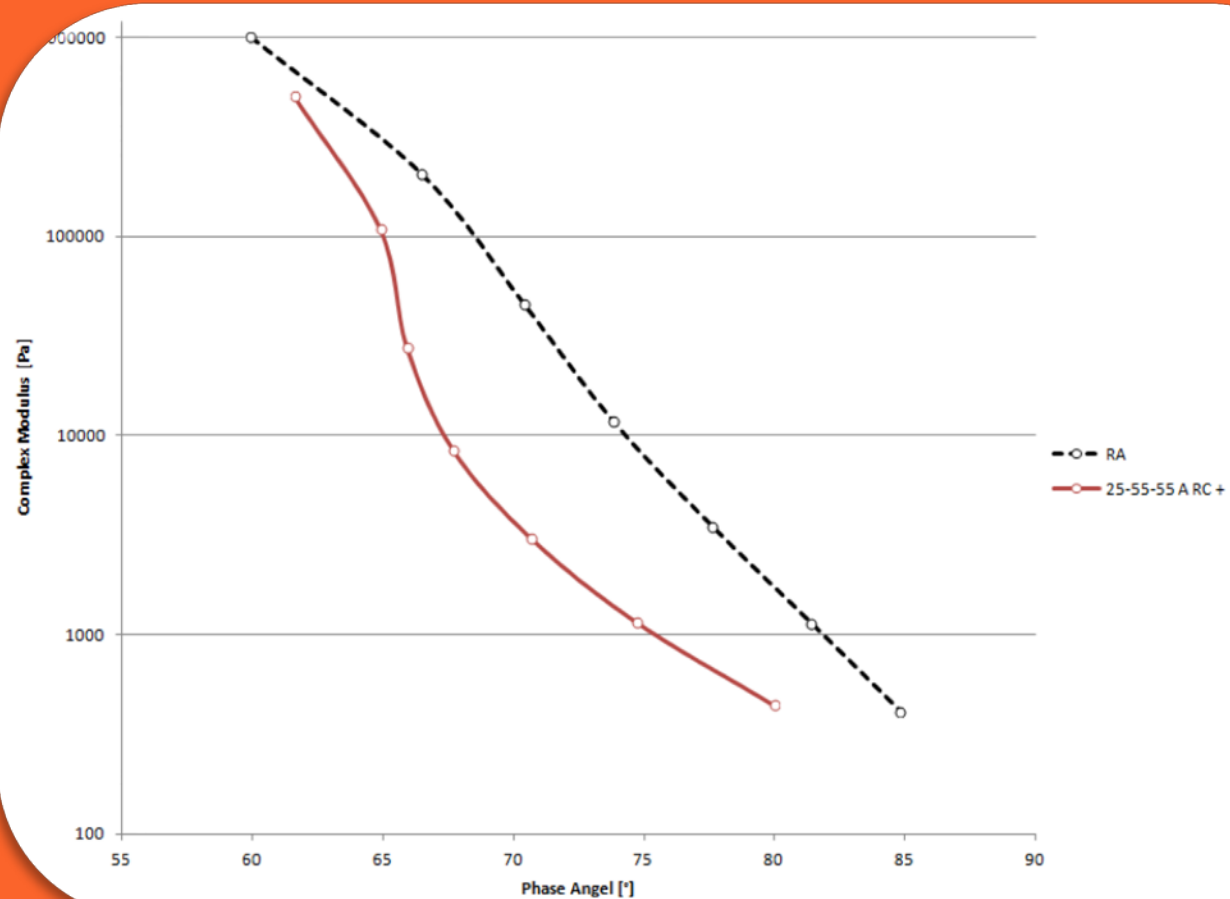
In Practise

	60 % 40 %	25/55-55 RC+ RA	25/55-55
Penetration @ 25 °C [1/10 mm]		35	25-55
Softening Point R&B [°C]		61,0	> 55
Elastic Recovery [%]		77	> 50
Breaking Point Fraass [°C]		-11	< -10

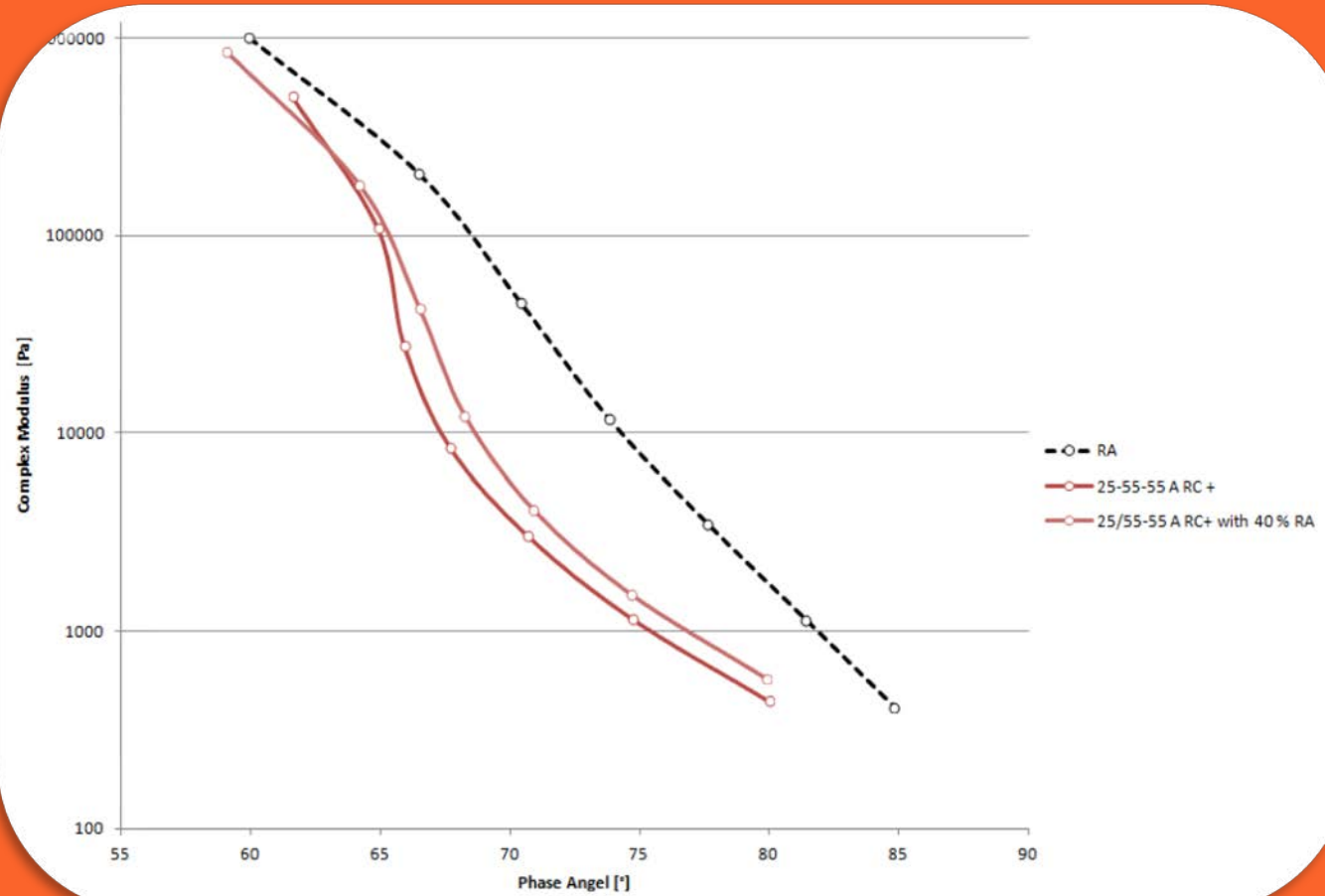
In Practise



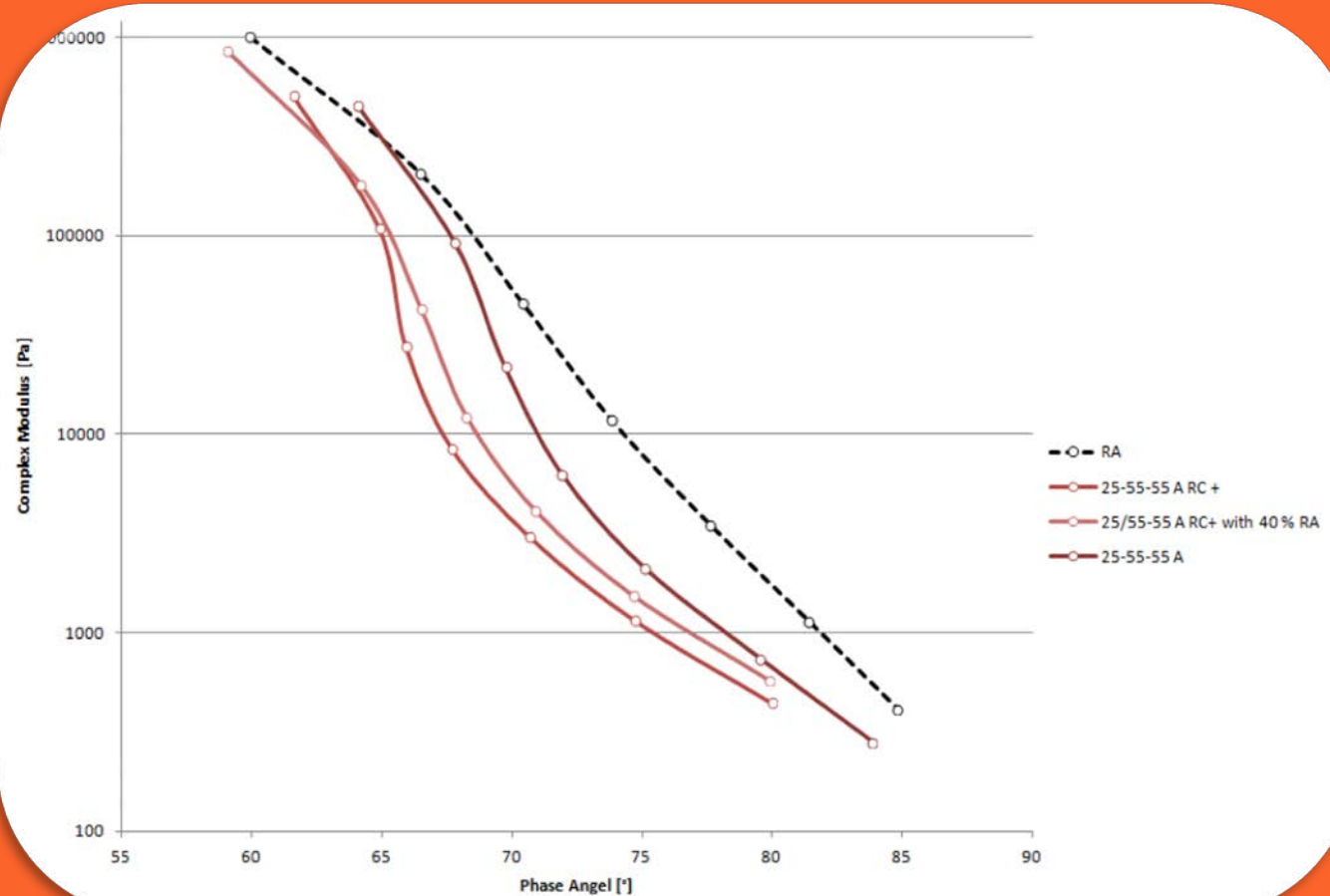
In Practise



In Practise



In Practise



Open Questions



Softening Point R&K

- Do we need an upper limit or we lack only an appropriate test method for addressing the low-temperature properties?



Use of softer binder

- Analog procedure for PmB as for the road bitumen when using asphalt granulate?

Conclusion



Specially formulated PMB-RC types allow a share of RAP from 40 - 50%



PmB-RC-made asphalts are equivalent to those with exclusively fresh binder

Guideline DAV

http://asphalt.de/site/startseite/literatur/international_publications/



asphalt

Recycling of asphalt



asphalt
GUIDELINES

Thomas Sandmann
TOTAL Bitumen Deutschland GmbH

Tel: +49 4852 888-178
thomas.sandmann@total.de

