

Recycling on a High Performance Level



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TOTAL



FIGURES | 1



Asphalt Figures in 2013 (dav)

- › total production of hot mix asphalt in Germany
41 Mio. t
- › available recycling materials in Germany
11.5 Mio. t
- › share of recycling materials used in warm recycling
in Germany
90 % = 10.3 Mio. t
- › share of reclaimed asphalt for new hot mix
production ~25 %

**Asphaltproduktion
in Deutschland** (Stand August 2014)



Produktionsjahr	Mischgut- produktion	davon aus Wiederverwendung (Anfall + WDV-Rate in Klammern)		Anteil Wiederver- wendung (WDV in Prod.)
		Millionen Tonnen		in %
2011	50	11,7	(von ~ 14, d.h. ~ 84%)	23,4
2012	41	10	(von ~ 11,5 d.h. ~ 87%)	24,4
2013	41	10,3	(von ~ 11,5 d.h. ~ 90%)	25,1

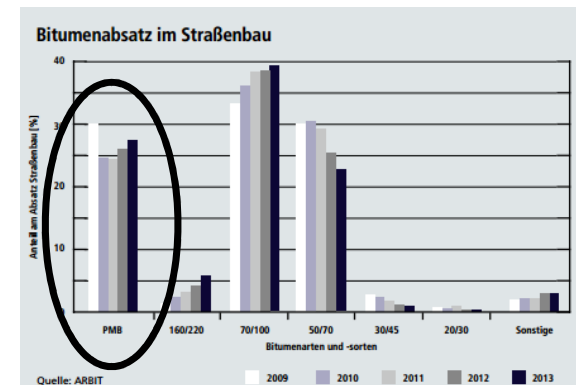
Wiederverwendungsrate = verwerfeter Ausbaumasphalt / Gesamt-Anfall an Ausbaumasphalt
Anteil Wiederverwendung = verwerfeter Ausbaumasphalt/Mischgutproduktion
*Annahme, dass in diesen Jahren Ausbaumasphalt im Wesentlichen nur in den ABL anfiel

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Asphalt Figures in 2013 (EAPA, ARBIT)

- › application in binder courses
~ 19 % of total annual HMA production
(mostly with PMB)
- › application in stone mastic asphalt
~ 10 % of total annual HMA production
(mostly with PMB)



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APPLICATION IN SURFACE-, BINDER- AND BASE COURSES IN % OF TOTAL ANNUAL HMA PRODUCTION

Country	Surface course	Binder course	Base course
Austria	25	10	65
Belgium	50		50
Croatia	54	5	41
Czech Republic	60	18	22
Denmark	42	9	49
Estonia	67	7	26
Finland	91	0	9
Germany	30	19	51
Greece	87	10	3

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SURFACE COURSES WITH STONE MASTIC ASPHALT EN 13108-5

Country	% of total annual hot and warm mix asphalt production in 2013	In '13 applied area in million m²
Austria	1,3	
Belgium	13,8	8,1
Croatia	1,7	1,0
Czech Republic	6,5	3,2
Denmark	10,6	4,6
Estonia	8,4	
Finland	11,3	
Germany	10,0	No data
Hungary	3,2	2,5



Recycling in Germany

› Experience with RA in Germany since more than 30 years

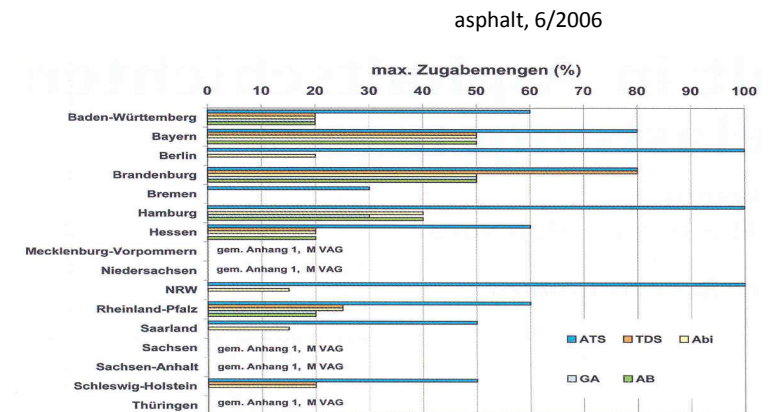
› different regulations in the regions of Germany

- base courses < 100 % share of RA
- binder courses < 50 % share of RA
- surface courses < 50 % share of RA

› 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

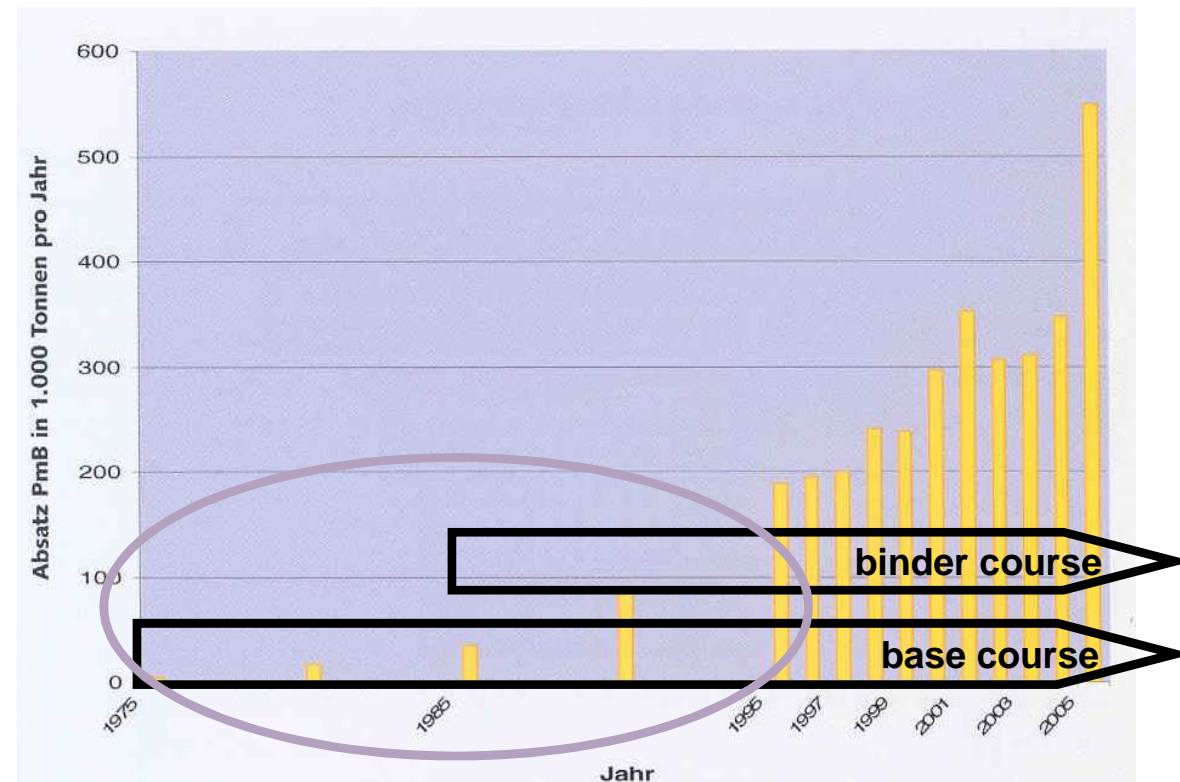
› new hotmix production that contains reclaimed material ~ 97 % (in 2012)



CUSTOMER DEMAND | 2

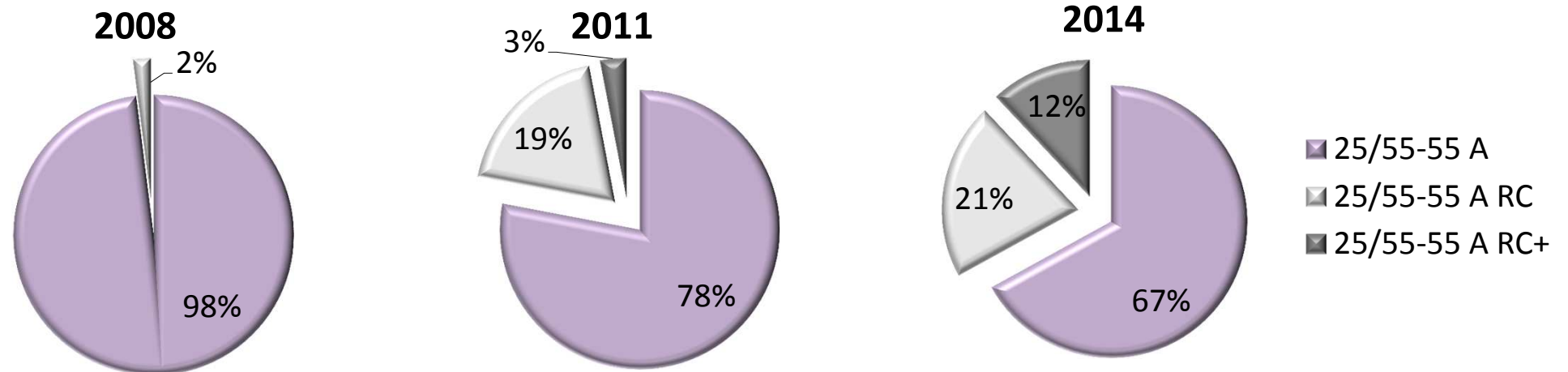
Need for PMB RC Types

- › increasing demand for PMB products because of higher traffic loads
- › decrease in new road constructions
- › increase of reconstructions
- › life time of base courses ~ 50 a
- › life time of binder courses ~ 30 a
- › PMB mostly used in binder and surface courses





PMB Production TBD





Customer Demand

- › 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 an elastic recovery > 50 % (equal to origin binder)
- › product must make a high share of RA possible

Demand of Authorities



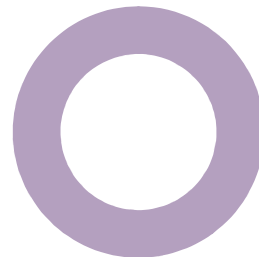
Asphalt with 100 % PMB

Customer Demand



Asphalt with PMB
and high share of RA

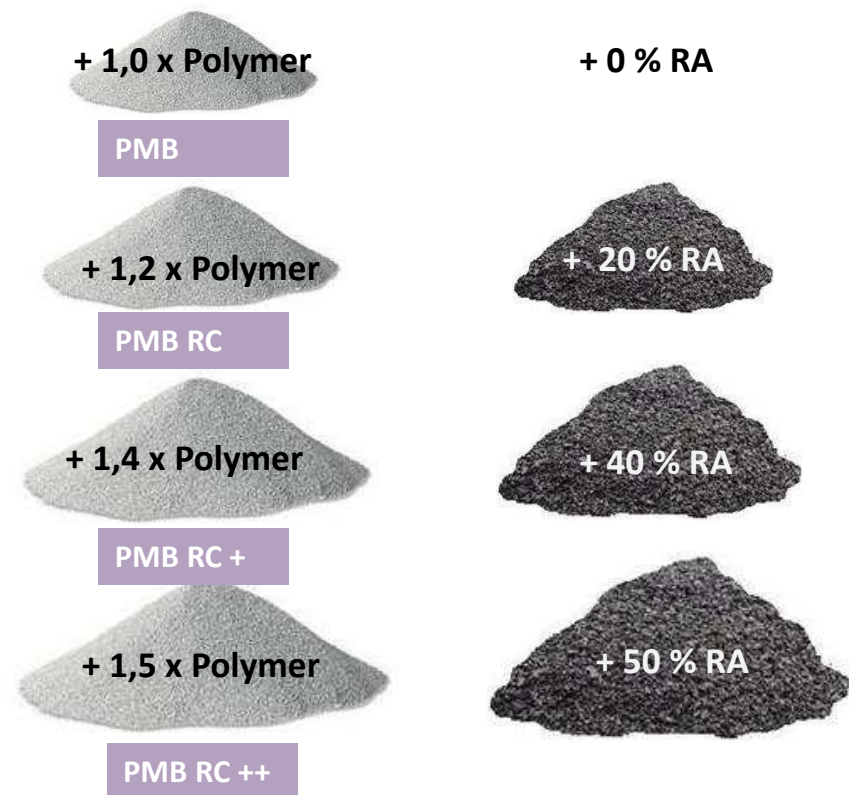
TOTAL Result



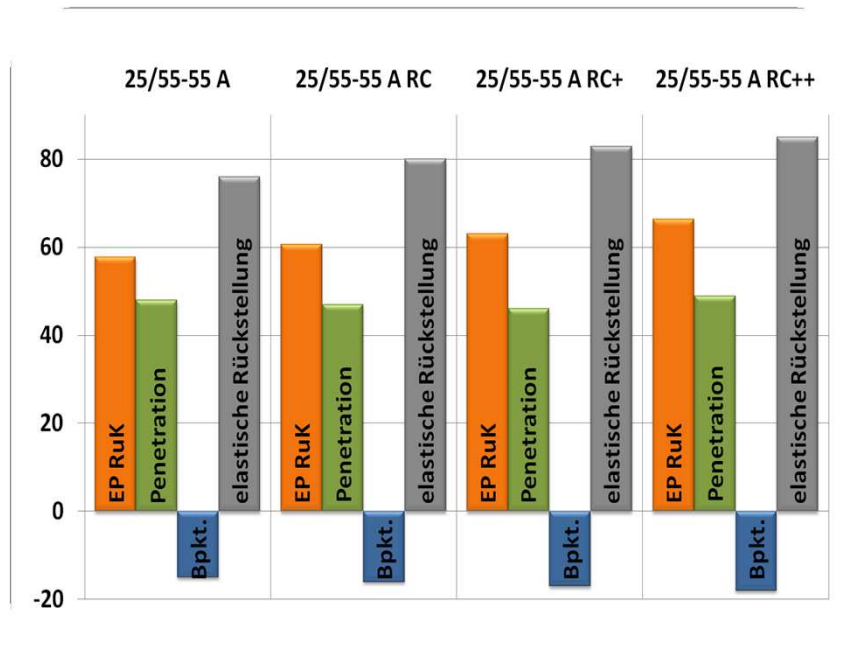
Asphalt with 100 % STYRELF

SOLUTION | 3

PMB for Recycling



Effects of Modification

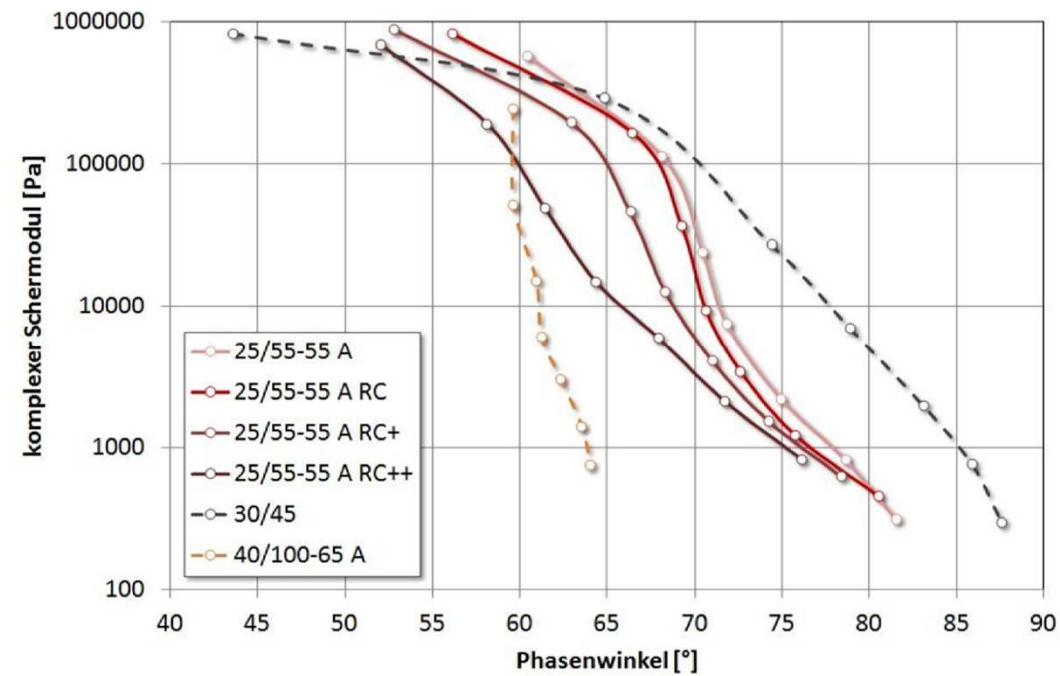


- + SP R&B increasing
- Needle Penetration not changing
- Breaking Point decreasing
- + Elastic Recovery increasing

Black Diagram

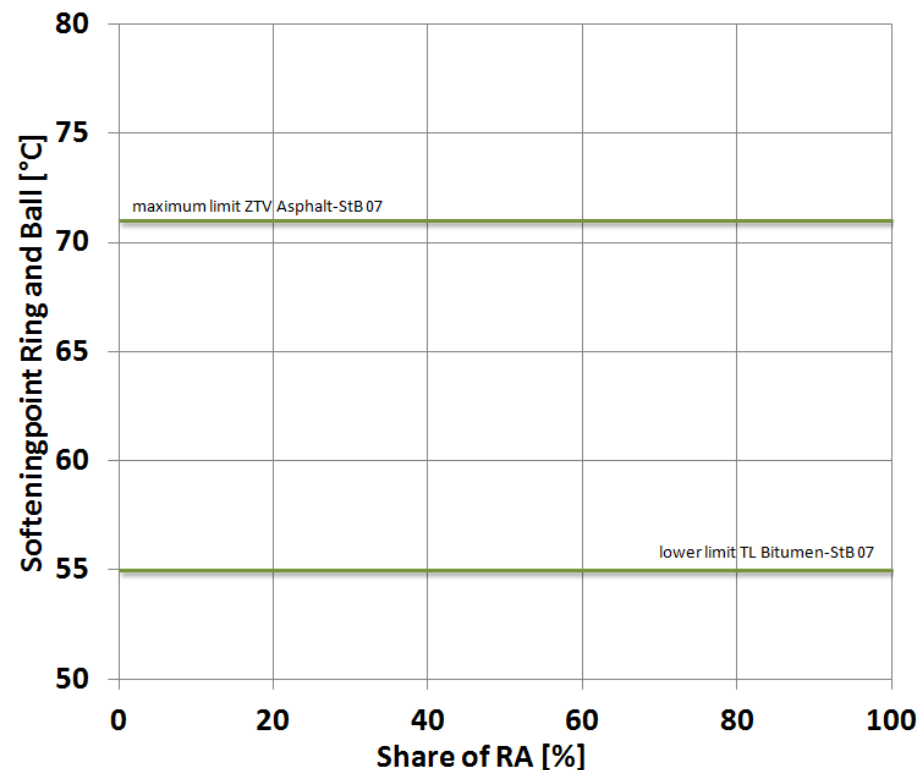


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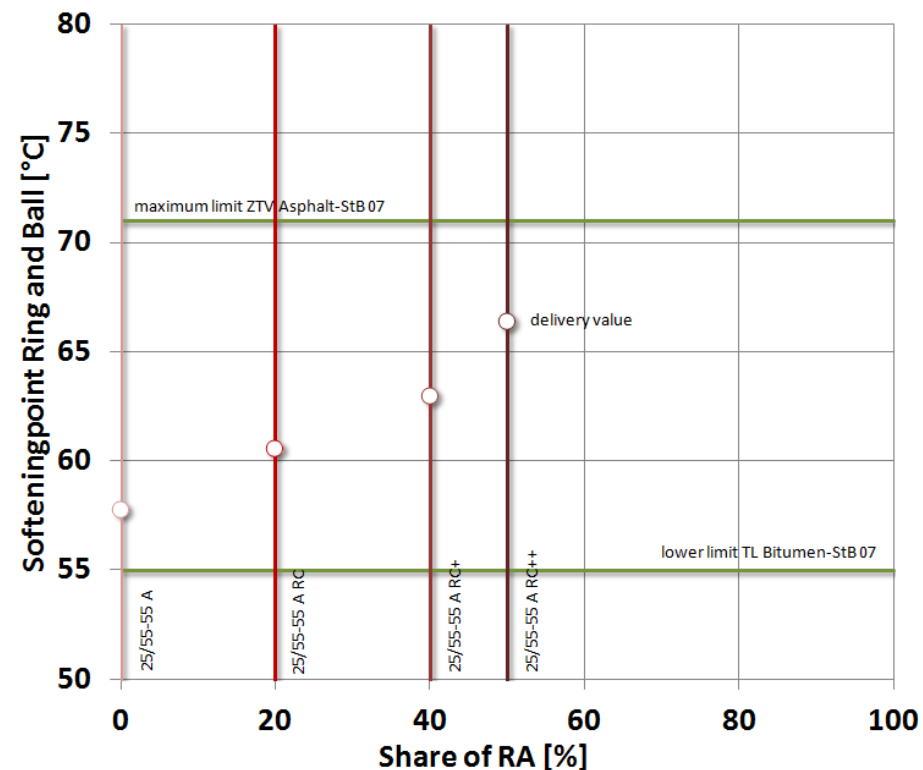


Consequence of Technical Regulation



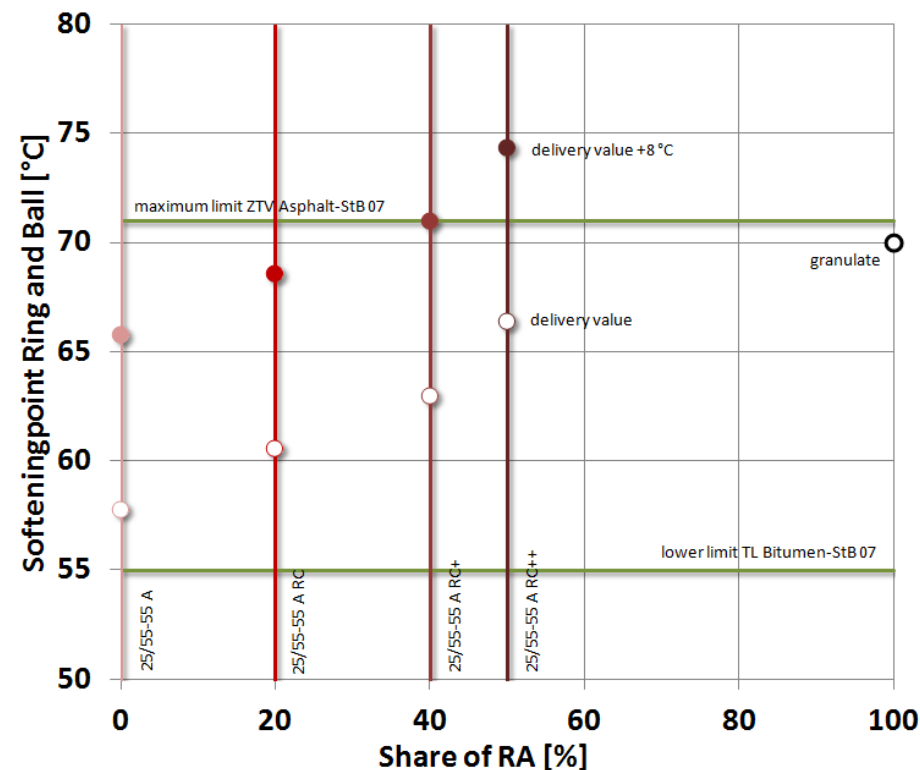


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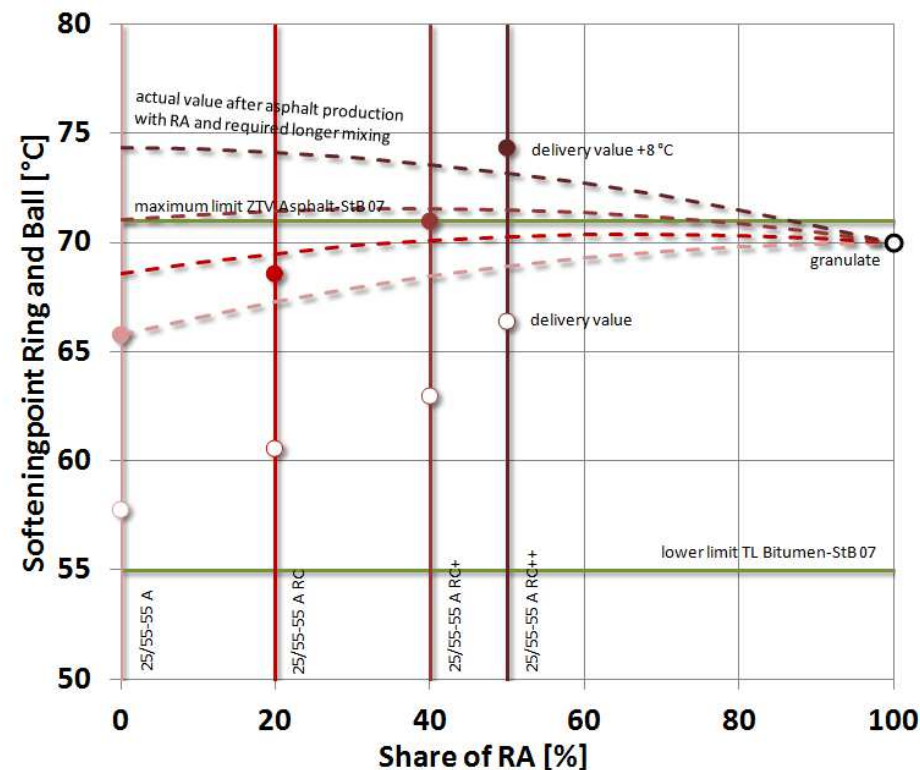


Consequence of Technical Regulation



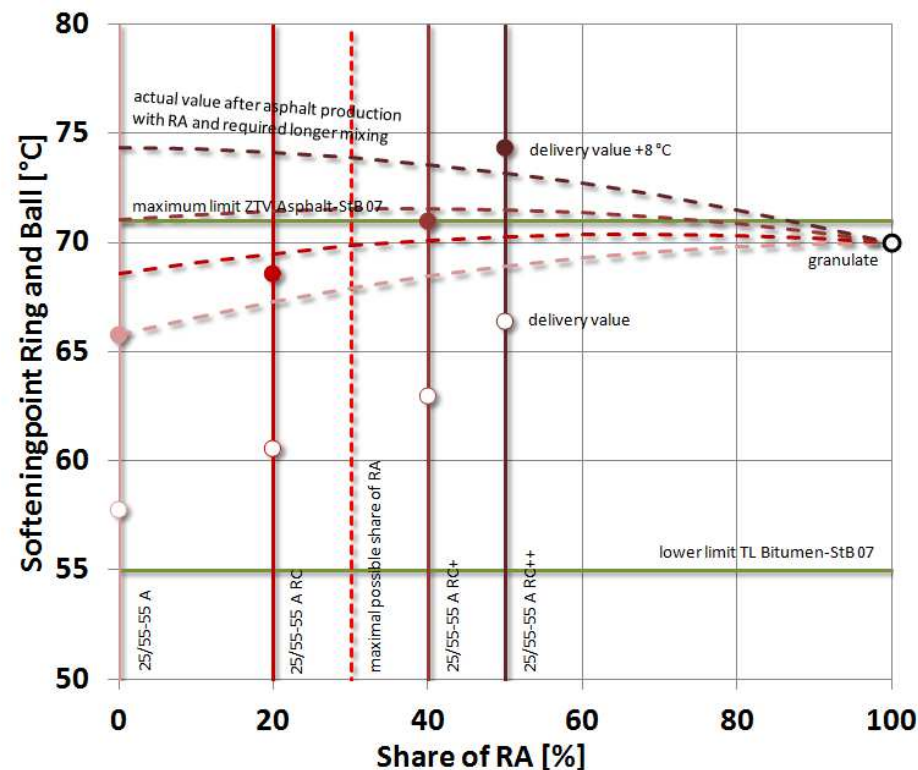


Consequence of Technical Regulation





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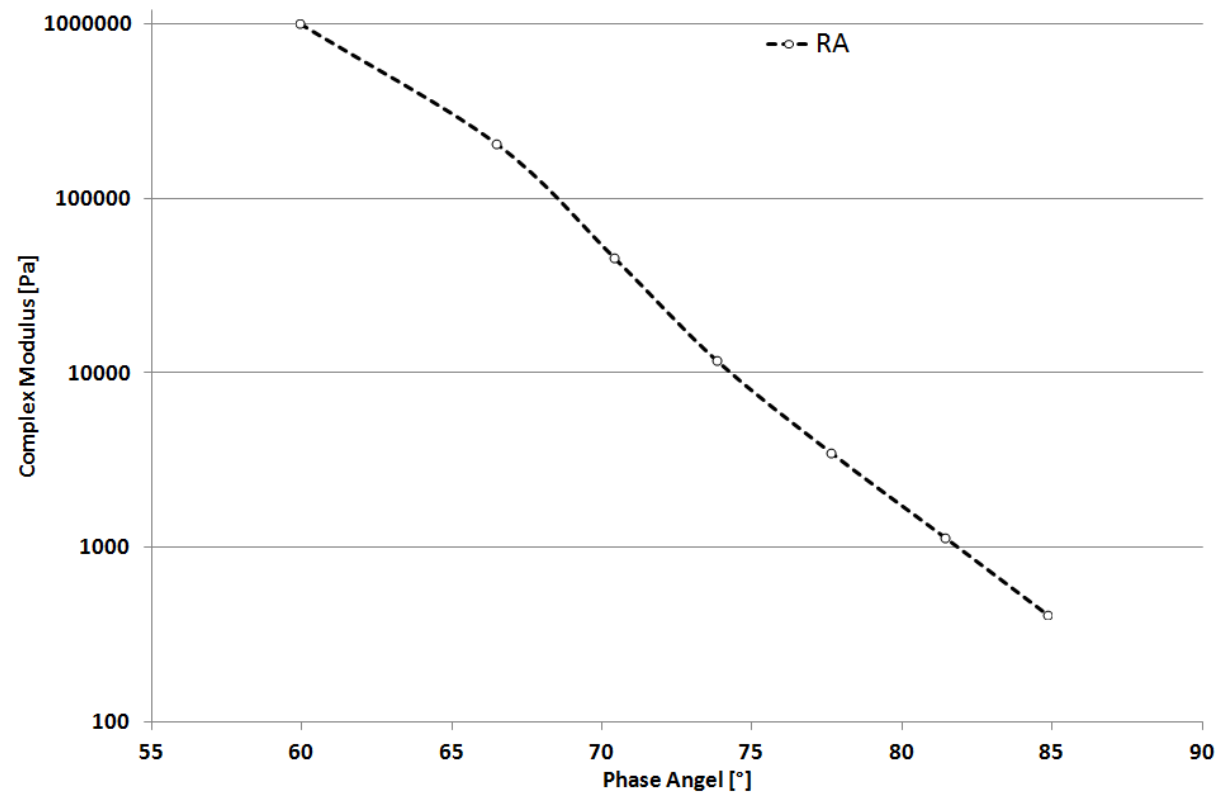


In Practice

	60 % 40 %	25/55-55 RC+ RA	25/55-55
Penetration @ 25 °C [1/10 mm]		35	25-55
Softening Point R&B [°C]		62,6	> 55
Elastic Recovery [%]		77	> 50
Breaking Point Fraass [°C]		-11	< -10

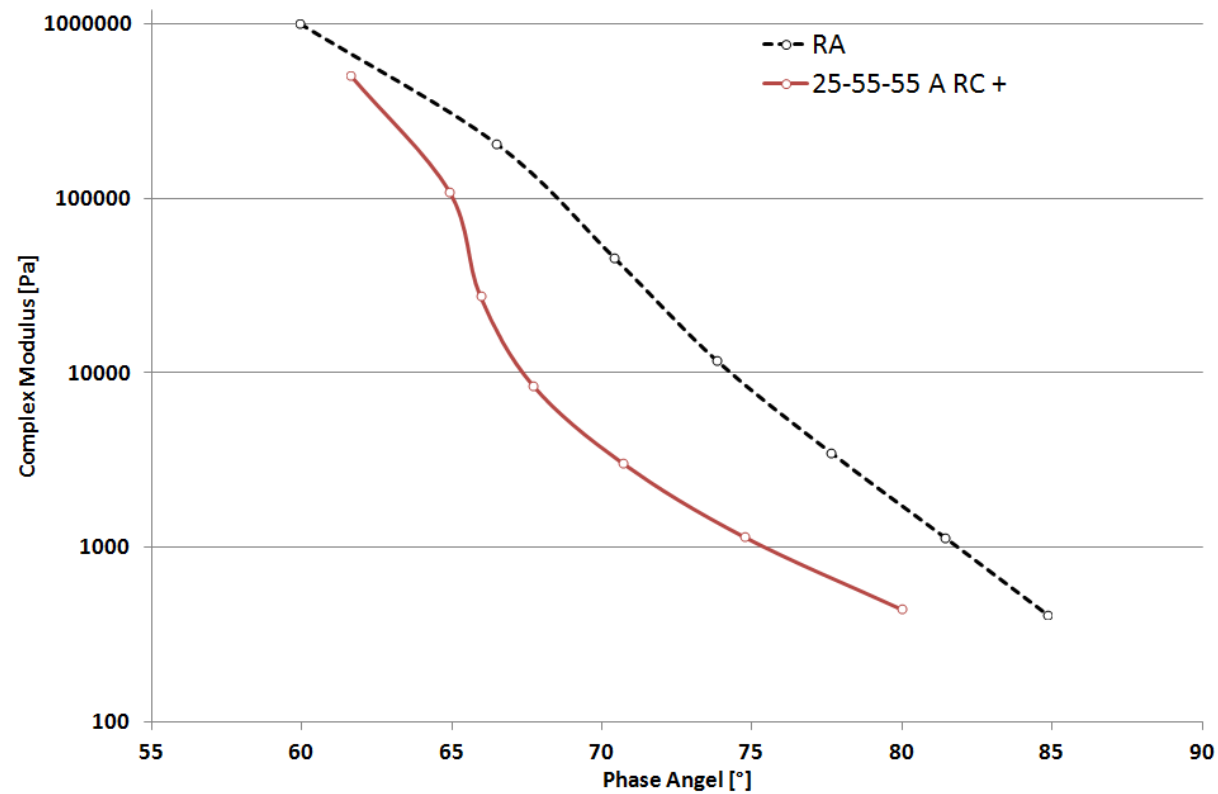


In Practice



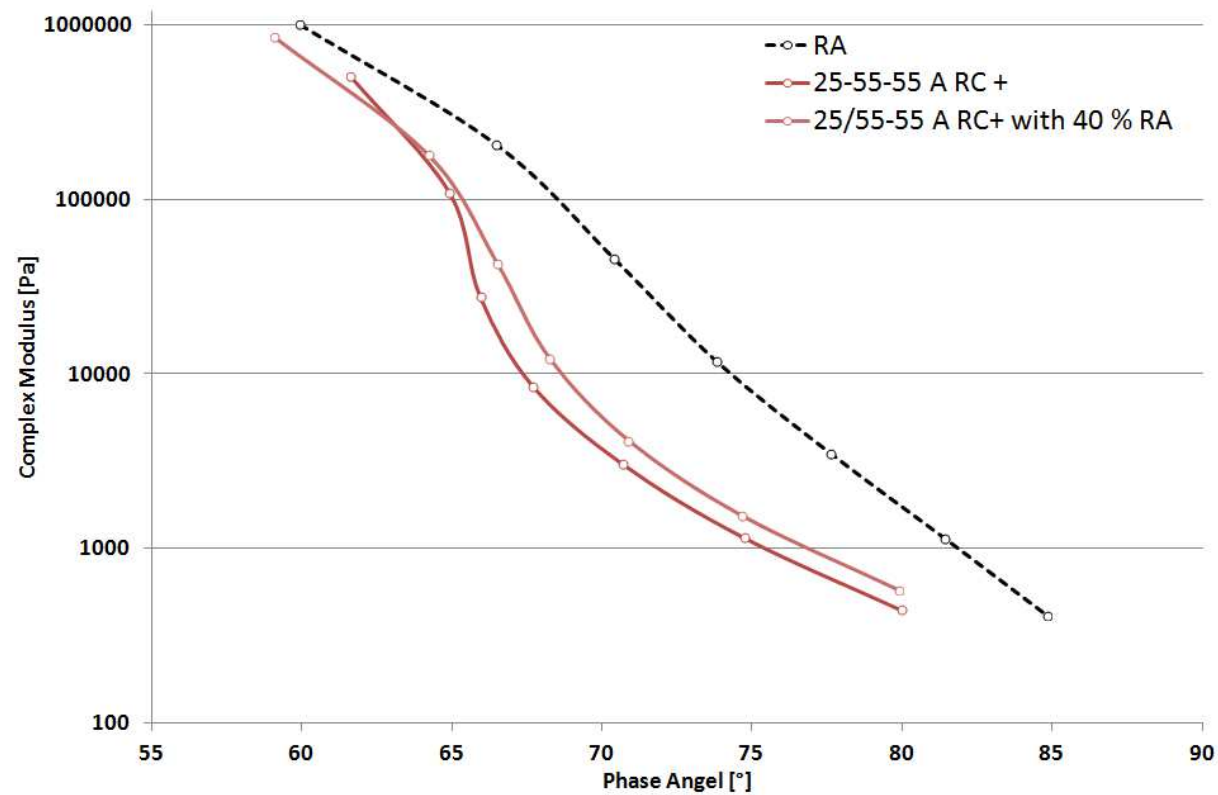


In Practice



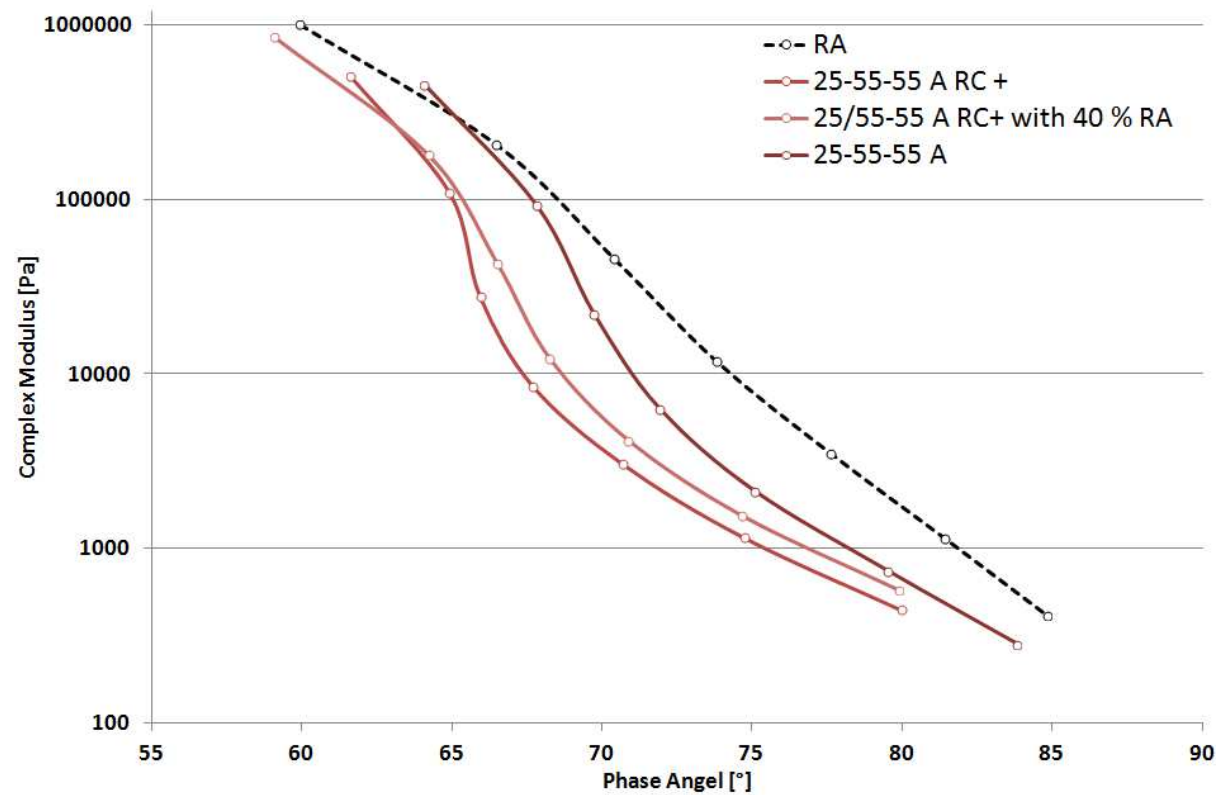


In Practice





In Practice



CONCLUSION

- › Specially formulated PMB-RC types allow for a RA share of 40 %
- › resulting properties comply with the requirements of the advertised binder
- › PmB-RC-made asphalts are equivalent to those with exclusively fresh binder
- › Re-use of RA on a High Performance Level

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