

Ramtech Ltd.

Testing, research and consulting in asphalt technology
Sachsova 6/VIII, 10000 Zagreb, Croatia



Test report identification No.

CT-CTT-019/2017

**Laboratory test results of
Measuring Resistance to Thermal Cracking**

according to:

HRN EN 12697-46: Low Temperature Cracking and Properties by Uniaxial Tension Tests

performed on:

asphalt specimens compacted in laboratory

according to standard test method

(HRN EN 12697-33:2008)

using asphalt mixture of type:

SMA 16 + 50/70 + TecRoad polymer additive

prepared in laboratory according to standard test method

(EN 12697-35:2008)

mixture composition:

sample taken from Gencor Asphalt Plant

Client: BECHTEL ENKA GP

Laboratory measuring

Matija Šafran

Matija Šafran,
Laboratory Research Department

RAMTECH d.o.o.
za ispitivanje, istraživanje i
konzalting iz područja asfaltna tehnologije
10 000 Zagreb, Sachsova 6

Test report by:

Tomislav Šafran

Tomislav Šafran, dipl.ing.građ.
Laboratory Research Department

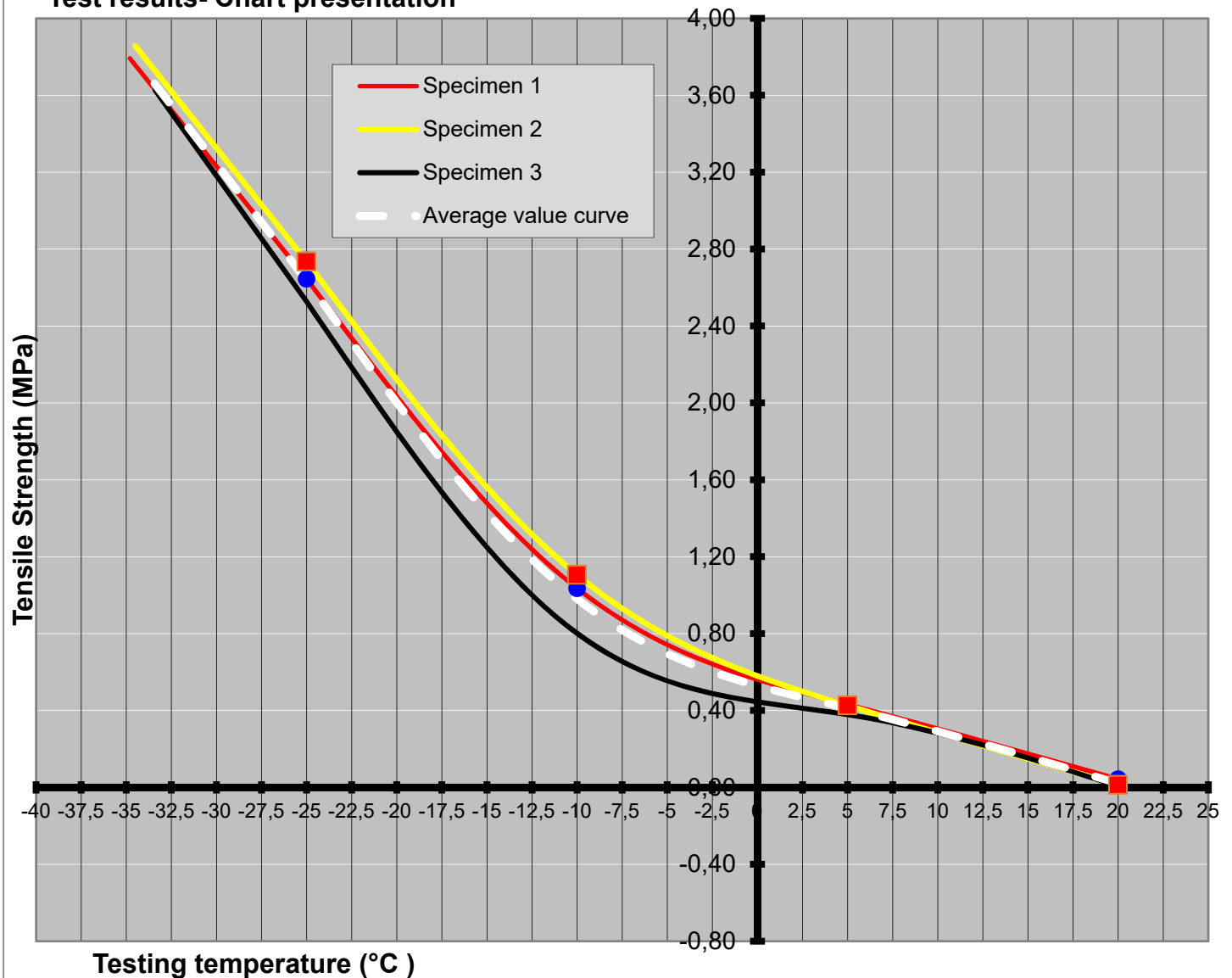
11th of October, 2017.

Resistance of asphalt binder course SMA 16 to low temperature cracking*according to HRN EN 12697-46:2012*(8.2) and HRN EN 13108-1:2016 (5.3.9 norme)*

Client	BECHTEL ENKA GP
Construction Product:	Asphalt
Type of Asphalt:	SMA 16 + 50/70 + TecRoad polymer additive
Traffic Load:	Highways
Laboratory Designation:	17-2450
Mixture Composition:	sample taken from Gencor Asphalt Plant
Date of Compaction:	2017-09-12
Date of Testing:	from 2017-09-25 to 2017-10-09

Laboratory Test Results for a series of three specimens:

Tensile Strength	3,758	[MPa]
Temperature at break	-34,2	[°C]

Test results- Chart presentation

Cooling test measured data - specimen 1			
Temperature (°C)	Tensile Strength (MPa)	Temperature (°C)	Tensile Strength (MPa)
20,0	0,043	-3,0	0,660
19,5	0,056	-3,5	0,679
19,0	0,069	-4,0	0,699
18,5	0,083	-4,5	0,720
18,0	0,096	-5,0	0,742
17,5	0,109	-5,5	0,766
17,0	0,122	-6,0	0,790
16,5	0,136	-6,5	0,816
16,0	0,149	-7,0	0,843
15,5	0,162	-7,5	0,871
15,0	0,175	-8,0	0,901
14,5	0,188	-8,5	0,932
14,0	0,201	-9,0	0,965
13,5	0,214	-9,5	0,999
13,0	0,228	-10,0	1,035
12,5	0,241	-10,5	1,073
12,0	0,254	-11,0	1,112
11,5	0,267	-11,5	1,153
11,0	0,279	-12,0	1,195
10,5	0,292	-12,5	1,239
10,0	0,305	-13,0	1,284
9,5	0,318	-13,5	1,330
9,0	0,331	-14,0	1,378
8,5	0,343	-14,5	1,427
8,0	0,356	-15,0	1,478
7,5	0,369	-15,5	1,529
7,0	0,381	-16,0	1,582
6,5	0,394	-16,5	1,635
6,0	0,406	-17,0	1,689
5,5	0,419	-17,5	1,745
5,0	0,431	-18,0	1,801
4,5	0,443	-18,5	1,858
4,0	0,456	-19,0	1,916
3,5	0,468	-19,5	1,974
3,0	0,480	-20,0	2,033
2,5	0,493	-20,5	2,093
2,0	0,506	-21,0	2,153
1,5	0,519	-21,5	2,213
1,0	0,532	-22,0	2,274
0,5	0,546	-22,5	2,336
0,0	0,561	-23,0	2,397
-0,5	0,575	-23,5	2,459
-1,0	0,591	-24,0	2,521
-1,5	0,607	-24,5	2,583
-2,0	0,624	-25,0	2,645
-2,5	0,641	-34,8	3,792
Tensile Strength (MPa)	3,792	Temperature at break (°C)	-34,8

Cooling test measured data - specimen 2			
Temperature (°C)	Tensile Strength (MPa)	Temperature (°C)	Tensile Strength (MPa)
20,0	0,013	-3,0	0,695
19,5	0,027	-3,5	0,717
19,0	0,040	-4,0	0,740
18,5	0,054	-4,5	0,764
18,0	0,067	-5,0	0,789
17,5	0,081	-5,5	0,815
17,0	0,094	-6,0	0,842
16,5	0,108	-6,5	0,870
16,0	0,121	-7,0	0,900
15,5	0,135	-7,5	0,931
15,0	0,148	-8,0	0,963
14,5	0,162	-8,5	0,996
14,0	0,176	-9,0	1,031
13,5	0,189	-9,5	1,067
13,0	0,203	-10,0	1,105
12,5	0,217	-10,5	1,144
12,0	0,230	-11,0	1,185
11,5	0,244	-11,5	1,228
11,0	0,258	-12,0	1,271
10,5	0,272	-12,5	1,317
10,0	0,286	-13,0	1,363
9,5	0,299	-13,5	1,411
9,0	0,313	-14,0	1,460
8,5	0,327	-14,5	1,510
8,0	0,341	-15,0	1,561
7,5	0,355	-15,5	1,613
7,0	0,369	-16,0	1,666
6,5	0,383	-16,5	1,721
6,0	0,398	-17,0	1,776
5,5	0,412	-17,5	1,832
5,0	0,426	-18,0	1,888
4,5	0,440	-18,5	1,946
4,0	0,455	-19,0	2,004
3,5	0,469	-19,5	2,062
3,0	0,484	-20,0	2,122
2,5	0,499	-20,5	2,182
2,0	0,514	-21,0	2,242
1,5	0,530	-21,5	2,303
1,0	0,546	-22,0	2,364
0,5	0,563	-22,5	2,425
0,0	0,580	-23,0	2,487
-0,5	0,597	-23,5	2,549
-1,0	0,615	-24,0	2,611
-1,5	0,634	-24,5	2,673
-2,0	0,654	-25,0	2,735
-2,5	0,674	-34,5	3,857
Tensile Strength (MPa)	3,857	Temperature at break (°C)	-34,5

Cooling test measured data - **specimen 3**

Temperature (°C)	Tensile Strength (MPa)	Temperature (°C)	Tensile Strength (MPa)
20,0	0,007	-3,0	0,500
19,5	0,022	-3,5	0,512
19,0	0,037	-4,0	0,525
18,5	0,051	-4,5	0,539
18,0	0,066	-5,0	0,555
17,5	0,081	-5,5	0,572
17,0	0,096	-6,0	0,590
16,5	0,110	-6,5	0,610
16,0	0,124	-7,0	0,632
15,5	0,139	-7,5	0,655
15,0	0,153	-8,0	0,680
14,5	0,167	-8,5	0,707
14,0	0,181	-9,0	0,736
13,5	0,194	-9,5	0,768
13,0	0,207	-10,0	0,801
12,5	0,221	-10,5	0,837
12,0	0,233	-11,0	0,875
11,5	0,246	-11,5	0,915
11,0	0,258	-12,0	0,957
10,5	0,271	-12,5	1,001
10,0	0,282	-13,0	1,047
9,5	0,294	-13,5	1,095
9,0	0,305	-14,0	1,145
8,5	0,315	-14,5	1,196
8,0	0,326	-15,0	1,249
7,5	0,336	-15,5	1,303
7,0	0,345	-16,0	1,359
6,5	0,354	-16,5	1,416
6,0	0,363	-17,0	1,475
5,5	0,371	-17,5	1,535
5,0	0,379	-18,0	1,596
4,5	0,386	-18,5	1,658
4,0	0,393	-19,0	1,721
3,5	0,400	-19,5	1,785
3,0	0,406	-20,0	1,850
2,5	0,412	-20,5	1,915
2,0	0,418	-21,0	1,981
1,5	0,425	-21,5	2,048
1,0	0,431	-22,0	2,116
0,5	0,438	-22,5	2,184
0,0	0,445	-23,0	2,252
-0,5	0,452	-23,5	2,320
-1,0	0,460	-24,0	2,389
-1,5	0,469	-24,5	2,458
-2,0	0,478	-25,0	2,527
-2,5	0,488	-33,4	3,626
Tensile Strength (MPa)	3,626	Temperature at break (°C)	-33,4



INSTITUT IGH
DEPARTMENT FOR MATERIALS AND STRUCTURES
Laboratory for Roads
Laboratory for Asphalt and Bitumen
CROATIA, 10 000 ZAGREB, Janka Rakuše 1
Tel: +385 1/6125 721 Fax: +385 1/6125 100, www.igh.hr



Working order 82012985

Zagreb, 2017-08-29

TEST REPORT No. 72563-2546/17

Client:	BECHTEL ENKA GP
Contract:	2-2153-1-12985/14
Tested property:	BINDER DRAINAGE
Date of testing:	2017-08-29
Type of asphalt mixture:	SMA 16
Type of bitumen:	PmB 45/80-65
Additives:	Cellulose fibers
Identification of the samples:	17-2450
Composition of asphalt mix:	According to Asphalt Mix Design MD(BEGP)_15-04
Test method:	EN 12697-18:2004 Bituminous mixtures - Test methods for hot mix asphalt - Part 18: Binder drainage (Schellenberg method)*
Target test temperature, °C	190

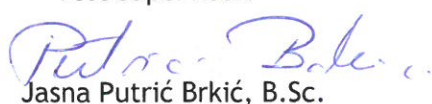
TEST RESULTS:

Temperature in the mixture after 60 min of heat storage in the oven		[°C]	188
Test sample No.	Drained material, D_i [% (m/m)]	Residue on the 1 mm sieve, R_i [% (m/m)]	
17-2450/01	0,3	-	
17-2450/02	0,3	-	
17-2450/03	0,3	-	

Average binder drainage, D	[% (m/m)]	0,3
------------------------------	-----------	-----

NOTE: -

Test Supervisor:


Jasna Putrić Brkić, B.Sc.

Head of Laboratory for Asphalt and Bitumen:


Klaudije Simić, B.Sc.

Test results are relevant only for tested samples.

*Test methods for which laboratory is accredited by Croatian Accreditation Agency (Accreditation No. 1043)

Document: OBL-12697-18/02

Page 1 of 1



Working order 82012985

TEST REPORT No. 72563-3102/17

Client: **BECHTEL ENKA GP**
Contract/purchase order: **2-2152-1-12985/14**
Construction product: **SMA 16 + 50/70 + TecRoad polymer additive**
Traffic load: **Highways**
Tested property: **Resistance to fatigue**
Date of test report: **2017-10-16**

Test Overseer:


Jasna Putrić Brkić, B.Sc.

Head of Laboratory for Asphalt and Bitumen:


Klaudije Simić, B.Sc.



Test Report No.: 72563-3102/17

1 SPECIMEN DATA

Type of Asphalt mixture:	SMA 16 + 50/70 + TecRoad polymer additive
Mix design mark:	-; samples taken from Gencor Asphalt Plant
Place of asphalt specimen preparation:	Institut IGH, Laboratory for Asphalt and Bitumen
Method of asphalt mixture preparation:	EN 12697-35:2016
Method of specimen compaction:	EN 12697-33:2003+A1:2007
Date of asphalt mixture preparation and specimen compaction:	2017-09-12
Time of specimen's storage prior testing:	since 2017-09-12 till 2017-10-04
Storage conditions:	(21 ± 2) °C
Specimen laboratory identification number:	17-2450
Number of test specimens:	18 prismatic test specimens, sawed from asphalt plate prepared in laboratory

2 TEST DATA

Test standard:	EN 12697-24:2012 Bituminous mixtures - Test methods for hot mix asphalt - Part 24: Resistance to fatigue; Annex D (4PB-PR)
Used equipment:	Servo pneumatic universal test device CRT-SA4PT-BFAT
Test temperature:	(20 ± 0,5) °C
Date of test beginning:	2017-10-04
Date of test finishing:	2017-10-16

Test Report No.: 72563-3102/17

3 TEST RESULTS

3.1 Determination of density of asphalt test specimens (EN 12697-6:2012; procedure B)

Table 1. Results of test specimens density determination

Specimen identification	Specimen height, h	Specimen width, b	Specimen length L_s	Mass of dry specimen, m_1	Specimen density, ρ_{bssd}
	[mm]	[mm]	[mm]	[g]	[Mg/m ³]
17-2450/1	49,4	48,4	400,3	2646,6	2,789
17-2450/2	49,1	48,9	400,2	2628,6	2,788
17-2450/3	49,3	48,8	400,2	2646,9	2,790
17-2450/4	49,2	48,4	400,1	2630,6	2,790
17-2450/5	49,3	48,7	400,0	2648,9	2,788
17-2450/6	51,4	48,5	400,1	2738,6	2,789
17-2450/7	51,1	48,4	399,7	2619,2	2,780
17-2450/8	48,9	48,6	399,8	2728,7	2,787
17-2450/9	49,1	47,8	399,8	2600,2	2,792
17-2450/10	49,5	48,6	400,2	2594,3	2,788
17-2450/11	48,9	49,0	399,9	2644,3	2,782
17-2450/12	49,2	49,1	399,9	2637,0	2,788
17-2450/13	49,0	48,7	400,0	2650,3	2,781
17-2450/14	48,9	48,6	400,2	2602,9	2,789
17-2450/15	49,1	48,2	400,2	2612,6	2,780
17-2450/16	48,6	48,6	400,1	2600,7	2,774
17-2450/17	48,9	48,3	400,0	2582,0	2,778
17-2450/18	49,2	48,0	399,9	2612,3	2,781

Test Report No.: 72563-3102/17

3.2 Determination of air voids content of asphalt test specimens (EN 12697-8:2003)

Table 2. Results of test specimens air voids content determination

Specimen identification	Specimen density, ρ_{bssd}	Maximum density of bituminous mixtures	Air void content
	[Mg/m ³]	[Mg/m ³]	V_m [% (v/v)]
17-2450/1	2,789	2,845	2,0
17-2450/2	2,788	2,845	2,0
17-2450/3	2,790	2,845	2,0
17-2450/4	2,790	2,845	2,0
17-2450/5	2,788	2,845	2,0
17-2450/6	2,789	2,845	2,0
17-2450/7	2,780	2,845	2,3
17-2450/8	2,787	2,845	2,1
17-2450/9	2,792	2,845	1,9
17-2450/10	2,788	2,845	2,0
17-2450/11	2,782	2,845	2,3
17-2450/12	2,788	2,845	2,0
17-2450/13	2,781	2,845	2,3
17-2450/14	2,789	2,845	2,0
17-2450/15	2,780	2,845	2,3
17-2450/16	2,774	2,845	2,6
17-2450/17	2,778	2,845	2,4
17-2450/18	2,781	2,845	2,3

Test Report No.: 72563-3102/17

3.3 Determination of resistance to fatigue by four point bending test on prismatic specimens (EN 12697-24; Annex D)

Table 3. Test parameters

Loading mode:	Constant deflection mode
Set of specimen deformation:	180 $\mu\epsilon$; 200 $\mu\epsilon$; 350 $\mu\epsilon$
Loading frequency:	30 Hz
Test temperature:	(20 $\pm$ 0,3) °C
Specimen acclimatisation time:	4 h
Mass of the movable parts of the equipment:	8100 g
Failure criteria:	50 % stiffness decrease

Test Report No.: 72563-3102/17

Table 4. Measured results and calculated values of resistance of fatigue

Specimen identification	Strain level	Average number of cycles	Standard deviation	Natural logarithm of cycles number	Natural logarithm of strain	Slope of the fatigue line	Initial strain at the 10 ⁶ cycles	Confidence interval relative to Q	Estimation of the standard deviation
	ϵ [$\mu\epsilon$]	N	S_N	$\ln(N)$	$\ln(\epsilon)$ [$\mu\epsilon$]	p	ϵ_6 [$\mu\epsilon$]	$\Delta \epsilon_6$ [$\mu\epsilon$]	$S_{x/y}$ [ln N]
17-2450	180	1133105	174556	13,93	5,193	-6,169	176	4,47	0,41
	200	394662	218083	12,75	5,298				
	350	15066	3176	9,60	5,857				

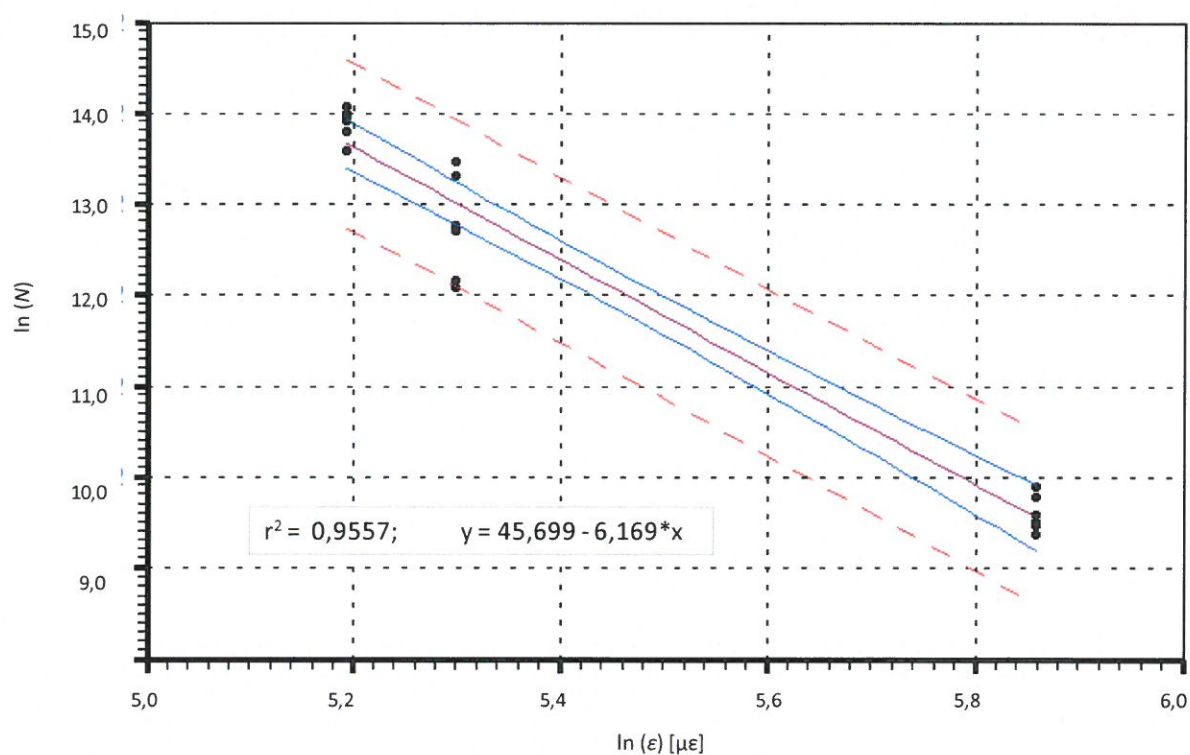


Figure 1. Fatigue line



INSTITUT IGH
DEPARTMENT FOR MATERIALS AND STRUCTURES
Laboratory for Roads
Laboratory for Asphalt and Bitumen
ZAGREB 10 000, Janka Rakuše 1
Tel: +385 1/6125 721, Fax: +385 1/6125 100, www.igh.hr



Working order 82012985

TEST REPORT No. 72563-2872/17

Client: **BECHTEL ENKA GP**

Contract/purchase order: **2-2153-1-12985/14**

Construction product: **Asphalt**

Type of asphalt: **SMA 16 (Mim Goleš + PmB 45/80-65)**

Traffic load: **Highways**

Tested property: **resistance to rutting**

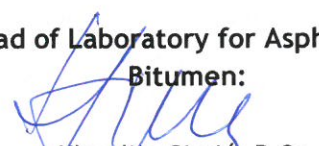
Date of test report: **2017-09-25**

Test Overseer:


Jasna Putrić Brkić, B.Sc.



Head of Laboratory for Asphalt and
Bitumen:


Klaudije Simić, B.Sc.

Test Report No.: 72563-2872/17

1. ASPHALT MIX DATA

Laboratory designation: 17-2450

Mixture composition: sample taken from Gencor Asphalt Plant

Used mixing method: -

Type of mixer: -

Date of manufacture of the mixture: -

Temperature/duration of mixing: -

2. TEST SAMPLES DATA

Compaction method used: EN 12697-33:2003+A1:2007 Bituminous mixtures - Test methods for hot mix asphalt - Part 33: Specimen prepared by roller compactor; clause 5.2 Methods using a smooth steel roller; clause 7.2.4.2 Compaction with controlled compaction energy*

Type of compactor: CRT-RC2SV

Dimensions of the mould: (305 x 400) mm

Nominal thickness of the specimens: 50 mm

Number of specimens: 2

Date of compaction of specimen No. 1: 11.09.2017.

Date of compaction of specimen No. 2: 11.09.2017.

Compaction temperature: 165 °C

Storage of test specimen: 23 °C

3. TEST DATA

Standard test method: EN 12697-22:2003+A1:2007 Bituminous mixtures - Test methods for hot mix asphalt - Part 22: Wheel tracking*

Test procedure: method B in air

Date of testing of specimen no.1: 21.09.2017.

Date of testing of specimen no.2: 22.09.2017.

Test temperature: 60 °C

Type of testing device: small device

Any deviation from the standard: none

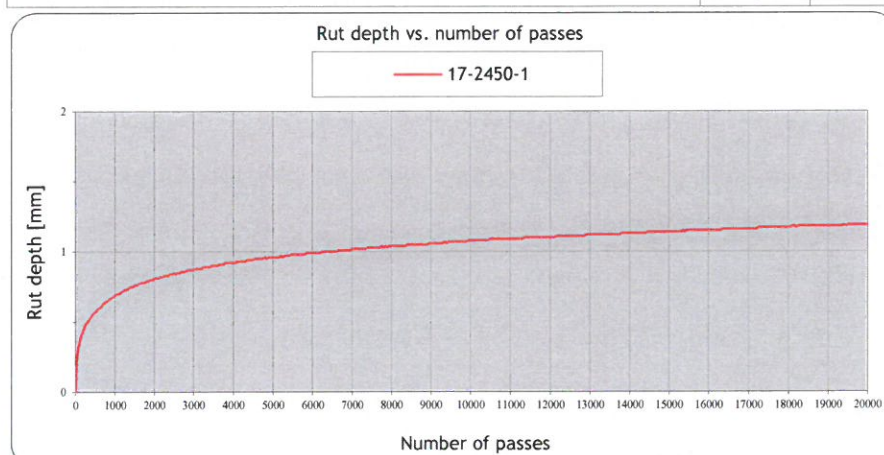
Test Report No.: 72563-2872/17

5. TEST RESULTS OF LABORATORY MADE SPECIMEN

TEST SPECIMEN 1

Number of passes <i>N</i>	Rut depth [mm]
0	0,00
2000	0,81
4000	0,92
6000	0,99
8000	1,04
10000	1,08
12000	1,10
14000	1,13
16000	1,15
18000	1,17
20000	1,19

Bulk density of specimen (EN 12697-6:2008; clause 9.3)*	2,790	Mg/m ³
Height of specimen (EN 12697-29:2003; clause 3.1)*	40,2	mm

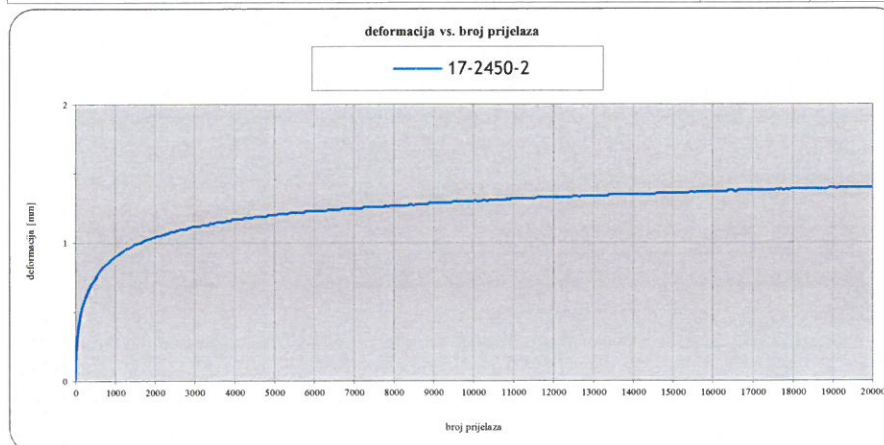


Wheel-tracking slope	<i>WTS</i> _{AIR}	0,02	mm/10 ³ load cycles
Proportional rut depth	<i>PRD</i> _{AIR}	3,0	%
Rut depth	<i>RD</i> _{AIR}	1,2	mm

TEST SPECIMEN 2

Number of passes <i>N</i>	Rut depth [mm]
0	0,00
2000	1,04
4000	1,17
6000	1,23
8000	1,27
10000	1,30
12000	1,33
14000	1,35
16000	1,37
18000	1,39
20000	1,40

Bulk density of specimen (EN 12697-6:2008; clause 9.3)*	2,795	Mg/m ³
Height of specimen (EN 12697-29:2003; clause 3.1)*	40,3	mm



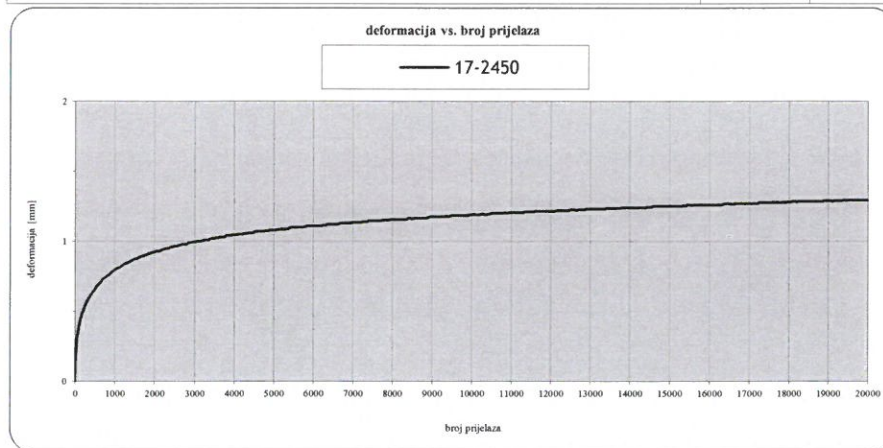
Wheel-tracking slope	<i>WTS</i> _{AIR}	0,02	mm/10 ³ load cycles
Proportional rut depth	<i>PRD</i> _{AIR}	3,5	%
Rut depth	<i>RD</i> _{AIR}	1,4	mm

Test Report No.: 72563-2872/17

MEAN VALUES

Number of passes <i>N</i>	Rut depth [mm]
0	0,0
2000	0,9
4000	1,0
6000	1,1
8000	1,2
10000	1,2
12000	1,2
14000	1,2
16000	1,3
18000	1,3
20000	1,3

Bulk density of specimen (EN 12697-6:2008; clause 9.3)*	2,793	Mg/m ³
Height of specimen (EN 12697-29:2003; clause 3.1)*	40	mm



Mean wheel-tracking slope	<i>WTS</i> _{AIR}	0,02	mm/10 ³ load cycles
Mean proportional rut depth	<i>PRD</i> _{AIR}	3,2	%
Mean rut depth	<i>RD</i> _{AIR}	1,3	mm

NOTE:



INSTITUT IGH, d.d.
DEPARTMENT FOR MATERIALS AND STRUCTURES
Laboratory for Roads
Laboratory for Asphalt and Bitumen
ZAGREB 10 000, Janka Rakuše 1
Tel: +385 1/6125 721, Fax: +385 1/6125 100, www.igh.hr



RN 82012985

TEST REPORT No. 72563-2594/17

Client: **BECHTEL ENKA GP**

Contract/ purchase order: **2-2153-1-12985/14**

Construction product: **Asphalt**

Type of asphalt: **SMA 16 PmB 45/80-65**

Traffic load: **Highways**

Tested property: **water sensitivity**

Date of test report: **2017-08-31**

Test Overseer:


Jasna Putrić Brkić, B.Sc.

Head of Laboratory for Asphalt and Bitumen:


Klaudije Simić, B.Sc.





INSTITUT IGH, d.d.
DEPARTMENT FOR MATERIALS AND STRUCTURES
Laboratory for Roads
Laboratory for Asphalt and Bitumen
ZAGREB 10 000, Janka Rakuše 1
Tel: +385 1/6125 721, Fax: +385 1/6125 100, www.igh.hr



Test report No.: 72563-2594/17

1. ASPHALT MIX DATA

Laboratory designation: 17-2450

Mixture composition: samples taken from Asphalt Plant

Material specifications standard: EN 13108-5:2006 + AC:2008 Bituminous mixtures - Material specifications - Part 1: Stone Mastic Asphalt

Used mixing method: EN 12697-35:2016 Bituminous mixtures - Test methods for hot mix asphalt - Part 35: Laboratory mixing*

Type of mixer: GZM-30+ producer "Josef Freundl Maschinen"

Date of manufacture of the mixture: -

Temperature/duration of mixing: 175 °C / 3 min

2. TEST SAMPLES DATA

Method of manufacture of specimens: EN 12697-30:2012 Bituminous mixtures - Test methods for hot mix asphalt - Part 30: Specimen preparation by impact compactor*

Type of impact compactor: impact compactor with steel anvil "InfraTest"

Date of compaction of the specimens: 2017-08-25

Number and type of test specimens: 8 laboratory made specimens

Compaction temp./number of blows: 165 °C / 2 x 35

3. TEST DATA

Standard test method: EN 12697-12:2008 Bituminous mixtures - Test methods for hot mix asphalt - Part 12: Determination of the water sensitivity of bituminous specimens; method A*

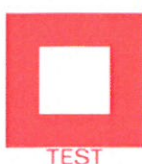
Test temperature: 15 °C

Beginning of the test: 2017-08-28

Ending of the test: 2017-08-31

Any deviation from the standard: none

Test results are relevant only for tested samples. *Test methods for which laboratory is accredited by Croatian Accreditation Agency (Accreditation No. 1043)



Test report No.: 72563-2594/17

4. TEST RESULTS

4.1 Determination of the dimensions of test specimens (EN 12697-29:2002*) and bulk density of test specimens (EN 12697-6:2012; clause 9.3*)

Table 1. Results of dimensions and bulk densities of dry specimens before conditioning

SUBSET OF DRY SPECIMENS				
Laboratory designation	Specimen height [mm]	Specimen diameter [mm]	Mass of dry specimen [g]	Bulk density [Mg/m ³]
17-2450/01	58,9	101,5	1223,9	2,706
17-2450/02	57,9	101,5	1227,0	2,704
17-2450/03	58,7	101,4	1225,9	2,696
17-2450/04	58,1	101,4	1226,8	2,709
Average	58,4	101,5	1225,9	2,704

Table 2. Results of dimensions and bulk densities of wet specimens before conditioning

SUBSET OF WET SPECIMENS					
Oznaka uzorka	Specimen height [mm]	Specimen diameter [mm]	Specimen volume [cm ³]	Mass of dry specimen	Bulk density [Mg/m ³]
17-2450/05	59,1	101,4	477,3	1226,1	2,696
17-2450/06	59,2	101,4	478,1	1223,4	2,708
17-2450/07	58,9	101,4	475,6	1223,0	2,706
17-2450/08	58,8	101,4	474,8	1225,1	2,704
Average	59,0	101,4	476,5	1224,4	2,704

Table 3. Results of dimensions of wet specimens after vacuum conditioning

SUBSET OF WET SPECIMENS after vacuum conditioning				
Oznaka uzorka	Specimen height [mm]	Specimen diameter [mm]	Specimen volume [cm ³]	Change in volume ¹⁾ [%]
17-2450/05	59,1	101,4	477,3	0,0
17-2450/06	59,2	101,4	478,1	0,0
17-2450/07	58,9	101,4	475,6	0,0
17-2450/08	58,8	101,4	474,8	0,0
Average	59,0	101,4	476,5	0,0

Note:

¹⁾ volume shall not increased by more than 2 % according to clause 6.1.2.2.5 of EN 12697-12

Test results are relevant only for tested samples. *Test methods for which laboratory is accredited by Croatian Accreditation Agency (Accreditation No. 1043)

Dokument: OBL-12697-12/03

Page 3 of 4

Test report No.: 72563-2594/17

4.2 Determination of the indirect tensile strength (EN 12697-23:2003*)

Table 4. Results of determination of the indirect tensile strength on dry specimens

SUBSET OF DRY SPECIMENS					
Laboratory designation	Maximum load [kN]	Indirect tensile strenght [GPa]	Deviation from mean value ²⁾ [%]	Type of failure ³⁾	Observation on aggregate after testing
17-2450/01	20,7	0,00220	7	c-combination	no crushed aggregate
17-2450/02	24,2	0,00262	11	c-combination	no crushed aggregate
17-2450/03	20,9	0,00224	5	c-combination	no crushed aggregate
17-2450/04	22,1	0,00239	1	c-combination	no crushed aggregate
Srednja vrijednost	22,0	0,00236			

Table 5. Results of determination of the indirect tensile strength on wet specimens after vacuum conditioning

SUBSET OF WET SPECIMENS after vacuum conditioning					
Laboratory designation	Maximum load [kN]	Indirect tensile strenght [GPa]	Deviation from mean value ²⁾ [%]	Type of failure ³⁾	Observation on aggregate after testing
17-2450/05	20,1	0,00214	4	c-combination	no crushed aggregate
17-2450/06	21,9	0,00232	4	c-combination	no crushed aggregate
17-2450/07	20,7	0,00221	1	c-combination	no crushed aggregate
17-2450/08	21,2	0,00226	1	c-combination	no crushed aggregate
Srednja vrijednost	21,0	0,00223			

Note:

²⁾ results must not differ by more than 17 % of the mean value according to clause 11.1 of EN 12697-23

³⁾ a - clear break line; b - deformation failure; c - combination according to clause 8.4 and figure.2 of EN 12697-23

4.3 Determination of the water sensitivity of bituminous specimens (EN 12697-12:2008, method A*)

Table 6. Results of determination of the water sensitivity

Indirect tensile strength - subset of wet specimens	Indirect tensile strength - subset of dry specimens	Indirect tensile strength ratio
ITS_w [GPa]	ITS_d [GPa]	$ITSR$ [%]
0,00223	0,00236	94,5

Test results are relevant only for tested samples. *Test methods for which laboratory is accredited by Croatian Accreditation Agency (Accreditation No. 1043)

Dokument: OBL-12697-12/03

Page 4 of 4

Working order: 82012985

Zagreb, 2017-08-29

TEST REPORT No. 72563-2545/17

Construction product: Bituminous mixture
Tested property: Composition and physical-mechanical properties

GENERAL DATA

Client:	BECHTEL ENKA GP		
Producer:	BECHTEL ENKA GP		
Construction site:	-		
Sampled by:	Client		
Type of asphalt:	SMA 16		
Date of sampling:	-	Date of receiving the sample:	2017-08-17
Date of test beginning:	2017-08-28	Date of test ending:	2017-08-29
			Laboratory designation: 17-2450

TEST RESULTS

COMPOSITION OF THE ASPHALT MIXTURE

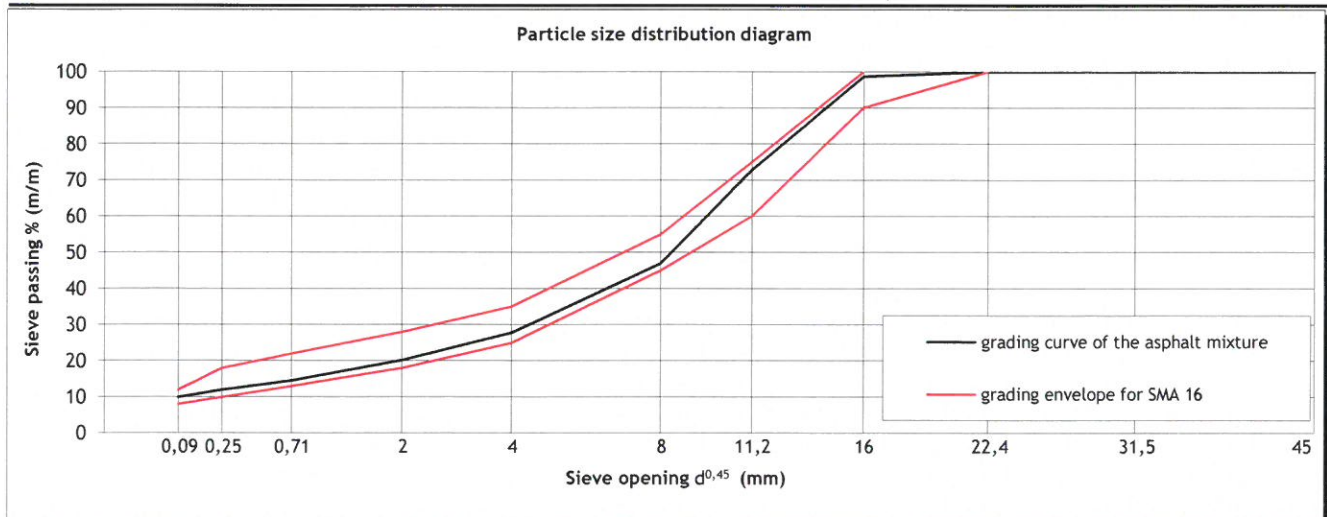
Bitumen content (EN 12697-1; asphaltanalyzer) % (m/m) **4,3** Date of testing: 2017-08-28

Particle size distribution (EN 12697-2) Date of testing: 2017-08-28

Sieve opening [mm]	0,063	0,09	0,125	0,25	0,5	0,71	1	2	4	5,6	8	11,2	16	22,4	31,5	45
Σ passing % (m/m)	9,7	9,9	10,5	11,9	13,5	14,5	15,6	20,1	27,7	34,2	46,9	72,8	98,7	100,0	100,0	100,0

PHYSICAL-MECHANICAL PROPERTIES OF THE ASPHALT MIXTURE

Bulk density (EN 12697-6; clause. 9.3)	kg/m ³	2,738	Mass of the dry specimen	g	1238,2
Maximum density (EN 12697-5; clause. 9.2 - otapalom)	Mg/m ³	2,845	Test temperature	°C	25,4
Air voids content (EN 12697-8)	% (v/v)	3,8			
Voids content in the mineral aggregate (EN 12697-8)	% (v/v)	15,3			
Voids in the mineral aggregate filled with bitumen (EN 12697-8)	% (v/v)	75,4			
Stability (EN 12697-34:2008)	kN	13,6			
Tangential flow (HRN EN 12697-34:2008)	mm	1,1			
Flow (HRN EN 12697-34:2008)	mm	2,2			
Marshall quotient (HRN EN 12697-34:2008)	kN/mm	6,2			



Note: The samples were taken by Clinet

Test Overseer:

Jasna Putrić Brkić
Jasna Putrić Brkić, B.Sc.

Head of Laboratory for Asphalt and Bitumen:

Klaudije Šimić
Klaudije Šimić, B.Sc.

Test results refer only to the tested specimens.