



PMB AND RECYCLING

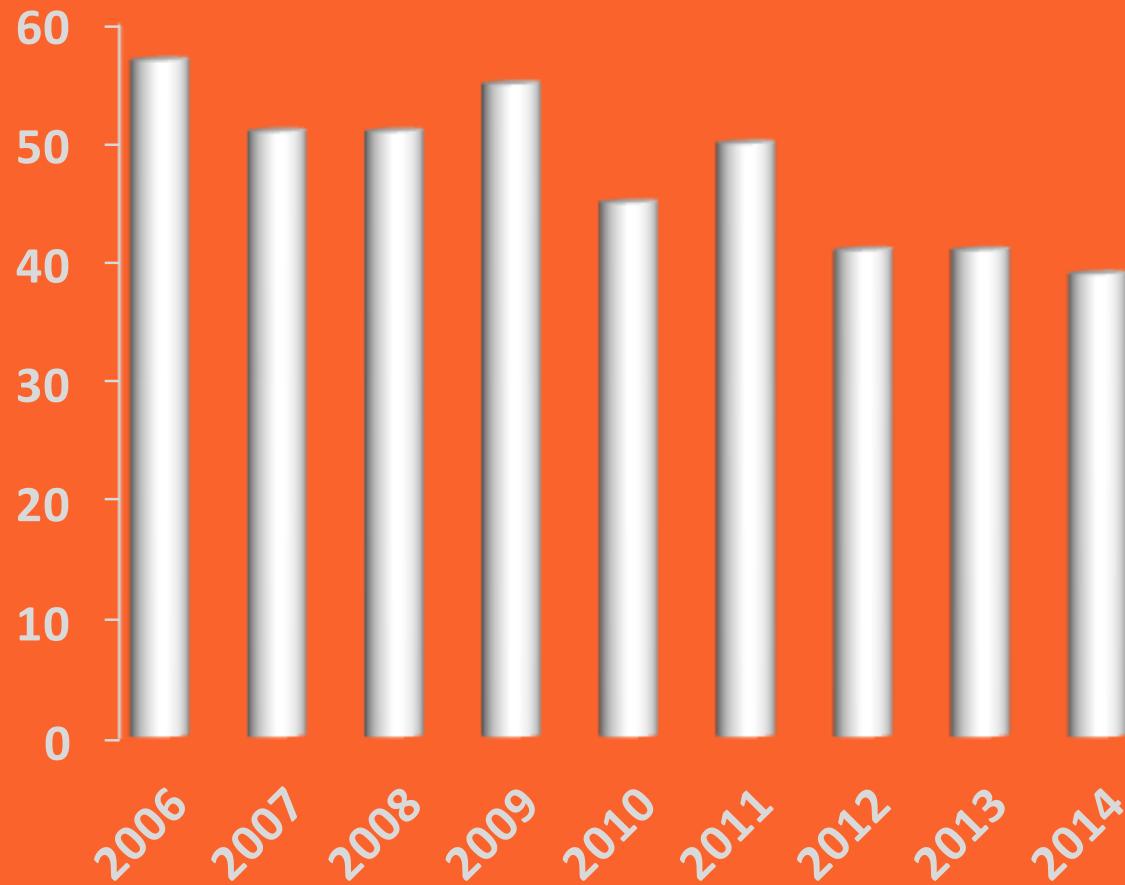
RECYCLING ON A HIGH PERFORMANCE LEVEL – EXPERIENCES FROM GERMANY –

Thomas Sandmann

TOTAL Bitumen Deutschland GmbH
Industriegebiet Süd
25541 Brunsbüttel
thomas.sandmann@total.de

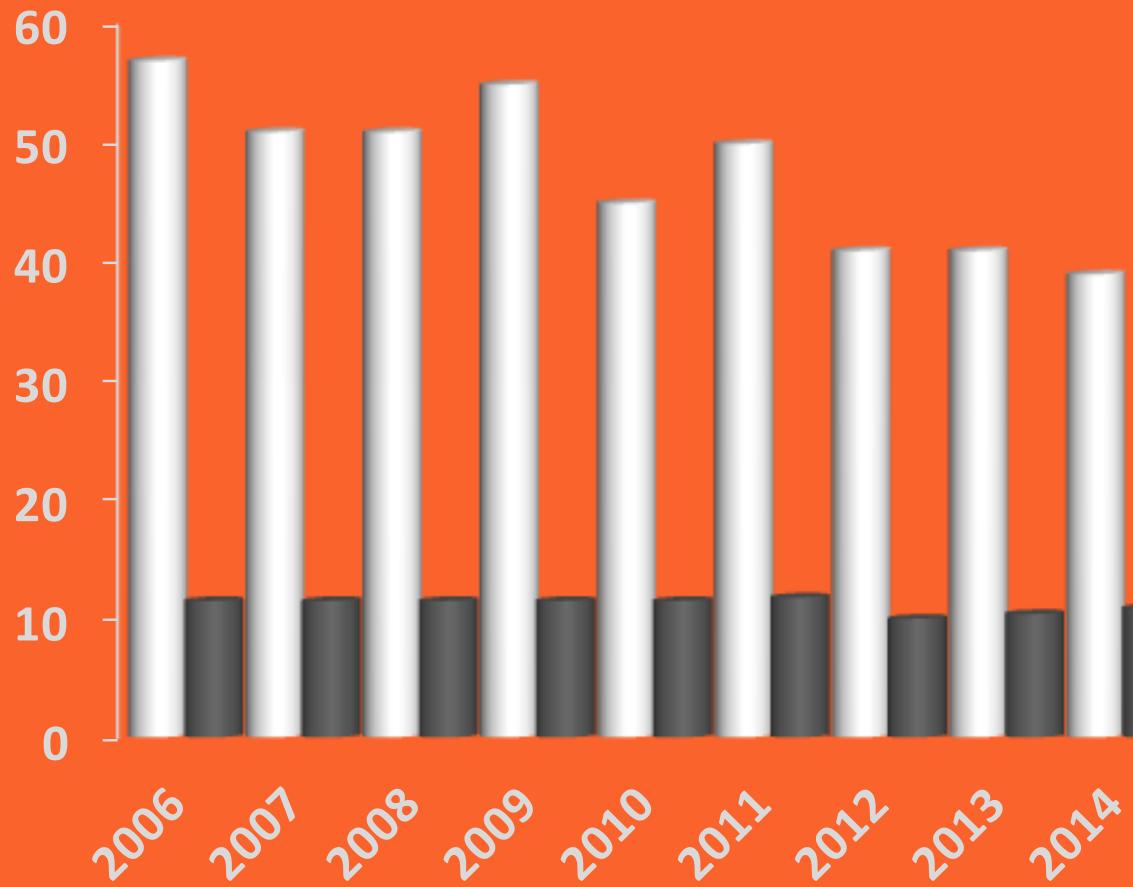
Asphalt production in Germany [Mio. t]

Quelle: EAPA; Asphalt in Figures 2006-2014



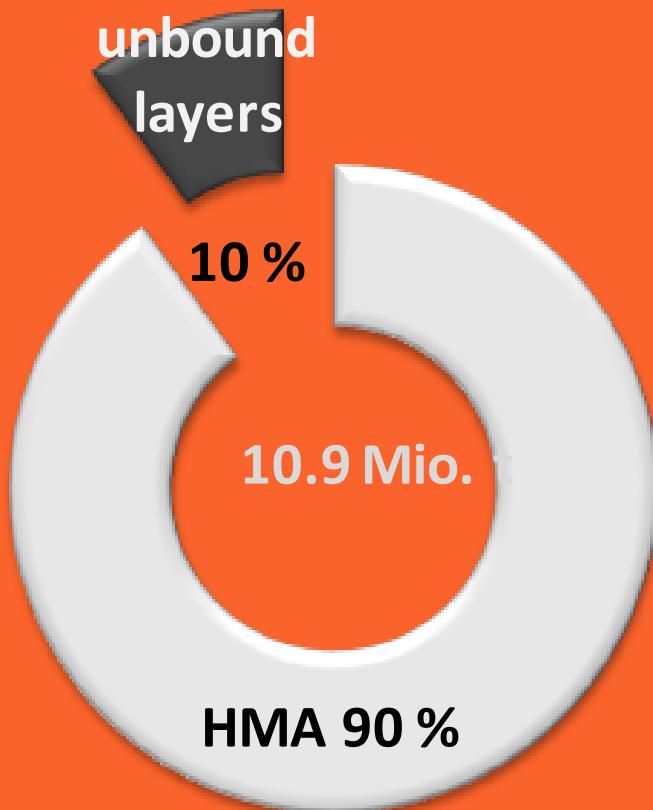
RAP used in hot and warm recycling [Mio. t]

Quelle: EAPA; Asphalt in Figures 2006-2014

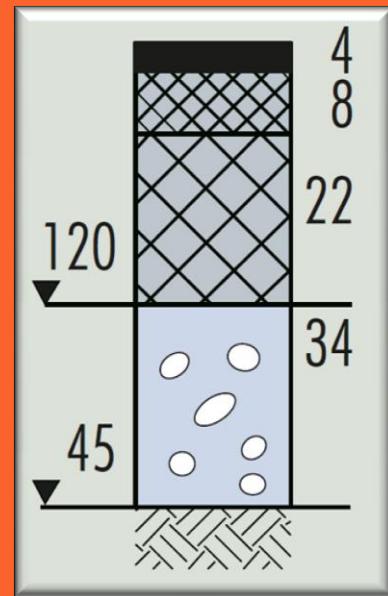


Recycling of Asphalt in Germany

Quelle: EAPA; Asphalt in Figures 2014

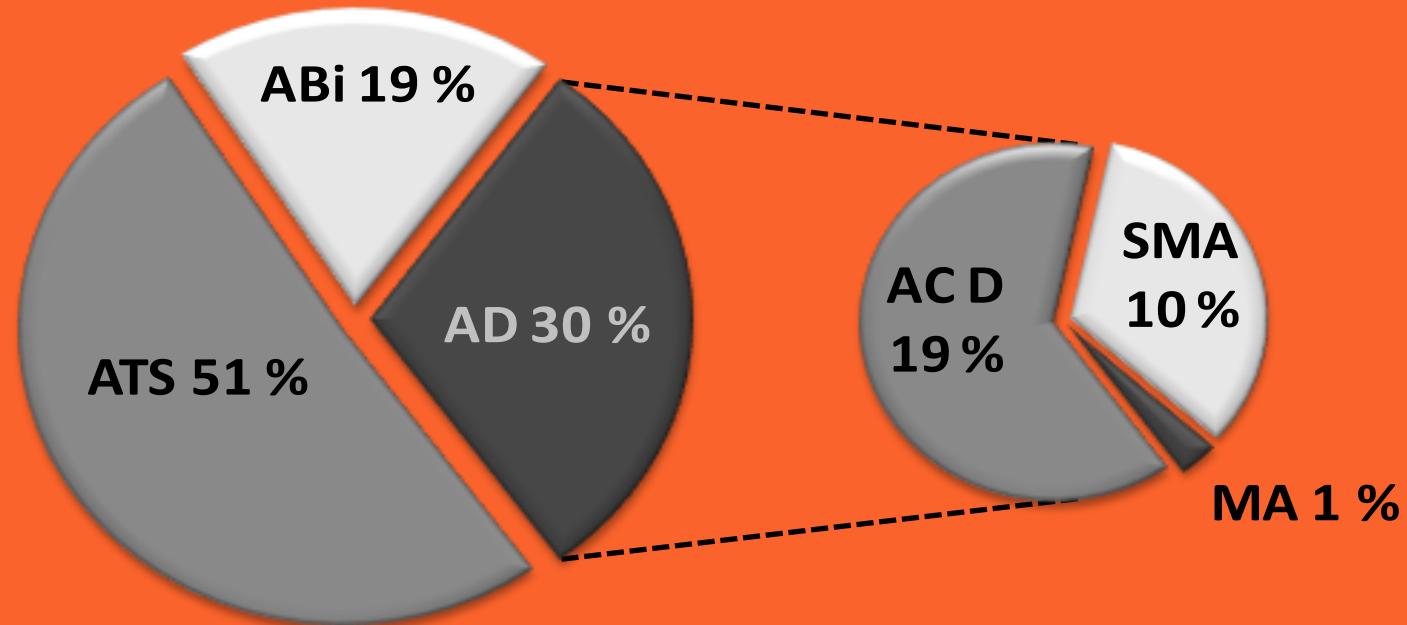


Quelle: DAV; Ausschreiben von Asphaltarbeiten



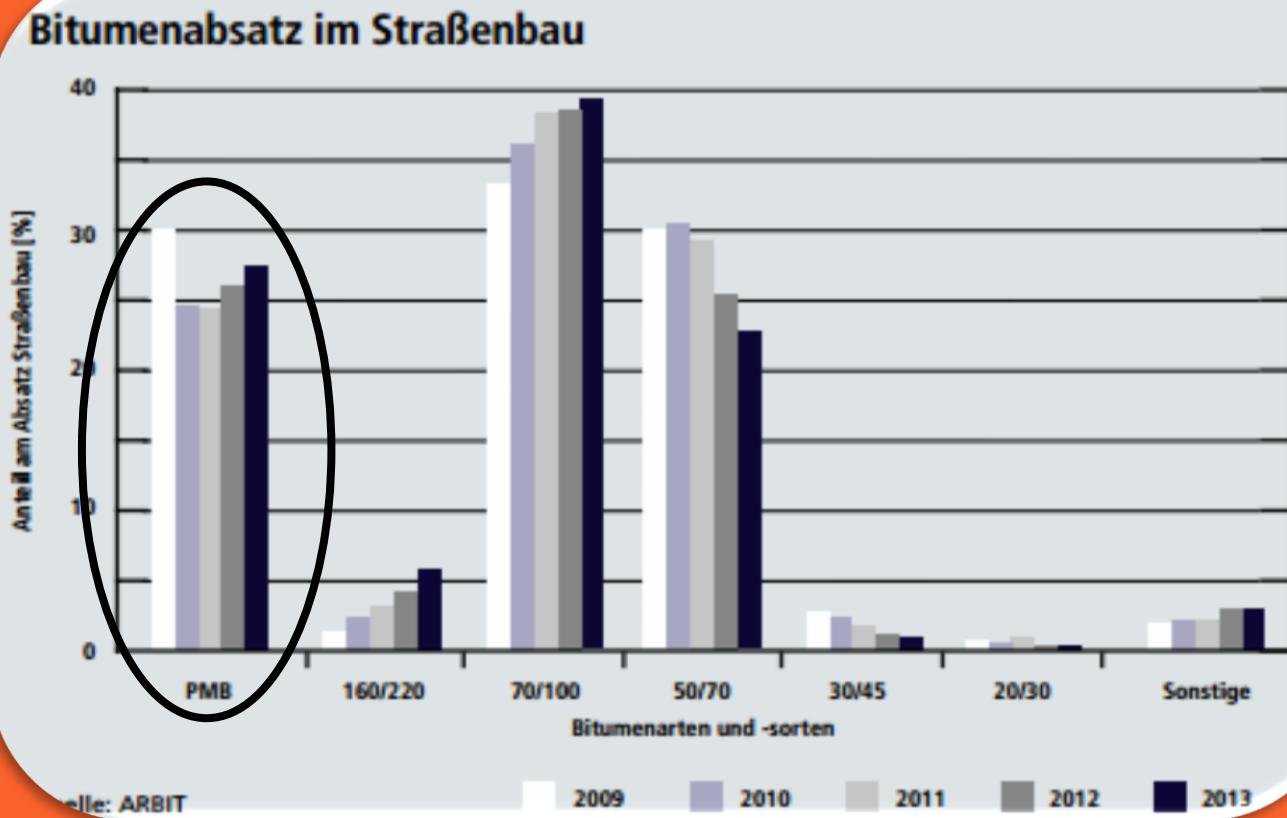
Asphalt Production [%]

Quelle: EAPA; Asphalt in Figures 2014



PmB in Road Construction

Quelle: www.arbit.de



Recycling of Asphalt in Germany

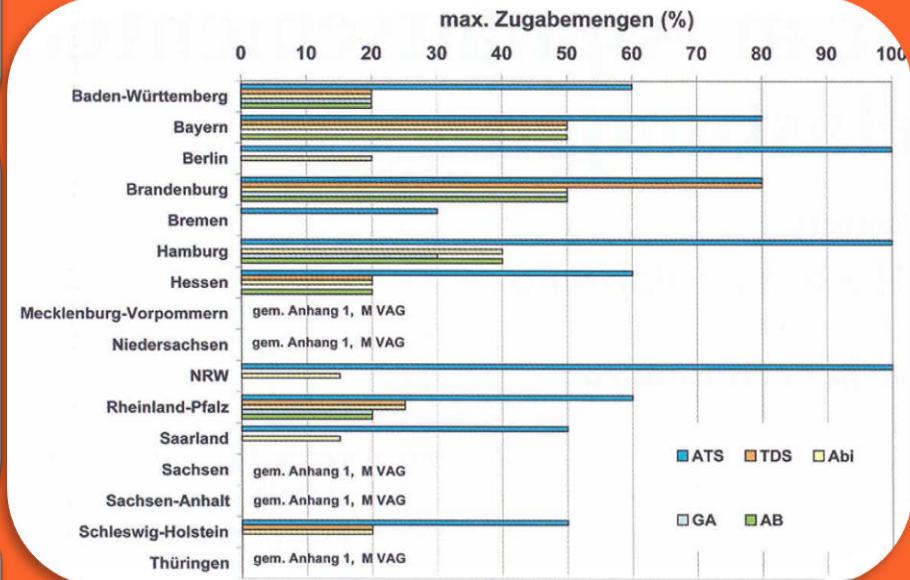
Experience with RA in Germany since more than 30 years

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

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

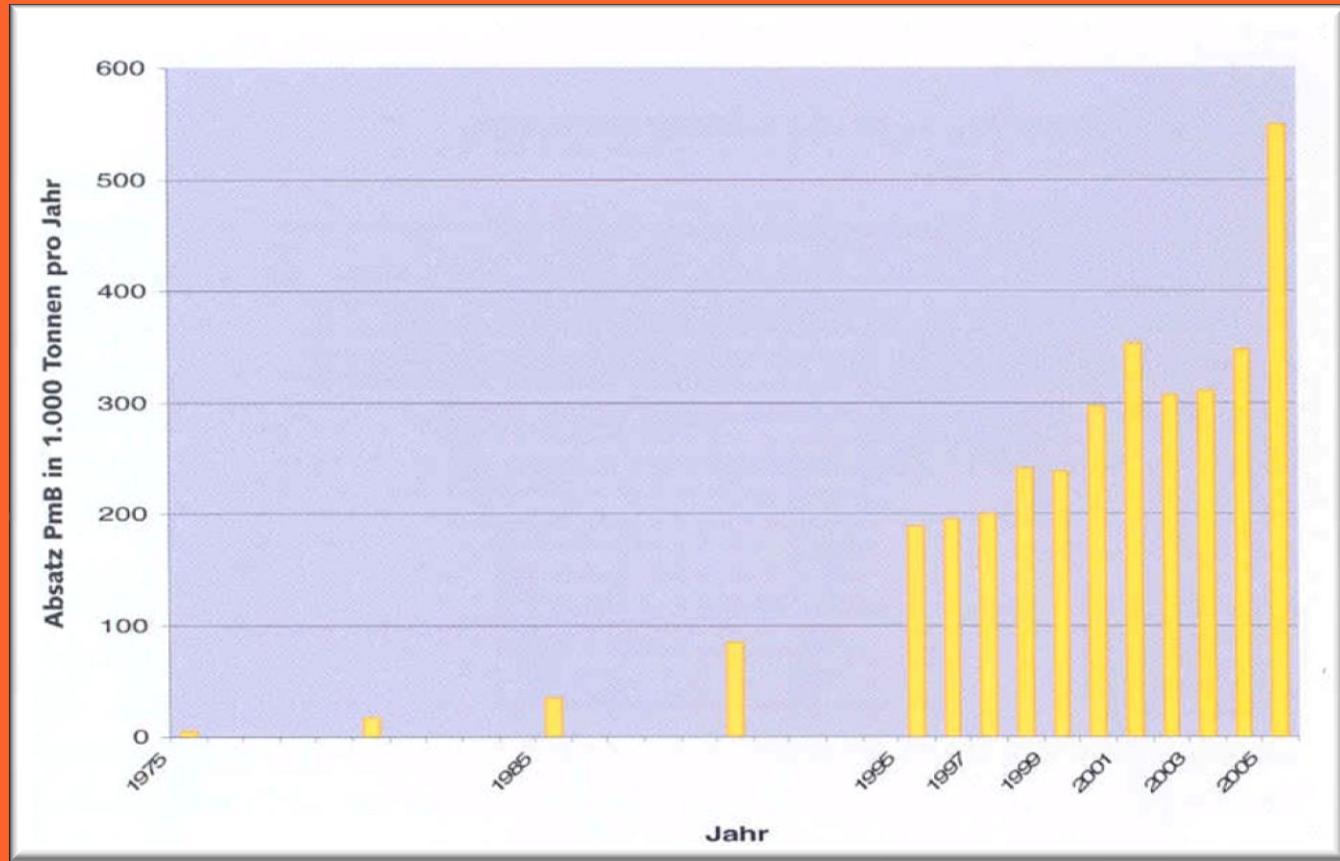
since 2005 < **40 %** share of RA

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



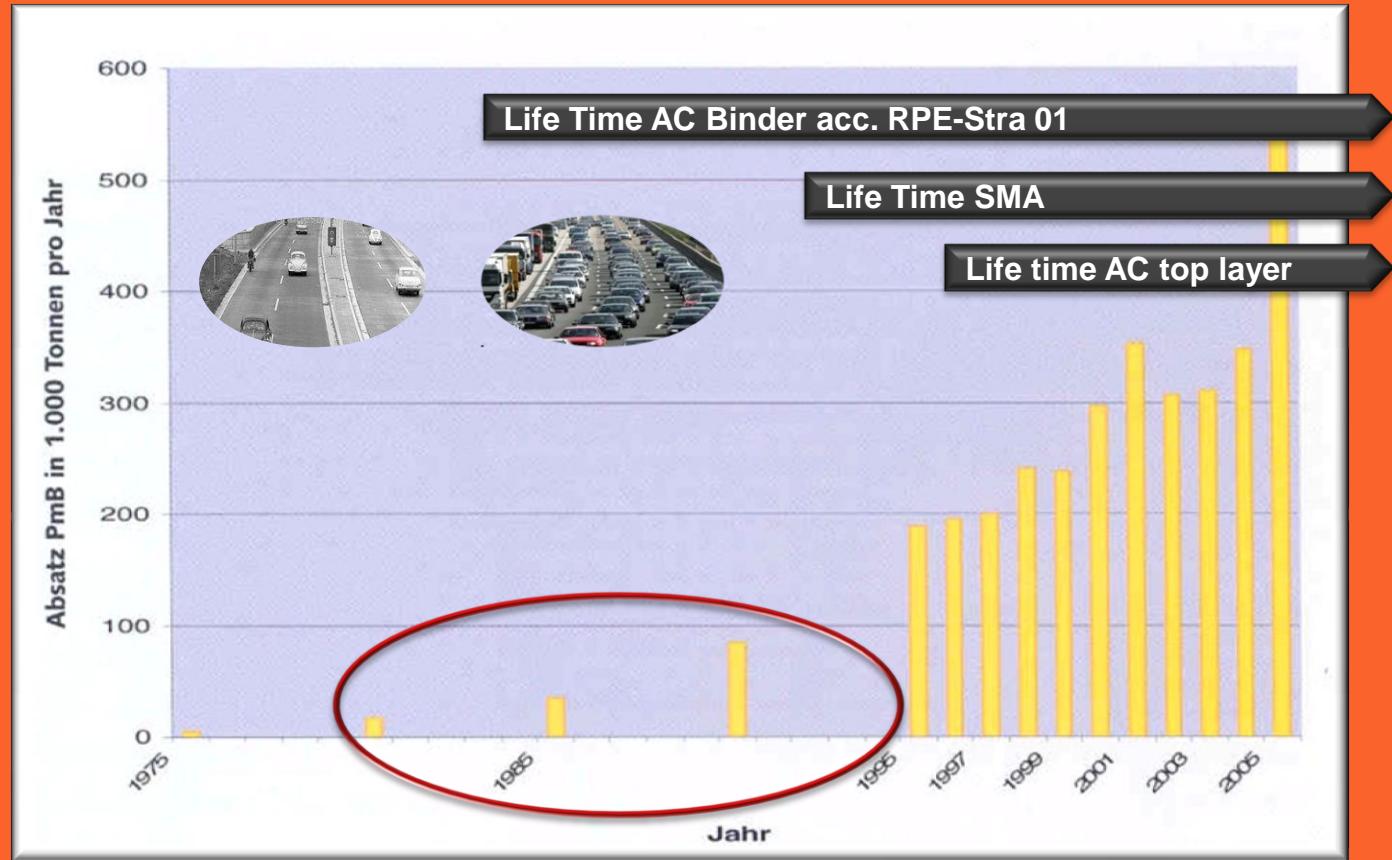
Need for PmB RC

Quelle: ARBIT; 75 Jahre ARBIT

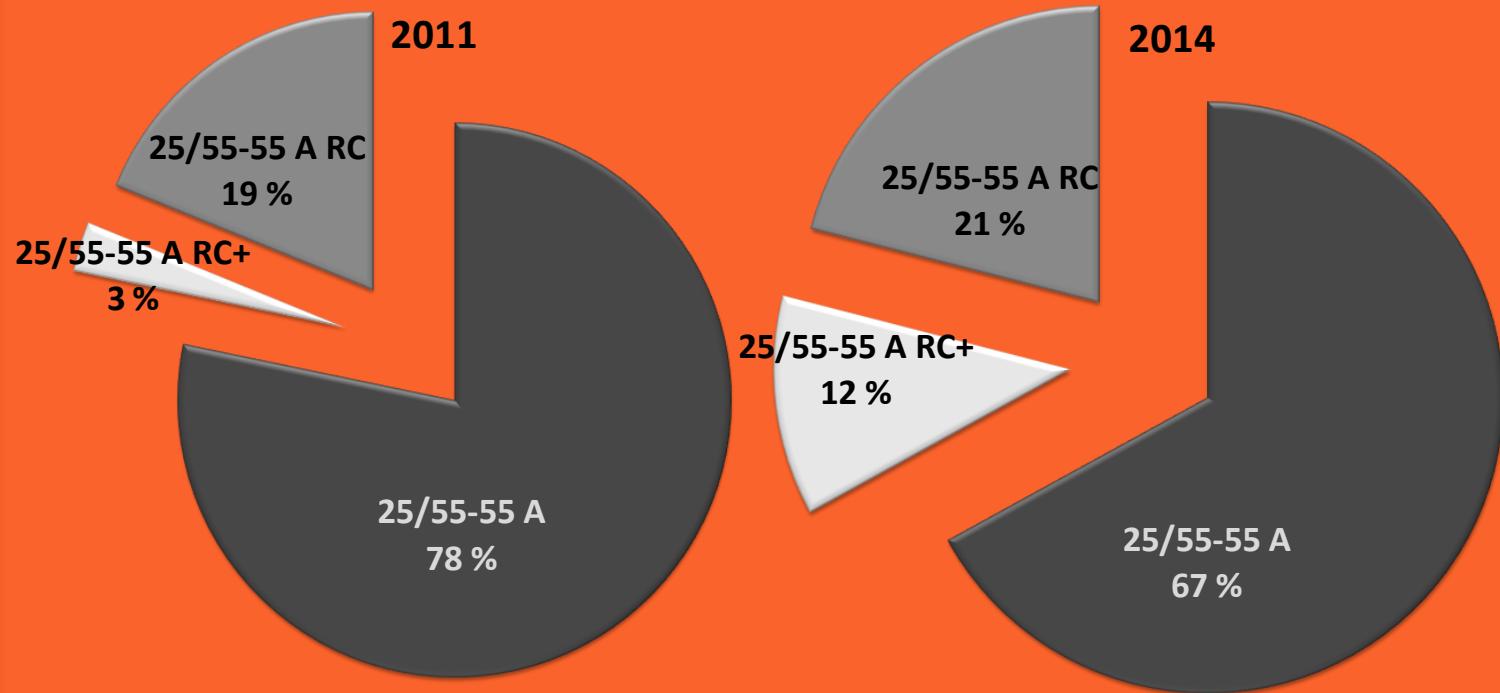


Need for PmB RC

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

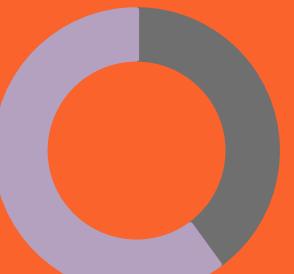
Authorities Demand



Asphalt with
100 % PMB

product must fulfill the national specifications for a PMB

Clients wish



Asphalt with PMB
and high share of
RA

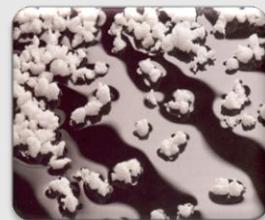
binder of RA must have a elastic recovery > 50% (equal to origin binder)

TOTAL
Result

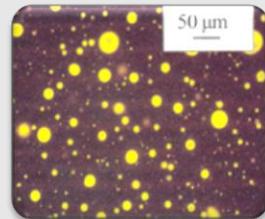


Asphalt with
100 % STYRELF

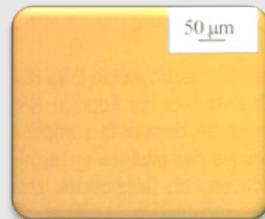
Production of PmB



Polymer modification



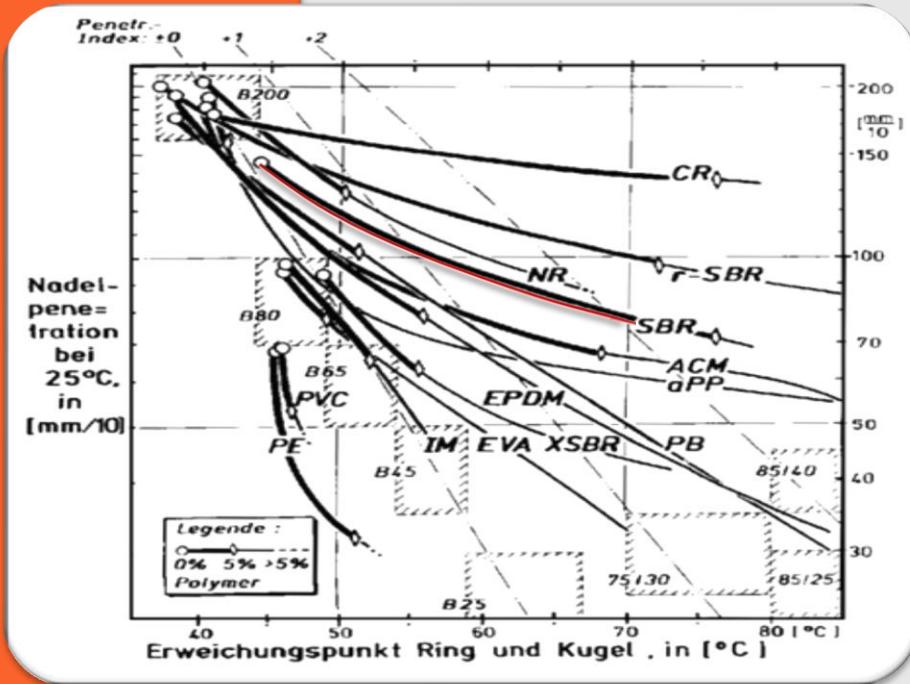
- spez. Pen Grade Bitumen**
- + Styrol-Butadien-Polymer**
- = physical mixture of Bitumen and Polymer**



- + Cross linking agent**
- = chemical cross-linked polymermodified Bitumen**

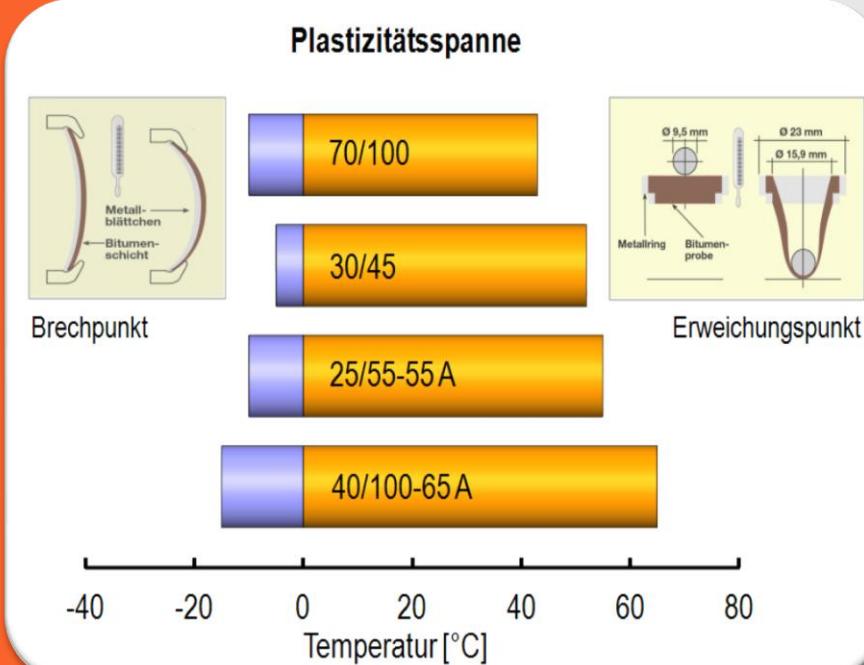
Polymer content

Quelle: Die Asphaltstrasse 1/85



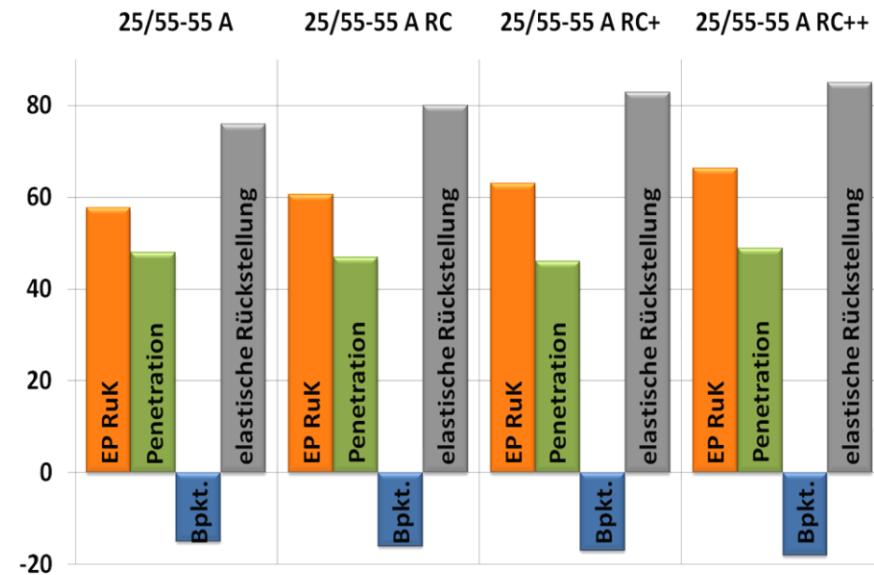
- ! Influence of variable polymers
- ! Excessive polymer content -> phase inversion

Effects of modification



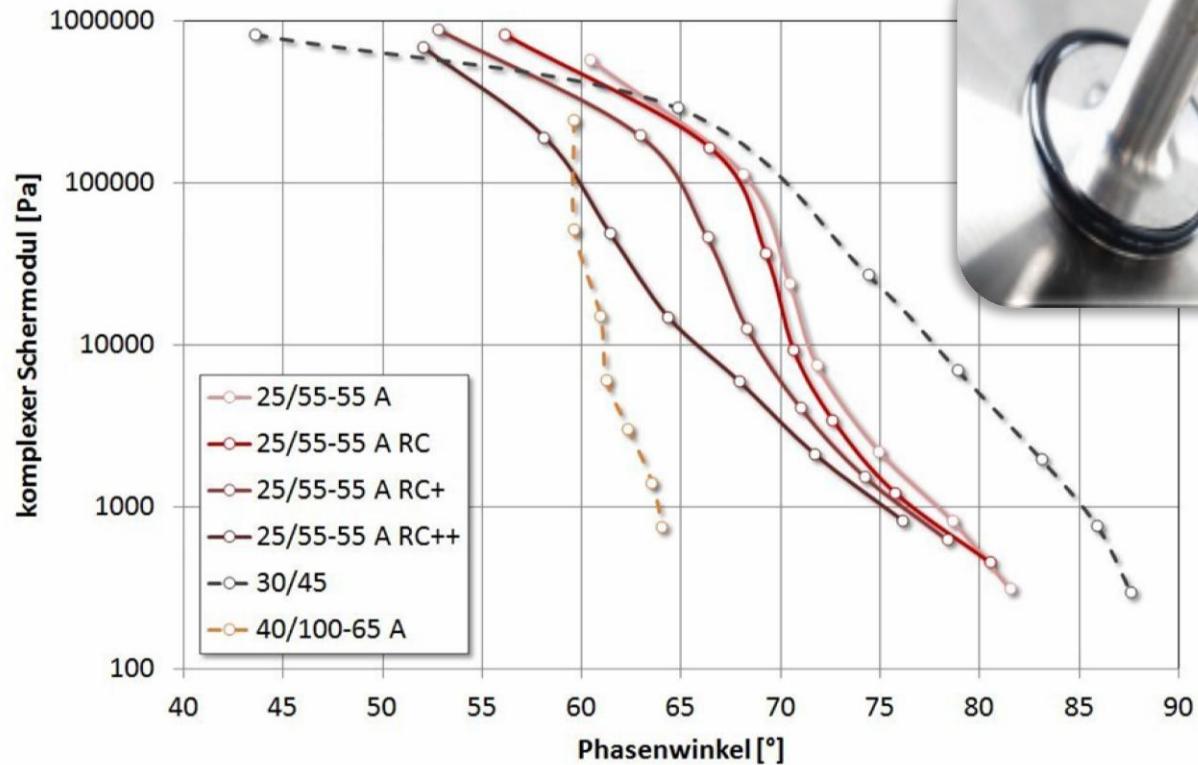
- + extended plasticity range
- + improved elasticity
- + better cohesion

Effects of modification



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

BLACK-Diagram



Technical Regulation



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

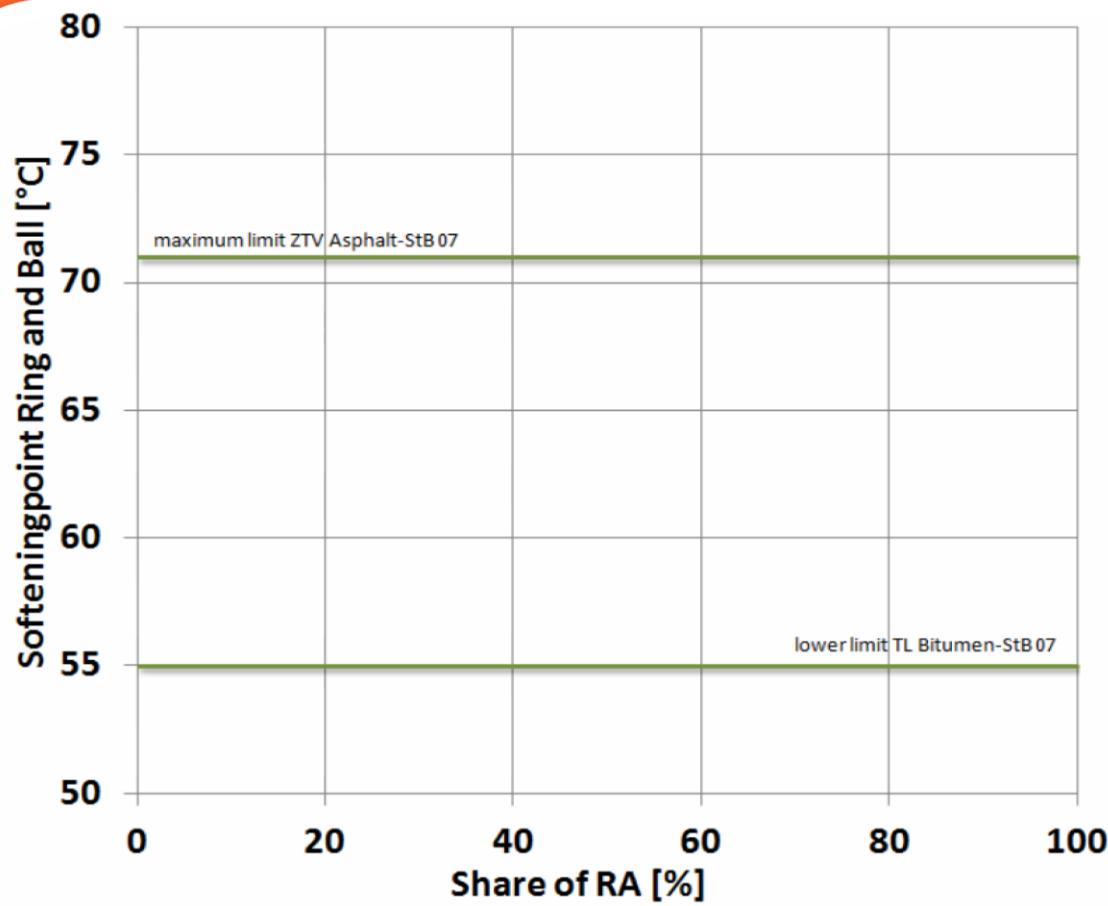


TL Asphalt-StB 07
Calculation of SP R&B when using
RAP

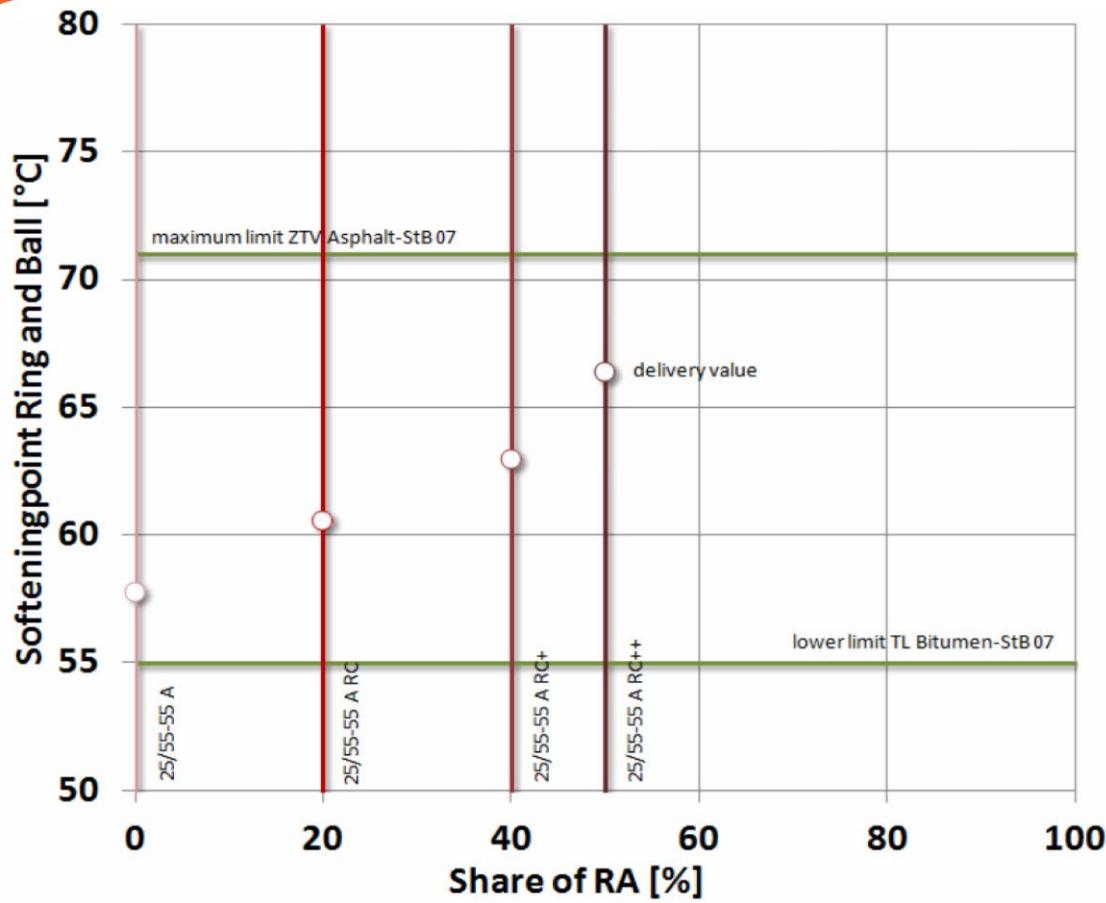


ZTV Asphalt-StB 07
Requirement for SP R&B and Elastic
Recovery (recovered binder)

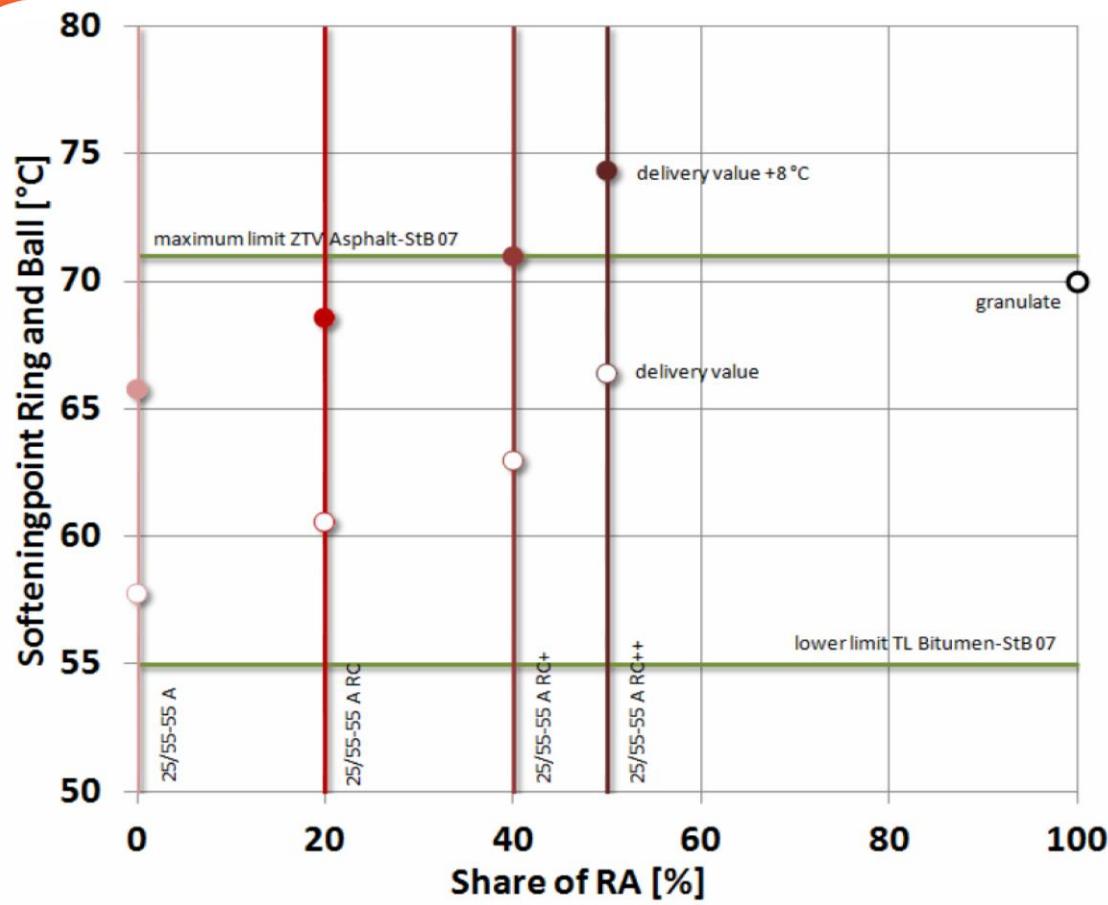
Consequence of Technical Regulation



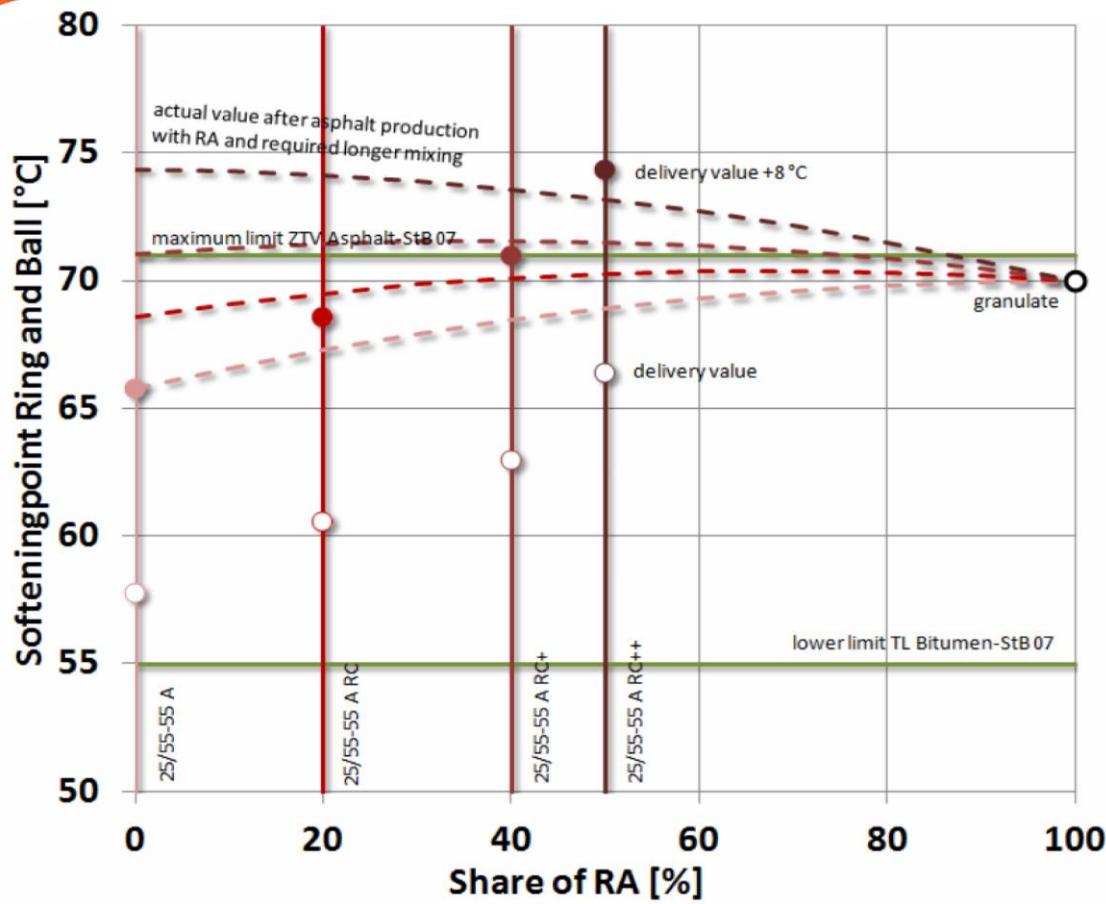
Consequence of Technical Regulation



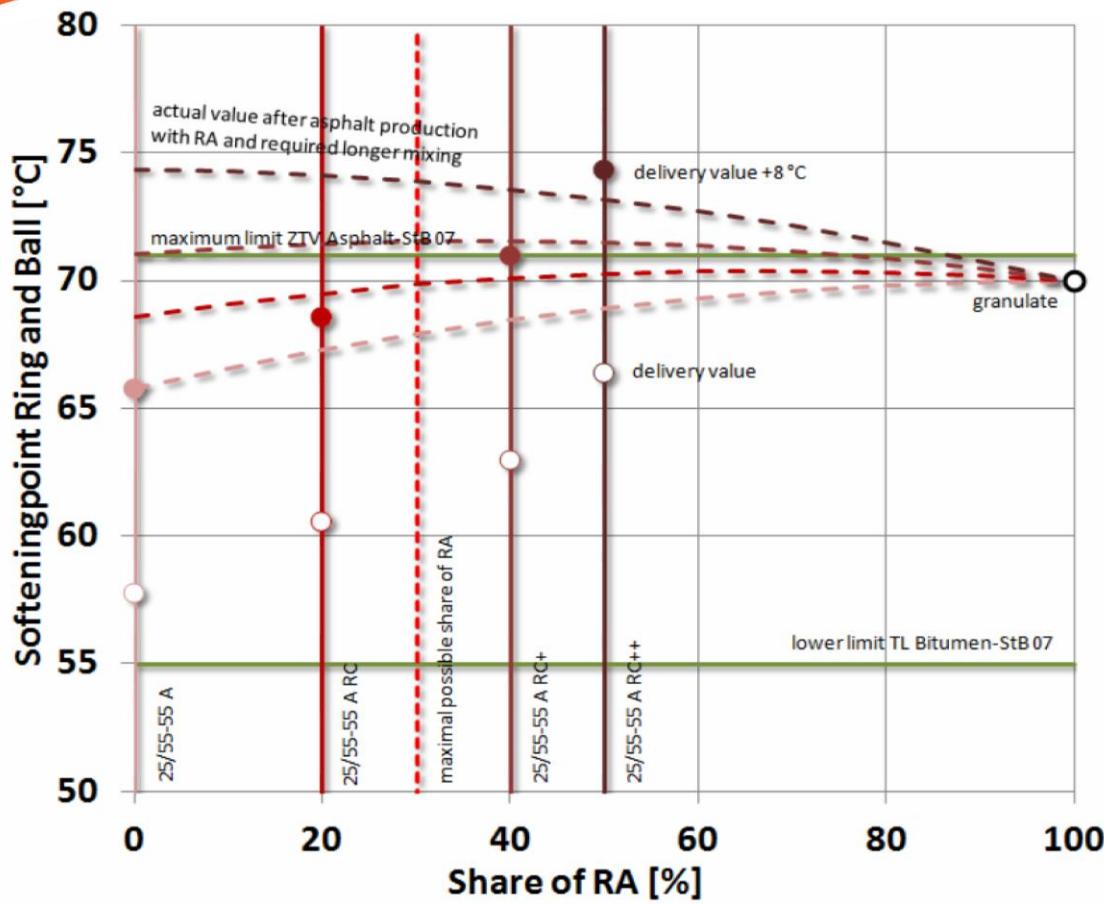
Consequence of Technical Regulation



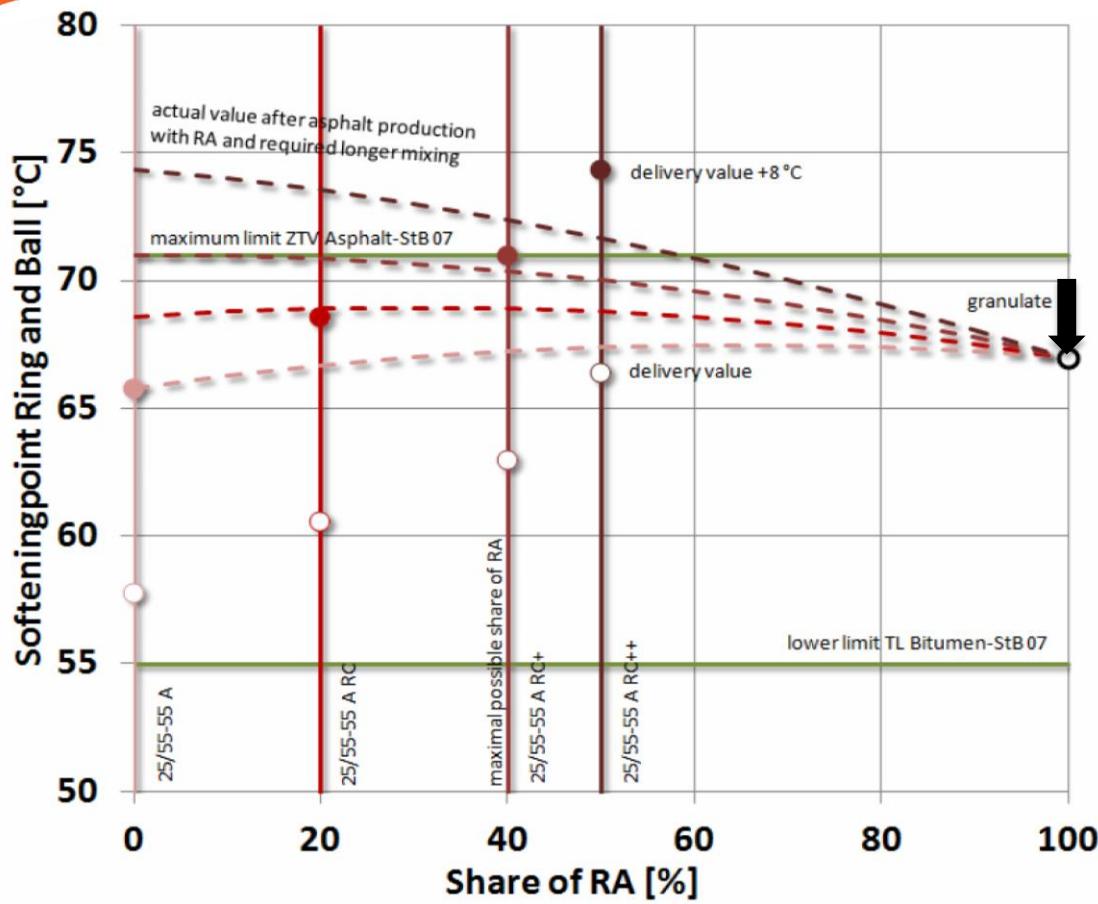
Consequence of Technical Regulation



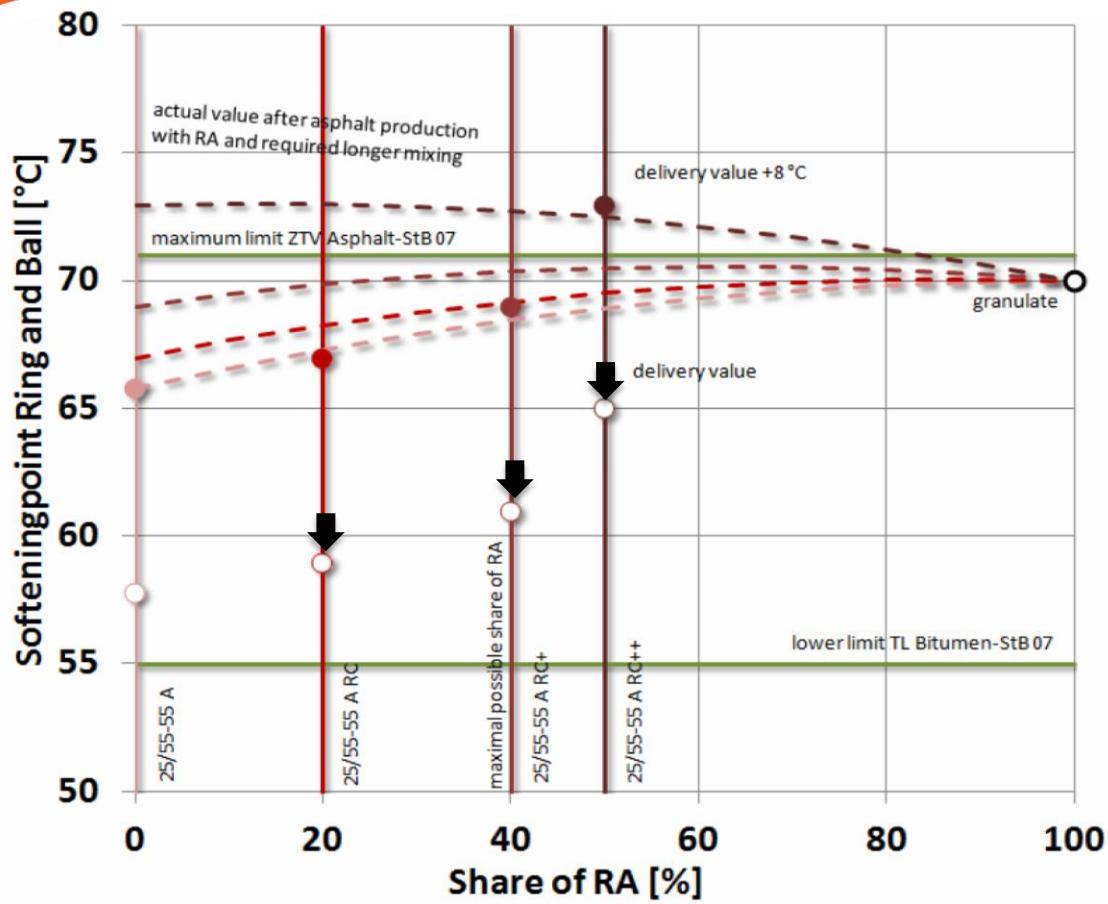
Consequence of Technical Regulation



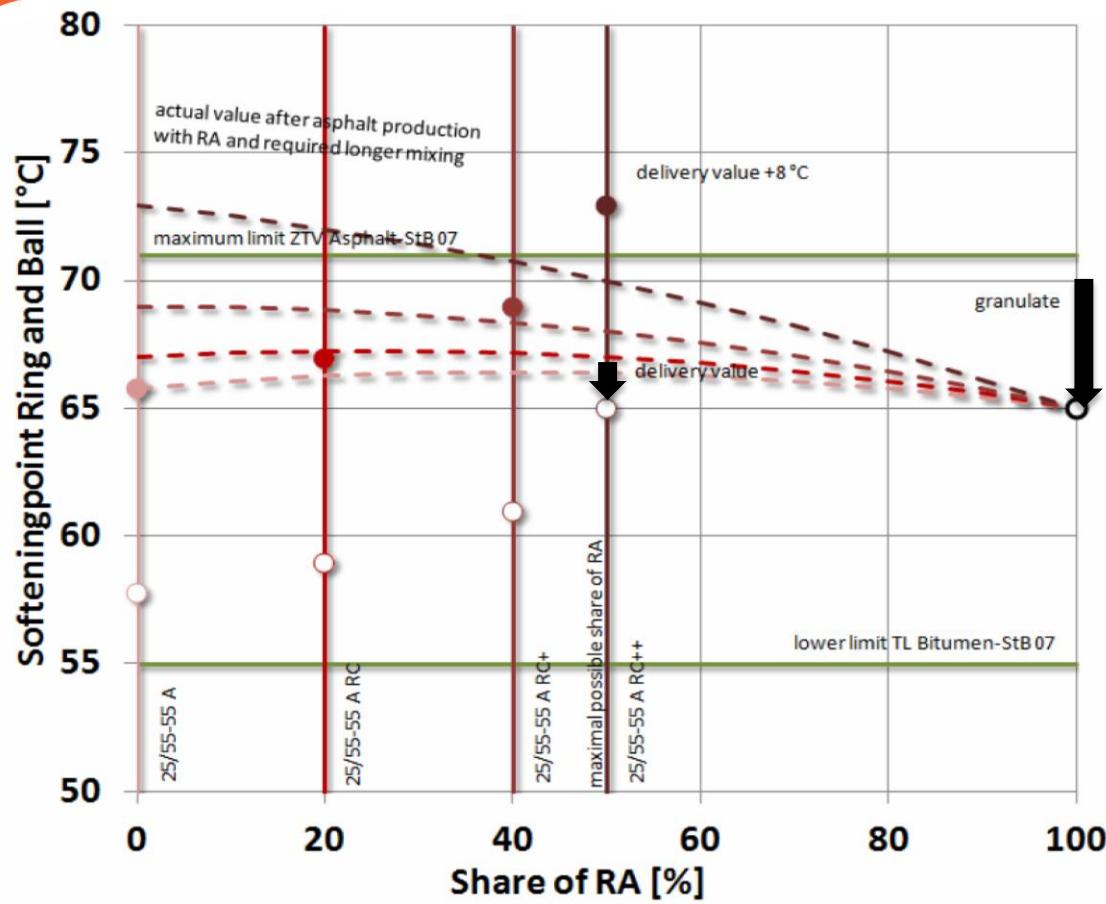
Decrease of R&B granulate



Decrease of R&B binder



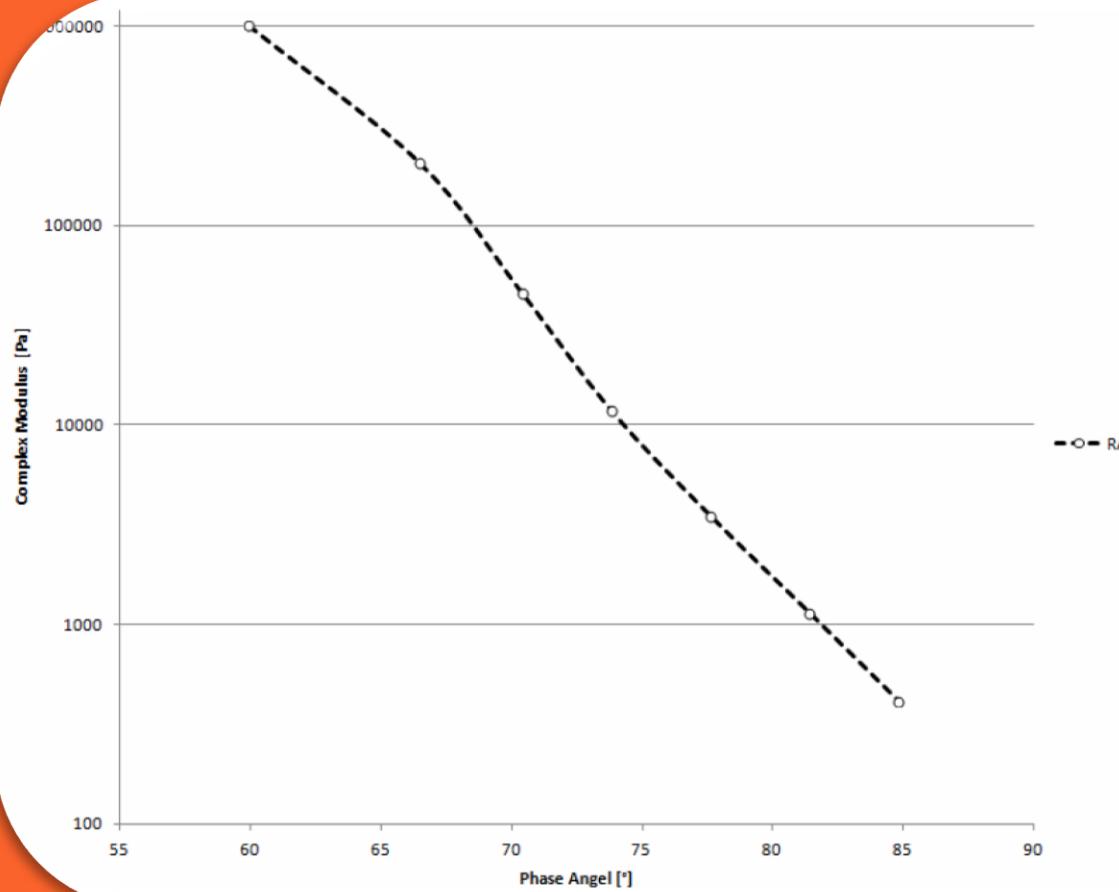
Decrease of R&B binder & granulate



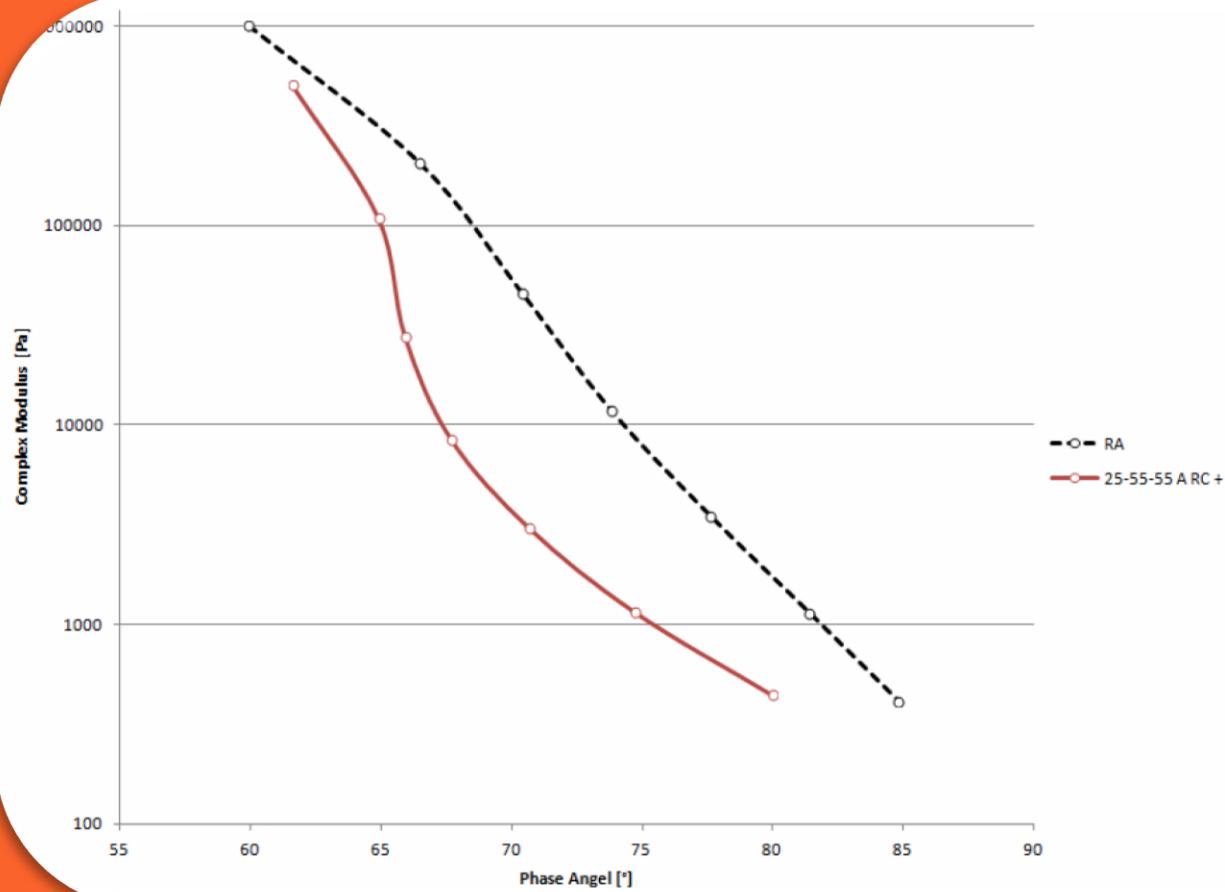
In Practice

	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

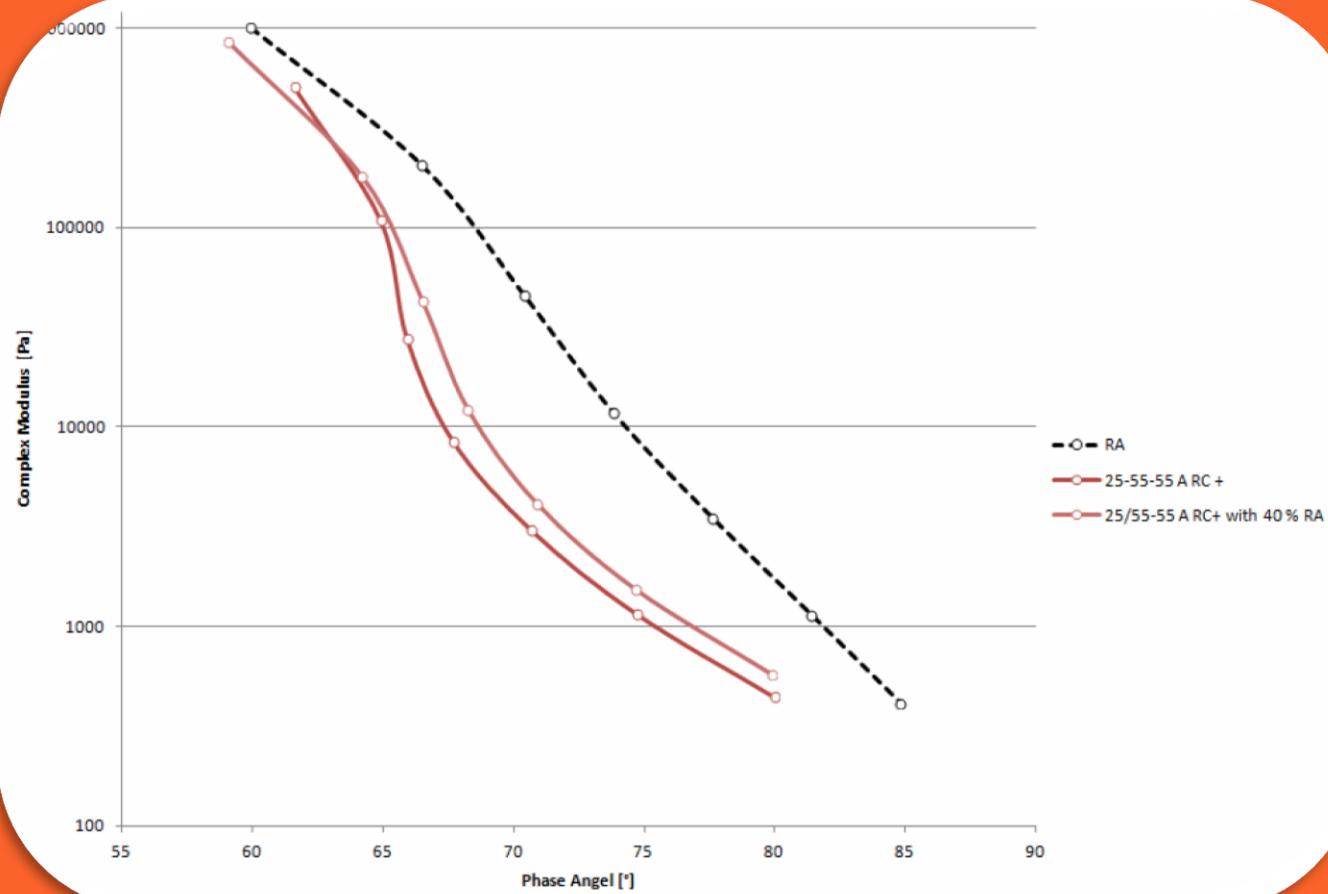
In Practice



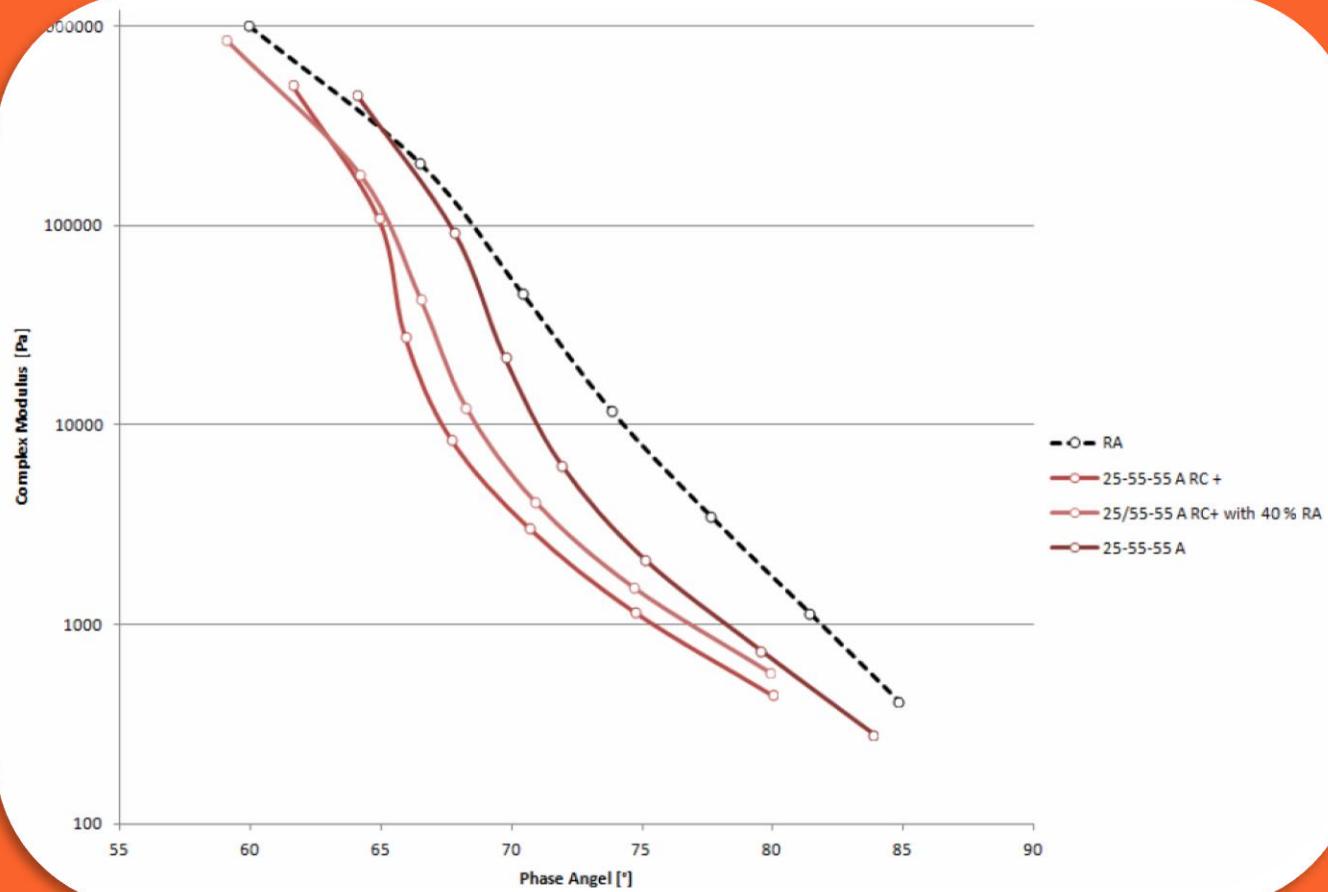
In Practice



In Practice



In Practice



Open Questions

Softening Point (R&B)



- 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



New set of rules and standards shows the way forward



asphalt
GUIDELINES

Thomas Sandmann
TOTAL Bitumen Deutschland GmbH

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

