71686 Remseck a. N.
Rainwiesen 2
Tel. 07141 29781-0
Fax 07141 29781-20
info@ibq-institut.de
www.ibq-institut.de

Branches:
78462 Konstanz
Paradiesstrasse 13 Tel.
07531 282255 Fax
07531 282277

73571 Goggingen
Brunnenäcker 9 Tel.
07175 9237330 Fax 07175
9237331

IBQ • 71686 Remseck a.N. • Rainwiesen 2

H. Geiger GmbH Attn:
Mr. Geiger Arn Gravel
Works 1
85125 Kinding / Pfraundorf

Asphalt mix optimization for special mix AC 11 DS UHSF-FA

Optimization of the special mix AC 11 DS UHSF-FA without using a wax- modified bitumen compared to a conventional AC 11 DS

Report No:	1674 / 12 / 15
Report date:	17.02.2016 (Yes/ This)
Client:	H. Geiger GmbH
Test period:	November 2015
Sample description:	Mixture W-50-14-0134 (MW GroBmehring) Mixture EP 5503 / 01 / 15 (IBQ laboratory mixture)
Pages:	5
Attachments:	Tracking test (2 pages) Pressure swelling test (6 pages)

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1. Process

In a follow-up project to the previous project "Conceptual design of a special mix AC 11 DS UHSF-FA using modified bitumen and an asphalt reinforcing fiber" (Report 1531-a / 09 / 15), H. Geiger GmbH (AG) commissioned us to optimize the special mix so that the use of wax-modified bitumen could be dispensed with.

The special mix AC 11 DS UHSF-FA was then produced in the IBQ laboratory with only one asphalt reinforcing fiber (AS-PP fiber) and then tested. The mixture and testing of the asphalt technological characteristics took place as part of the preparation of the initial test EP 5630 / 01 / 16 (IAM-GroBmehring) and EP 5503 / 01 / 15 (Kinding -Pfraundorf). To compare the properties of the special mix, the client of the GroBmehring mixing plant provided the IBQ with a sample of an AC 11 DS. Both mixes are to be compared and assessed with regard to their analysis results in accordance with TL Asphalt-StB 07/13.

2. Materials, documents and literature used or provided

• Asphalt-Armierungsfaser AS-PP Fiber •
Mischgutprobe W-50-14-0134 (MW GroBmehring)

• TL Asphalt-StB 07/13 •
TP Asphalt-StB 07/13

3. Investigations

The following investigations were carried out:

• Determination of the bulk density of asphalt according to TP Asphalt Part 5 • Determination of the bulk density on the Marshall specimen according to TP Asphalt Part 6 • Track pattern test according to TP Asphalt Part 22 • Uniaxial compression test according to TP Asphalt Part 25

The test results for the special mixture AC 11 DS UHSF-FA are taken from the results for the preparation of the above-mentioned initial test.

4. Laboratory results

The determined key figures are presented in tabular form below.

4.1 Results for determining the gross and volume density

Mixture type	Bulk density [g/cm3]	Volume density [g/cm3]	Void content [vol.%]	Setpoints
ACll NB	2,441	2,384	2,3	2,5 - 3,5
AC 11 DS UHSF-FA	2,440	2,372	2,8	

4.2 Results of the tracking test

Mixture type	Absolute rut depth RD air [mm]	Track plate Height d [mm]	Proportional rut depth PRD air[%]
ACll NB	4,9	40	12,3
AC 11 DS UHSF-FA	25	41	6 1

4.3 Results of the pressure swelling test

Mixture type	Strain rates [%0*104/n] 0,35 MPa		
AC 11 DS	12.3 13.1 at turning point		7,7
AC 11 DS UHSF-FA	0,8	0,0	1,0

5. Evaluation of the results

If one looks at the results of the raw and bulk density determination of both mix locations, it is noticeable that the values determined are almost the same. Thus, the addition of the Asphalt reinforcing fiber within the special mix has no particular influence regarding these two parameters on the general mix concept. The resulting The void content to be calculated is only in the case of conventional mix slightly below the minimum requirement according to TL Asphalt-StB 07/13 . The Special mix AC 11 DS UHSF-FA is within the requirement.

Despite almost identical results regarding the determined gross and volume density, the further analysis results of the performance tests carried out recognize clear differences.

Significantly better values were achieved across the board with the modified mix. The absolute rut depth determined in the track pattern test was on average 2.5 mm for the modified mix, which was half as much as for the test slabs that were produced without the asphalt reinforcing fiber. A similar picture emerged from the compression swelling tests carried out. The strain rates determined on the test specimens for the special mix AC 11 DS UHSF-FA were significantly lower than those for the conventional mix AC 11 DS.

The modification of the AC 11 DS UHSF-FA mix with the asphalt reinforcing fiber (AS-PP fiber) results in a significant increase in stability, even at high temperatures, even without the additional modification of the binding agent with wax. This means that the special mix tested here (without wax-modified binding agent) will also have a longer service life compared to a mix AC 11 DS usually produced in accordance with TL Asphalt-StB. The additional costs resulting from the modification should be more than compensated by a longer service life and the associated reduction in maintenance costs.

Remseck, den 17.02.2016

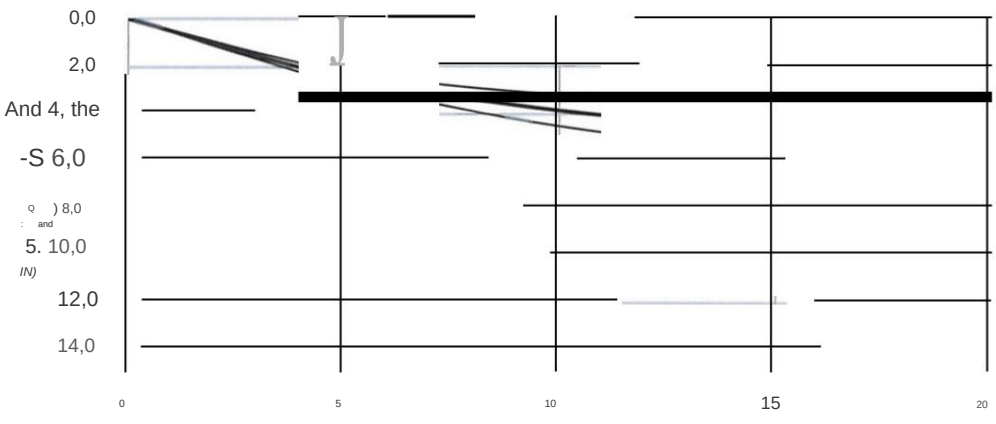
Dipl. Geol. Robert Fischer
(stellv. Prüfstellenleiter)

Test report number 1674 / 12 / 15

26.11.2015

Initial test number:	W-50-14-0134 (MW Großmehring)
Material:	AC 11 D S 25/55-55 A RC
Client:	H. Geiger GmbH
Type of compaction:	Rolling sector compaction device (TP Asphalt Part 33)
Profung:	Lane formation test (TP Asphalt Part 22)
Basis:	TP Asphalt StBPart 22 Track formation test
Spatial density (Marshall-Karper):	2,384 g/em3
Room-tight sample plate:	2,360 g/em3 / 2,360 g/em3
Degree of compaction of the plate:	99,0 % / 99,0 %
Test temperature:	60·c
Number of top rolls:	20,000 top rolls

Track depth plate 1 (d=40 mm)	Track depth plate 2 (d=40 mm)
4mm	5,8mm
Track depth agent: 4.9mm	
Absolute rut depth: RO air 4.9 mm. Proportional rut depth PRO air 12.3 %. Sample tempering takes place in the tracking device (t = 4h)	



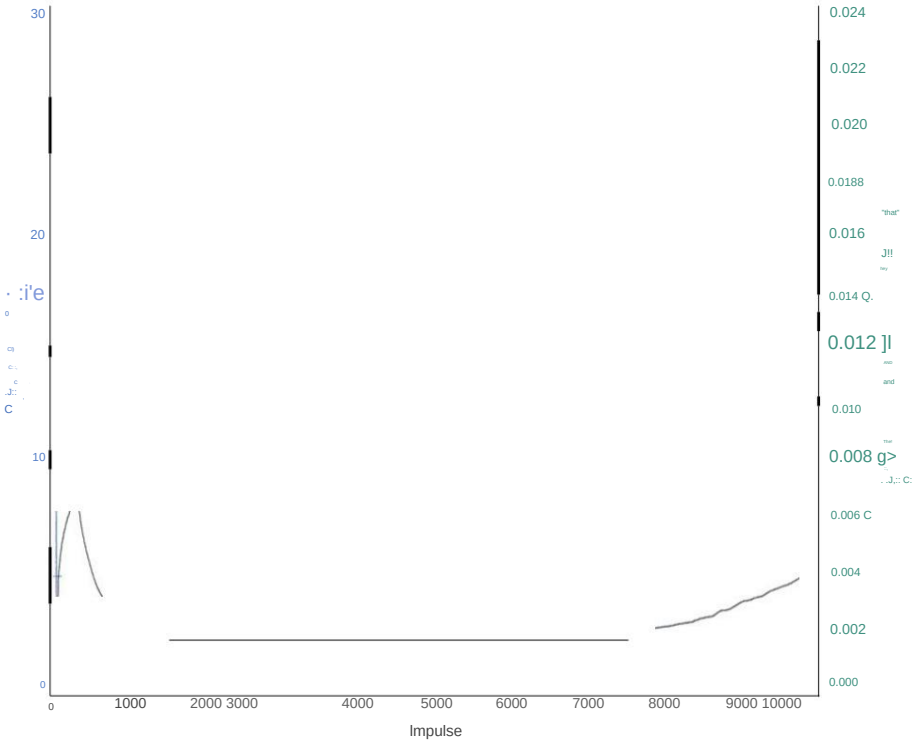
IBQ
Institute for Building Material Quality Assurance GmbH
Dr. M. Haberl
(Test Center Manager)

IBQ
Institute for Building Material Quality Assurance GmbH
Rainwiesen 2
1.1/. tk,O 7i686 Rernseek
.;..cTe/ 41-29781-0 Fax 07141-29781-20
email: info@ibq-asphalt.de

TPA-StB Part 25 B 1

Sample description:	W50-14-0134_H.Geiger GmbH_P1
Date/Time:	10.12.2015 12:41
Probenhohe:	61 mm
Sample diameter:	102,2 mm
Volume density:	2,384 Mg/m3
Target temperature:	50 •c
	Test body 1
	AC 11 DS PMB 25/55 AC
	GroBmehringen mixing plant
Priifer:	R. Fischer

Number of lastimouls at turning point	nW		3711
Stretching at the turning point	EW %.		15,3
Expansion rate at turning point	THAT ONE %. 10 -4/n		12,3

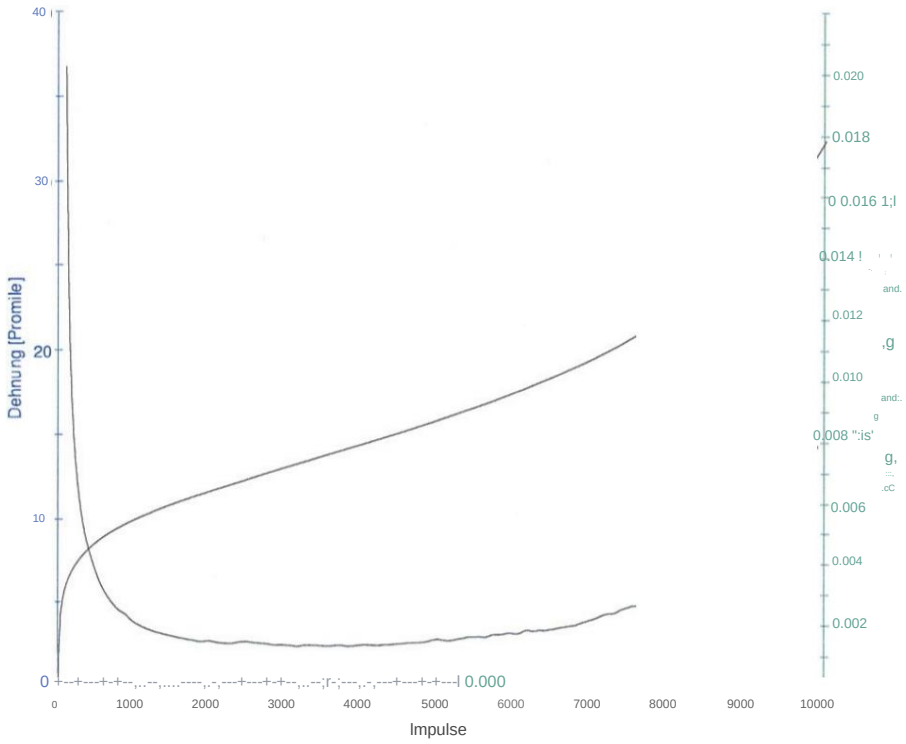


Remarks:

TPA-StB Part 25 B 1

Sample description:	W50-14-0134_H.Geiger GmbH_P2
Date/Time:	11.12.2015 11:35
Probenhohe:	61 mm
Sample diameter:	101,9 mm
Volume density:	2,384 Mg/m3
Target temperature:	5o •c
	Test body 2
	AC 11 DS PMB 25/55 AC
	Grol3mehringen mixing plant
Priifer:	R. Fischer

I Number of last mile at turning point	nW		3990
I Dehnuno at the turning point	It's 0%		14,5
I Strain rate at the inflection point	EW* %0 10h·4/n		13,1



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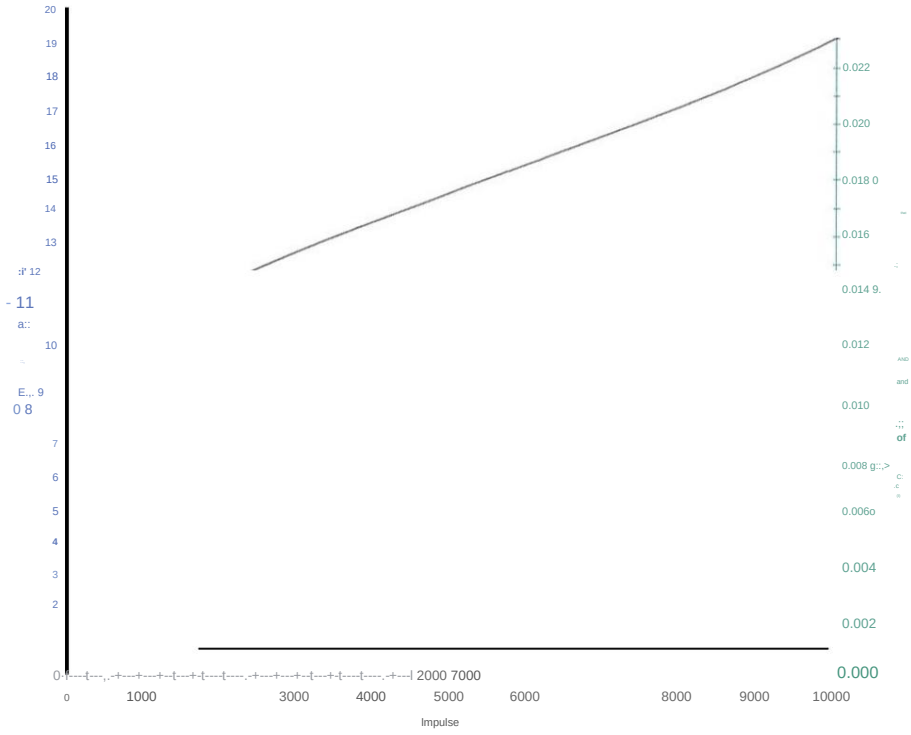
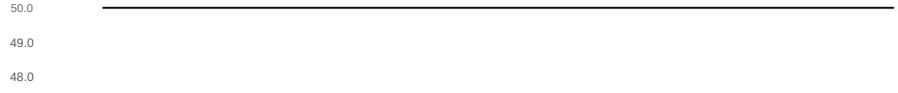
TPA-StB Part 25 B 1

Sample description:	W50-14-0134_H.Geiger GmbH_P3
Date/Time:	16.12.2015 13:54
Probenhohe:	61 mm
Sample diameter:	102 mm
Volume density:	2,384 Mg/m3
Target temperature:	50 °c
	Test body 3 AC 11 DS PMB 25/55 AC Grof3mehringen mixing plant
Prufer:	R. Fischer

Number of load pulses at the turning point	nW	15669
Dehnuna at the turning point	It's 0%	115,2
Expansion rate at turning point	EW•	%0 10A-4/n I 7,7





Remarks:

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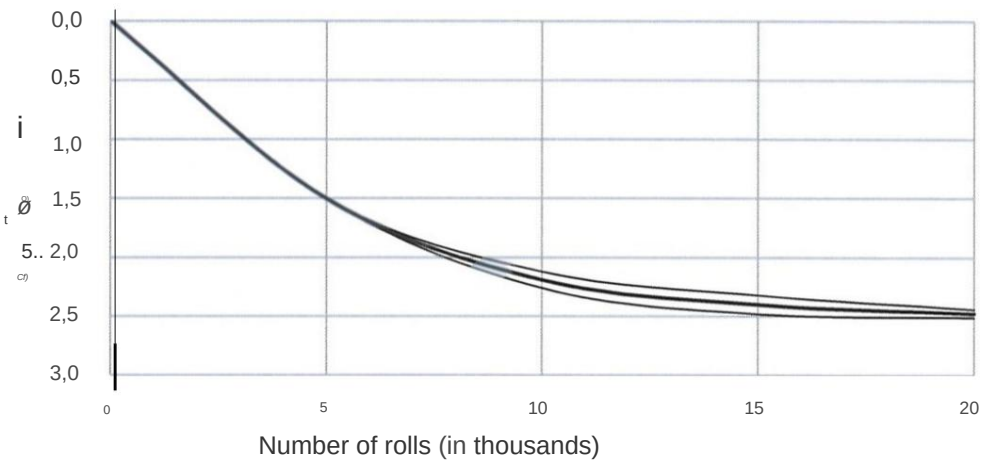
Test report number 5503 / 01 / 15

23.11.2015

Initial test number:	5503 / 01 / 15
Material:	AC 11 DS UHSF-FA 25/55-55 A
Client:	H. Geiger GmbH (Kinding-Pfraundorf)
Type of compaction:	Roller sector compaction device (TP Asphalt Part 33)
Pri.ifung:	Track formation test (TP Asphalt Part 22)
Basis:	TP Asphalt StB Part 22Track formation test
Volume density (Marshall body):	2,372 g/cm3
Density test plate:	2,353 g/cm3 / 2,353 g/cm3
Degree of compaction of the plate:	99,2 % / 99,2 %
Pri.iftemperatur:	60·c
Number of top rolls:	20,000 top rolls

Track depth plate 1 (d=41 mm)	Track depth plate 2 (d=41 mm)
2,51 mm	2,44 mm
Track depth agent: 2,5mm	
Absolute rut depth: RD air = 2.5 mm. Proportional rut depth PRD air = 6.1 %. Sample tempering takes place in the tracking device (t = 4h)	



IBQ
Institut für Baustoff-Qualitätssicherung GmbH

Dipl. Geol. D. Budach
(Leitung FB Asphalt & Bitumen)

IBQ INSTITUTE

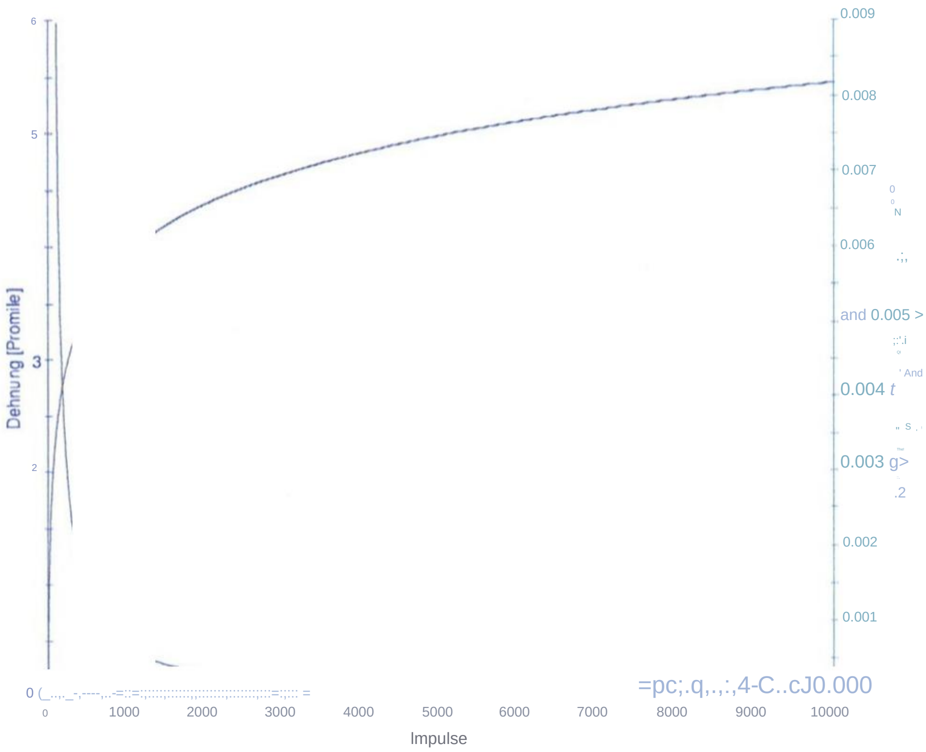
TPA-StB Part 25 8 1

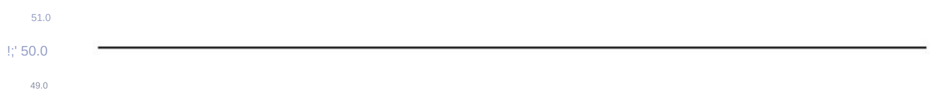
Sample description:	5503/01/15_H.Geiger GmbH_AC 11 UHSF-FA_opti_P1
Date/Time:	19.11.2015 08:09
Probenhohe:	60,9 mm
Sample diameter:	100,5 mm
Room density:	2,372 Mg/m3
Solitude:	50 °C

Probably: irper 1
25/55-55 A
fiber reinforced
without wax
TP Asphalt-StB Teil 25 B 1- WA (0,35 MPa)

Prufer: R. Fischer

Lastimouls number	n End		I 10000-=
Dehnuno	Still	I I	15_,4__
Expansion rate	And End•	%0 I%. 10A-4/n	I o,a



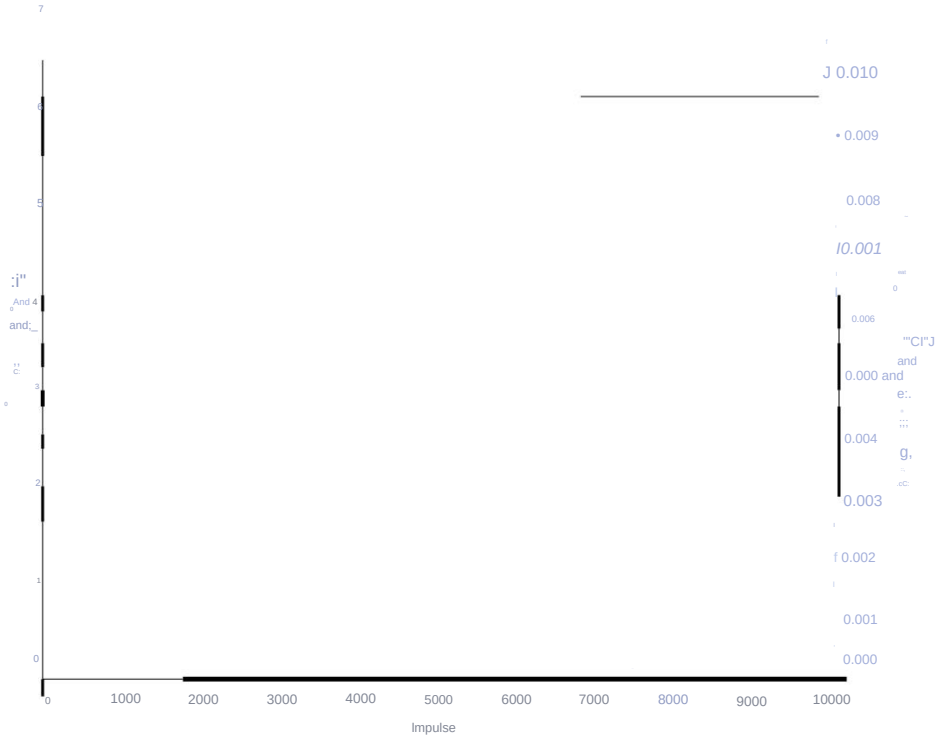


Remarks:

TPA-StB Part 25 B 1

Sample designation:	5503/01/1S_H.Geiger GmbH_AC 11 UHSF-FA_opti_P2
Date/Time:	19.11.2015 13:23
Probenhohe:	60,9 mm
Sample diameter:	100,7 mm
Volume density:	2,372 Mg/m3
Target temperature:	5o •c
	Test body 2 25/55-55A fiber reinforced without wax
	TP Asphalt-StB Teil 25 B 1- WA (0,35 MPa)
Priifer:	R. Fischer

Number of load pulses at the turning point	nW		**9411**
Dehnuna at the turning point	**EW** %.		6,0
Expansion rate at turning point	**EW•** %. 10" -4/n		0,0

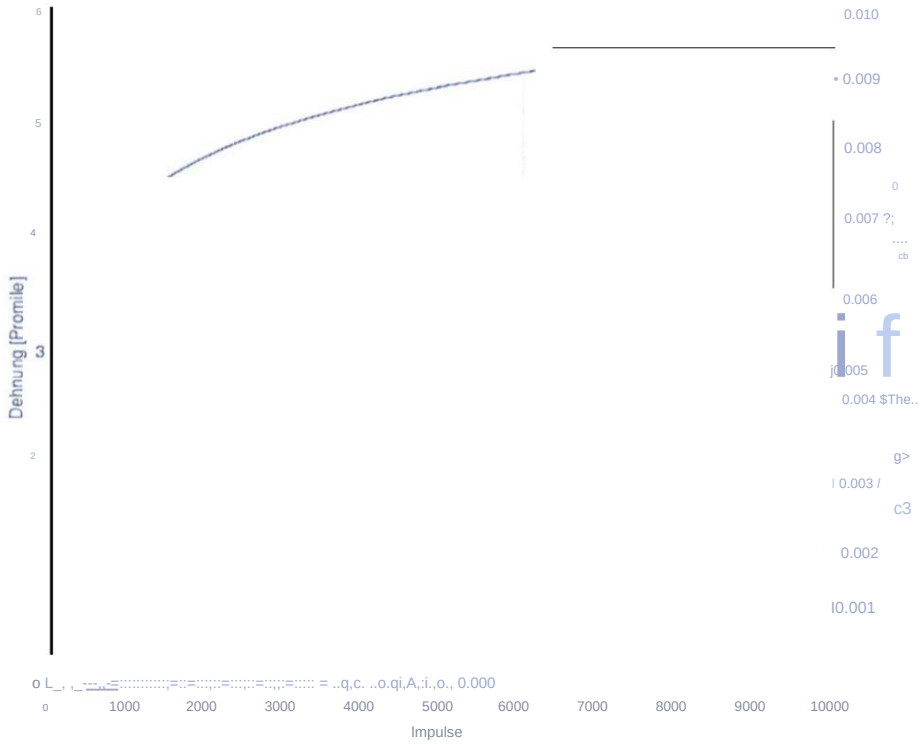


Remarks:

TPA-StB Part 25 B 1

Sample description:	5503/01/15_H.Geiger GmbH_AC 11 UHSF-FA_opti_P3
Date/Time:	20.11.2015 10:42
Probenhohe:	60,8 mm
Sample diameter:	100,8 mm
Volume density:	2,372 Mg/m3
Solitude:	50 °C
	Test body 3 25/55-55A fiber reinforced without wax TP Asphalt-StB Teil 25 B 1- WA (0,35 MPa)
Prufer:	R. Fischer

Load pulse number	n End	I	I 10000 ·-
Stretching	Still	I%0	15,8
Expansion rate	And End•	I%. 10"-4/n	I 1,0



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