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PROJECT REPORT

Project Number: 17435A

Performance of Viacore AC 8 Low Temperature Performance

by

**Ass. Prof. Dipl.-Ing. Dr. techn.
Bernhard Hofko**

and

Ing. David Valentin

On behalf of

**Österreichische Vialit GmbH
Josef-Reiter-Straße 78
A-5280 Braunau**

Vienna, August 2018

This report contains 5 pages and one annex with test reports.

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1. Contents of this Project

The Institute of Transportation, Research Center of Road Engineering, Vienna University of Technology was contracted by Österreichische Vialit GmbH, Josef-Reiter-Straße 78, A-5280 Braunau, represented by Mr. Thomas Schinkinger to carry out performance based tests for a Viacore AC 8.

The following tests have been conducted:

Test Method	Standard	Remarks
Production of asphalt mix slabs by steel segment compactor	EN 12697-33	
Dimensions of specimens	EN 12697-29	
Bulk density	EN 12697-6	SSD Method
Low temperature performance	EN 12697-46	TSRST and UTST at 4 test temperatures

2. Materials and Specimen Production

For this project, asphalt mix samples of Viacore AC 8 were provided by the client in January 2018. Tensile Stress Restrained Specimen Tests (TSRST) and Uniaxial Tensile Stress Tests (UTST) at +5°C, -10°C, -25°C and -35°C were carried out.

For specimen production, the asphalt mix was homogenized in a laboratory mixer according to EN 12697-35 at room temperature with 3 M% of water. Subsequently, the mix was compacted to slabs in a steel segment compactor. The slabs were conditioned for 24 h at room temperature and another 48 h at +60°C in a heating cabinet. After another 24 h storage at room temperature, the slabs were cut and cored into specimens. Dimensions and bulk density of the specimens were determined before testing.

3. Asphalt Mix Test Results

3.1. Low Temperature Performance of Viacore AC 8

To assess the low temperature performance, TSRST and UTST were carried out. The results of TSRST are presented in Figure 1. The left diagram shows the single tests in different colours and the mean value and standard deviation in black lines. The right diagram shows the cracking temperature and the stress at cracking.

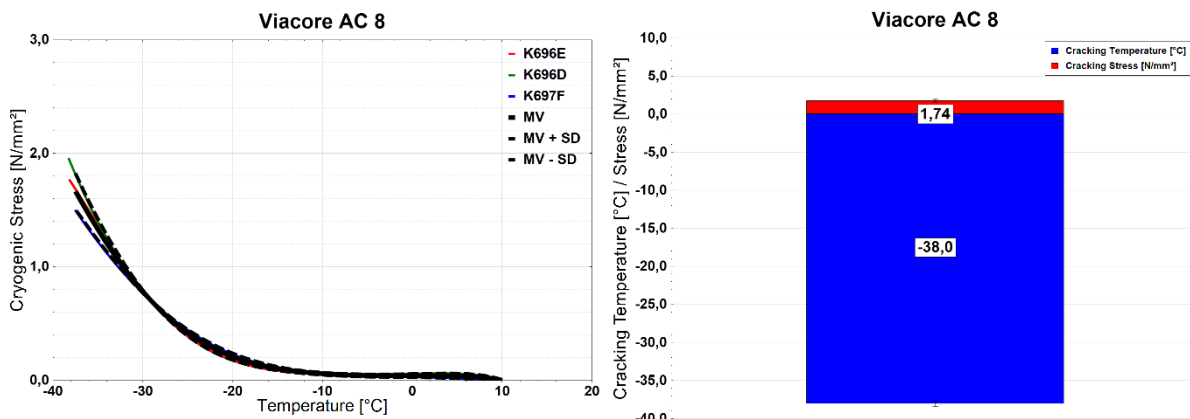


Figure 1: TSRST results of Viacore AC 8

The TSRST results in a mean cracking temperature of -38°C. This corresponds to a category $TSRST_{max-30,0}$ according to EN 13108-1.

The combined analysis of TSRST and UTST results in the tensile strength reserve. The tensile strength reserve is represented by a green curve in Figure 2. It describes the stress that can be put on a pavement structure in addition to temperature induced (cryogenic) stresses by traffic before the pavement fails by cracking. For the Viacore AC 8, a maximum tensile strength reserve of 1.95 N/mm² can be determined at a temperature of -19°C.

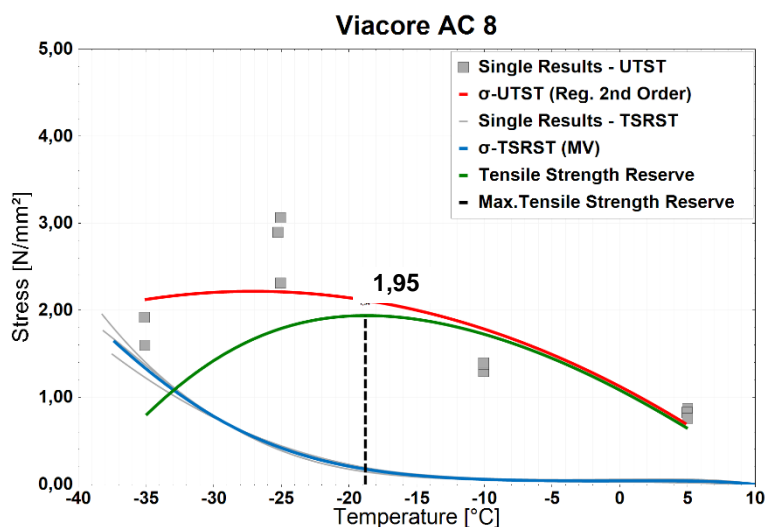


Figure 2: Tensile strength reserve from TSRST and UTST

Bernhard Hofko
 Ass. Prof. DI Dr. Bernhard Hofko
 Head of Laboratory

Vienna, August 2018

David Valentin
 Ing. David Valentin
 Project Manager

APPENDIX

Project Number: 17435A

This Annex contains all test reports.

Test report: bulk density, dimensions, space density and voids content
P429-PR
Page 1 von 1

Client	Österreichische Vialit GmbH
Date	26.01.2018
Project	17435
Project manager	David Valentin
Tested by	David Valentin
Standard	-
	EN 12697-05:2010, EN 12697-8:2003, EN 12697-29:2003

Sample information

Asphalt mixture	Viacore AC 8	Lab Code	AS1156
Asphalt sample	Viacore AC 8	Laboratory ID	A687
Origin	Österreichische Vialit GmbH		

Results

Maximum density of the mixture			
Maximum density [Mg/m³]	2,39	Test method	A - Volumetric method
Test temperature [°C]	-	Test liquid	water

Specimen	Length [mm]	Width [mm]	Height [mm]	Dry mass [g]	Bulk density Method B [Mg/m³]	Air void content [V%]
K696A	224,3	51,2	51,1	1285,7	2,231	
K696B	224,3	51,0	51,2	1291,0	2,238	
K696C	224,2	50,6	50,8	1288,3	2,239	
K696D	224,1	51,4	51,2	1309,5	2,249	
K696E	224,2	51,2	50,9	1296,0	2,251	
K696F	223,9	50,9	51,0	1285,7	2,244	
K696G	223,9	51,1	50,8	1278,5	2,235	
K696H	223,8	51,2	50,6	1261,6	2,220	

Test report: bulk density, dimensions, space density and voids content
P429-PR
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Client	Österreichische Vialit GmbH
Date	31.01.2018
Project	17435
Project manager	David Valentin
Tested by	Bernhard Hadler
	-
Standard	EN 12697-05:2010, EN 12697-8:2003, EN 12697-29:2003

Sample information

Asphalt mixture	Viacore AC 8	Lab Code	AS1156
Asphalt sample	Viacore AC 8	Laboratory ID	A687
Origin	Österreichische Vialit GmbH		

Results

Maximum density of the mixture			
Maximum density [Mg/m³]	2,39	Test method	A - Volumetric method
Test temperature [°C]	-	Test liquid	water

Specimen	Length [mm]	Width [mm]	Height [mm]	Dry mass [g]	Bulk density Method B [Mg/m³]	Air void content [V%]
K697A	226,9	50,6	52,2	1260,6	2,148	
K697B	227,0	50,9	52,0	1293,3	2,185	
K697C	226,8	50,9	51,9	1303,4	2,203	
K697D	226,8	51,0	51,9	1310,0	2,214	
K697E	226,9	51,0	51,9	1311,5	2,214	
K697F	226,7	50,8	51,9	1301,8	2,205	
K697G	226,6	51,0	52,1	1301,1	2,196	
K697H	226,7	51,4	52,1	1276,8	2,164	

Test Report: Tensile Stress Restrained Specimen Test
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Page 1 of 1

Client	Österreichische Vialit GmbH
Date	09.02.2018
Project	17435
Project Manager	David Valentin
Tester	Bernhard Hadler
Standard	EN 12697-46, Version 2012

Sample Data

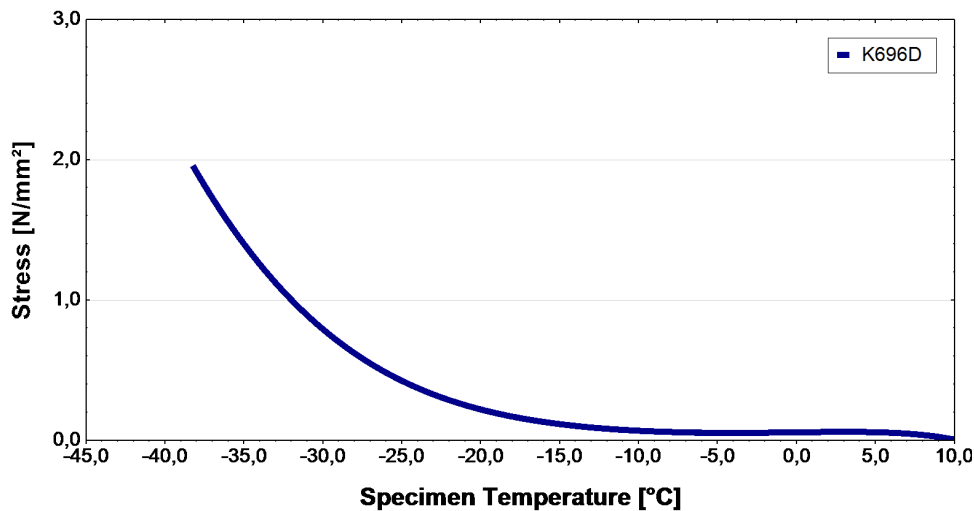
Lab Code	K696D	Air void content	
Asphalt Type	Viacore AC 8		

Device Data & Test Parameters

Device	Elektromechanische Prüfmaschine LFMZ 50		
Software	DionPro V4.10	Test Program	Abkuehlversuch_10Gh_081105
Start Temp.	10 °C	Cooling Rate	10 K/h

Test Results

Failure Stress	1,96 MPa	Failure Type	Brittle Failure
Failure Temp.	-38,3 °C	Point of Failure	0 cm from 1



Remarks:

Test Report: Tensile Stress Restrained Specimen Test
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Client	Österreichische Vialit GmbH
Date	01.02.2018
Project	17435
Project Manager	David Valentin
Tester	Bernhard Hadler
Standard	EN 12697-46, Version 2012

Sample Data

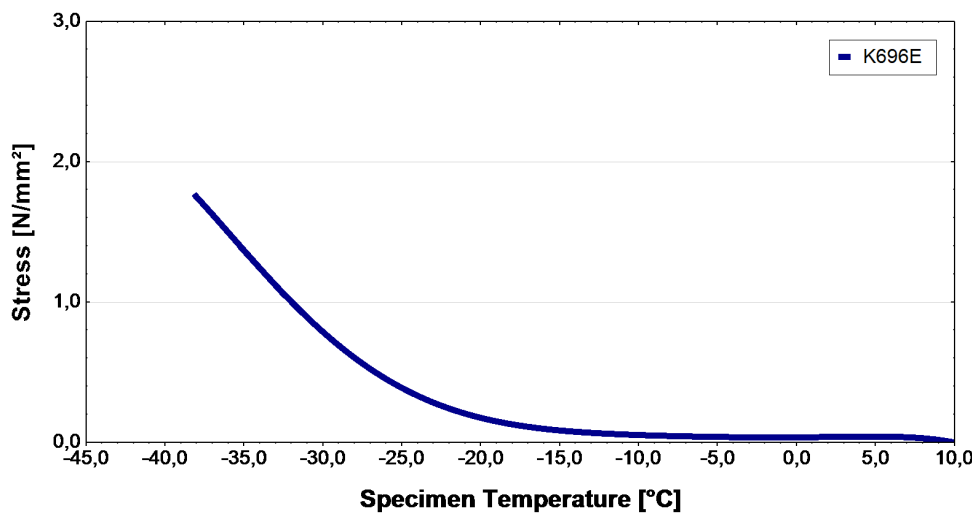
Lab Code	K696E	Air void content	
Asphalt Type	Viacore AC 8		

Device Data & Test Parameters

Device	Elektromechanische Prüfmaschine LFMZ 50		
Software	DionPro V4.10	Test Program	Abkuehlversuch_10Gh_081105
Start Temp.	10 °C	Cooling Rate	10 K/h

Test Results

Failure Stress	1,77 MPa	Failure Type	Brittle Failure
Failure Temp.	-38,2 °C	Point of Failure	0 cm from 2



Remarks:

Test Report: Tensile Stress Restrained Specimen Test
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Client	Österreichische Vialit GmbH
Date	12.02.2018
Project	17435
Project Manager	David Valentin
Tester	Bernhard Hadler
Standard	EN 12697-46, Version 2012

Sample Data

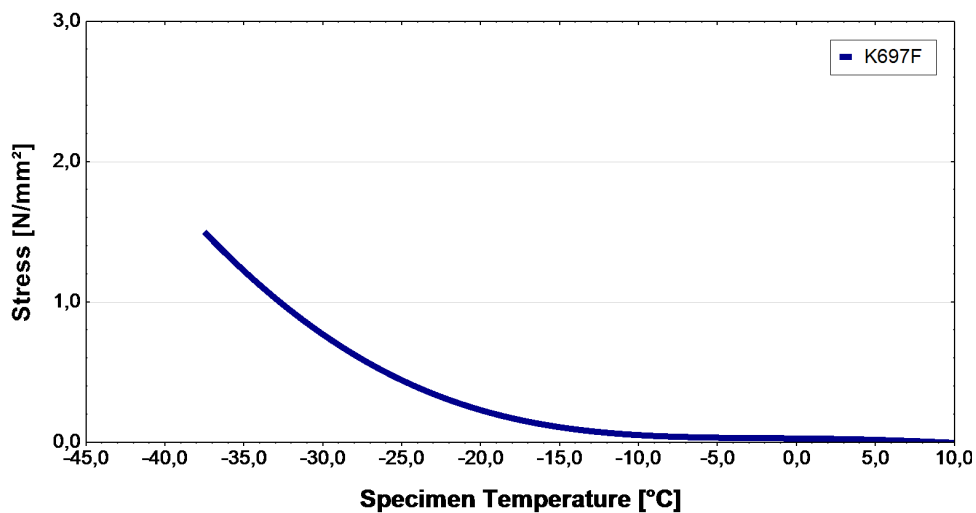
Lab Code	K697F	Air void content	
Asphalt Type	Viacore AC 8		

Device Data & Test Parameters

Device	Elektromechanische Prüfmaschine LFMZ 50		
Software	DionPro V4.10	Test Program	Abkuehlversuch_10Gh_081105
Start Temp.	10 °C	Cooling Rate	10 K/h

Test Results

Failure Stress	1,50 MPa	Failure Type	Brittle Failure
Failure Temp.	-37,6 °C	Point of Failure	0 cm from 1



Remarks:

Test Report: Uniaxial Tensile Stress Test (UTST)
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Client	Österreichische Vialit GmbH
Date	05.02.2018
Project	17435
Project Manager	David Valentin
Tester	Bernhard Hadler
Standard	EN 12697-46, Version 2012

Sample Data

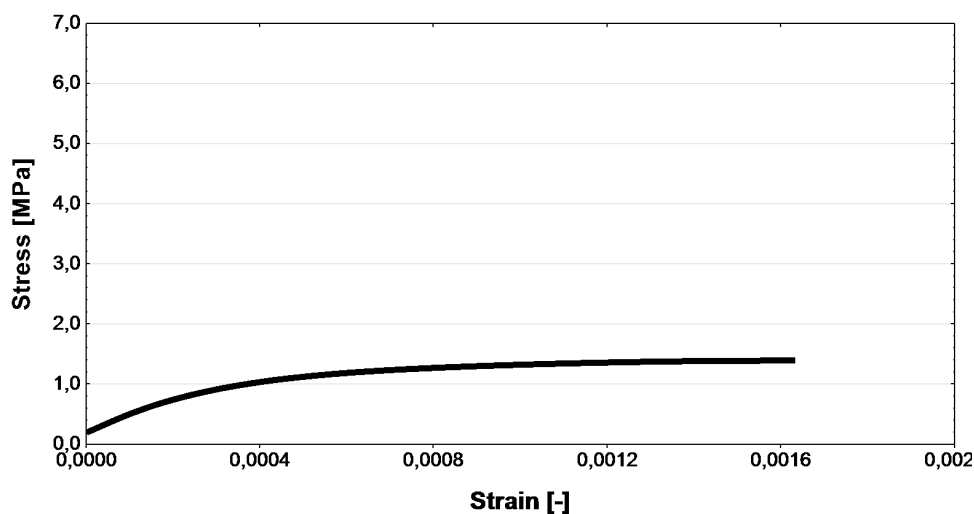
Lab Code	K696A	Production	Produced in lab
Mix Production	EN 12697-35	Slab Production	EN 12697-33
Bulk Density	2,231 Mg/m ³ Method B	Air void content	
Length	224,3 mm		
Width	51,2 mm	Height	51,1 mm
Asphalt Type	Viacore AC 8		

Device Data & Test Parameters

Device	Elektromechanische Prüfmaschine LFMZ 50		
Software	DionPro V4.10	Test Program	Zugversuch_alleTemp_080923
Test Temp.	-10,0 °C	Deformation Rate	1,4 mm/min <=> 1,7 %/min

Test Results

Tensile Strength	1,39 MPa	Failure Type	Brittle Failure
Strain at Failure	0,163 %	Point of Failure	0 cm from 1



Remarks:

Test Report: Uniaxial Tensile Stress Test (UTST)
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Client	Österreichische Vialit GmbH
Date	02.02.2018
Project	17435
Project Manager	David Valentin
Tester	Bernhard Hadler
Standard	EN 12697-46, Version 2012

Sample Data

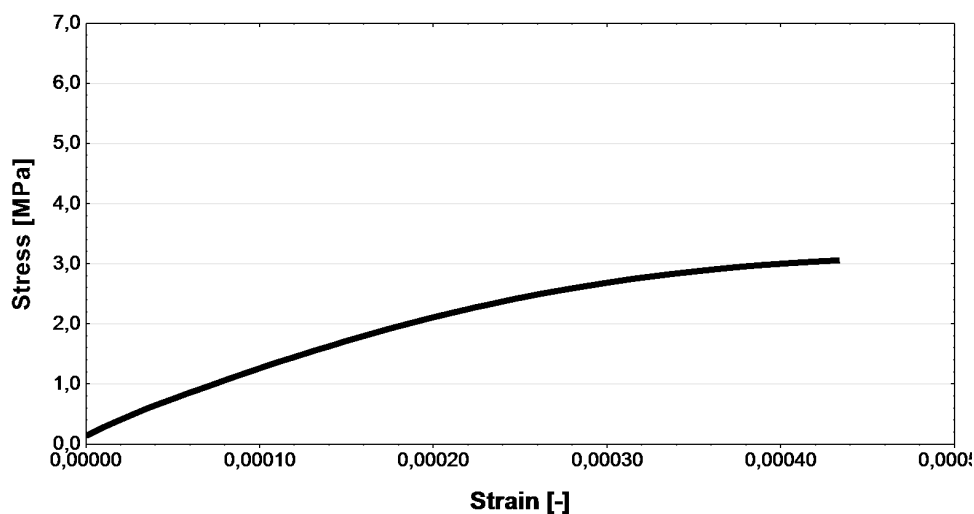
Lab Code	K696B	Production	Produced in lab
Mix Production	EN 12697-35	Slab Production	EN 12697-33
Bulk Density	2,238 Mg/m ³ Method B	Air void content	
Length	224,3 mm		
Width	51,0 mm	Height	51,2 mm
Asphalt Type	Viacore AC 8		

Device Data & Test Parameters

Device	Elektromechanische Prüfmaschine LFMZ 50		
Software	DionPro V4.10	Test Program	Zugversuch_alleTemp_080923
Test Temp.	-25,1 °C	Deformation Rate	1,4 mm/min <=> 1,7 %/min

Test Results

Tensile Strength	3,06 MPa	Failure Type	Brittle Failure
Strain at Failure	0,0434 %	Point of Failure	2 cm from 2



Remarks:

Test Report: Uniaxial Tensile Stress Test (UTST)
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Client	Österreichische Vialit GmbH
Date	01.02.2018
Project	17435
Project Manager	David Valentin
Tester	Bernhard Hadler
Standard	EN 12697-46, Version 2012

Sample Data

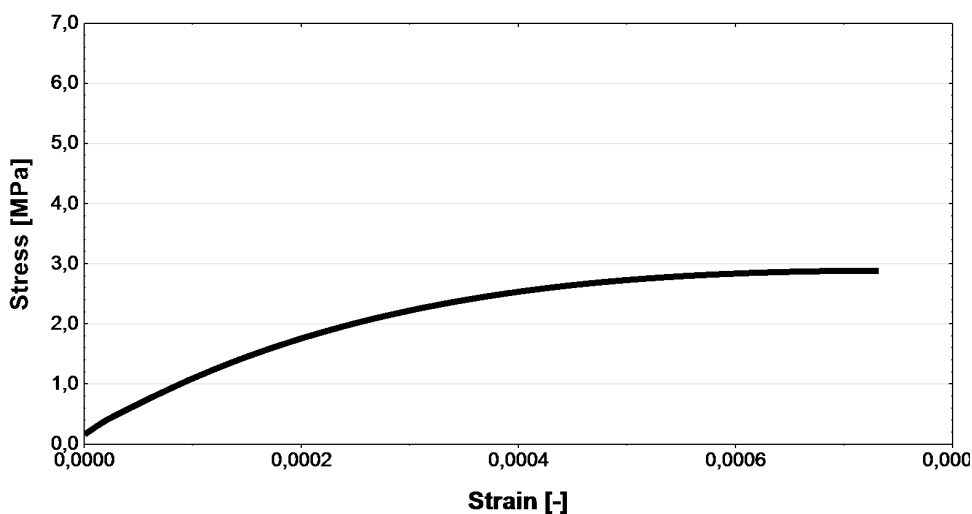
Lab Code	K696C	Production	Produced in lab
Mix Production	EN 12697-35	Slab Production	EN 12697-33
Bulk Density	2,239 Mg/m ³ Method B	Air void content	
Length	224,2 mm		
Width	50,6 mm	Height	50,8 mm
Asphalt Type	Viacore AC 8		

Device Data & Test Parameters

Device	Elektromechanische Prüfmaschine LFMZ 50		
Software	DionPro V4.10	Test Program	Zugversuch_alleTemp_080923
Test Temp.	-25,2 °C	Deformation Rate	1,4 mm/min <=> 1,7 %/min

Test Results

Tensile Strength	2,89 MPa	Failure Type	Brittle Failure
Strain at Failure	0,0732 %	Point of Failure	0 cm from 2



Remarks:

Test Report: Uniaxial Tensile Stress Test (UTST)
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Client	Österreichische Vialit GmbH
Date	05.02.2018
Project	17435
Project Manager	David Valentin
Tester	Bernhard Hadler
Standard	EN 12697-46, Version 2012

Sample Data

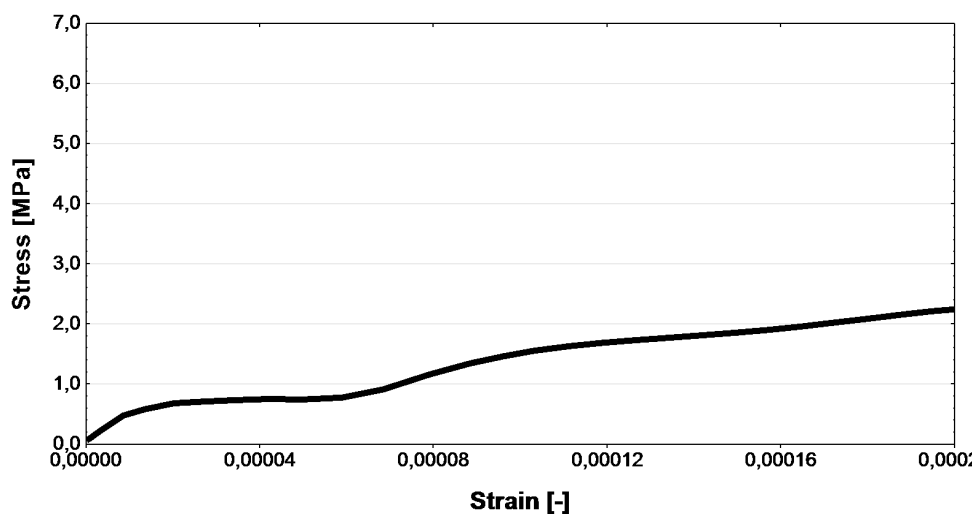
Lab Code	K696G	Production	Produced in lab
Mix Production	EN 12697-35	Slab Production	EN 12697-33
Bulk Density	2,235 Mg/m ³ Method B	Air void content	
Length	223,9 mm		
Width	51,1 mm	Height	50,8 mm
Asphalt Type	Viacore AC 8		

Device Data & Test Parameters

Device	Elektromechanische Prüfmaschine LFMZ 50		
Software	DionPro V4.10	Test Program	Zugversuch_alleTemp_080923
Test Temp.	-25,1 °C	Deformation Rate	1,3 mm/min \Leftrightarrow 1,7 %/min

Test Results

Tensile Strength	2,31 MPa	Failure Type	Brittle Failure
Strain at Failure	0,021 %	Point of Failure	0 cm from 3



Remarks:

Test Report: Uniaxial Tensile Stress Test (UTST)
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Client	Österreichische Vialit GmbH
Date	07.02.2018
Project	17435
Project Manager	David Valentin
Tester	Bernhard Hadler
Standard	EN 12697-46, Version 2012

Sample Data

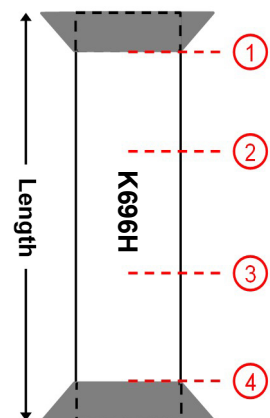
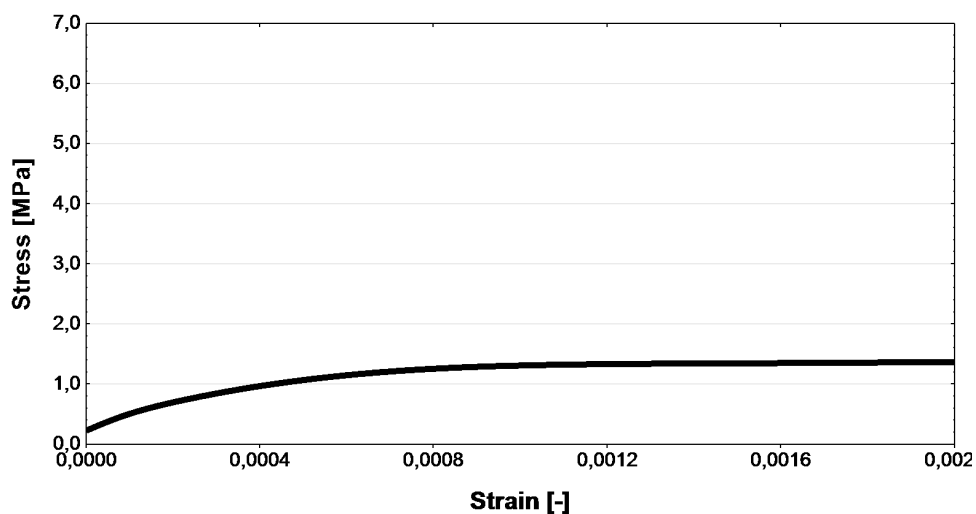
Lab Code	K696H	Production	Produced in lab
Mix Production	EN 12697-35	Slab Production	EN 12697-33
Bulk Density	2,220 Mg/m ³ Method B	Air void content	
Length	223,8 mm		
Width	51,2 mm	Height	50,6 mm
Asphalt Type	Viacore AC 8		

Device Data & Test Parameters

Device	Elektromechanische Prüfmaschine LFMZ 50		
Software	DionPro V4.10	Test Program	Zugversuch_alleTemp_080923
Test Temp.	-10,1 °C	Deformation Rate	1,3 mm/min \Leftrightarrow 1,7 %/min

Test Results

Tensile Strength	1,38 MPa	Failure Type	Brittle Failure
Strain at Failure	0,226 %	Point of Failure	0 cm from 2



Remarks:

Test Report: Uniaxial Tensile Stress Test (UTST)
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Client	Österreichische Vialit GmbH
Date	13.02.2018
Project	17435
Project Manager	David Valentin
Tester	Bernhard Hadler
Standard	EN 12697-46, Version 2012

Sample Data

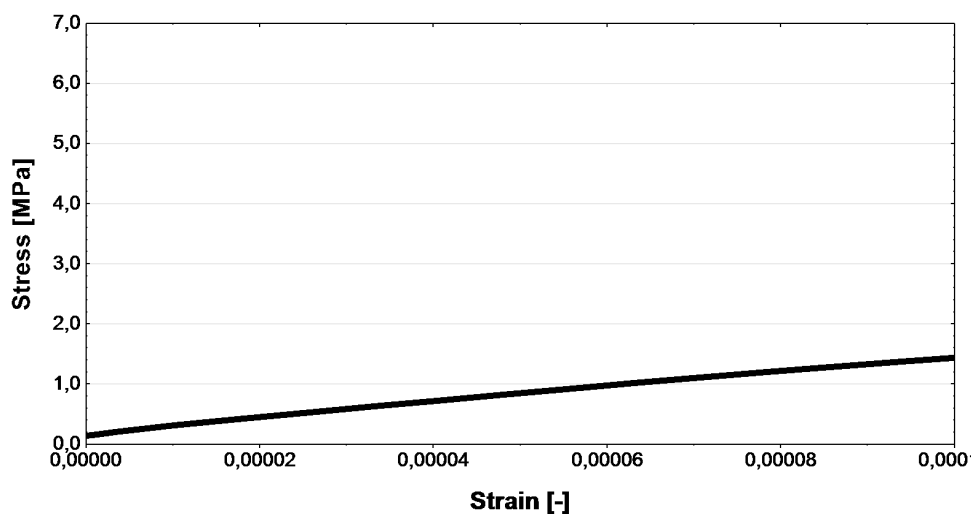
Lab Code	K697A	Production	Produced in lab
Mix Production	EN 12697-35	Slab Production	EN 12697-33
Bulk Density	2,148 Mg/m ³ Method B	Air void content	
Length	226,9 mm		
Width	50,6 mm	Height	52,2 mm
Asphalt Type	Viacore AC 8		

Device Data & Test Parameters

Device	Elektromechanische Prüfmaschine LFMZ 50		
Software	DionPro V4.10	Test Program	Zugversuch_alleTemp_080923
Test Temp.	-35,1 °C	Deformation Rate	1,4 mm/min <=> 1,7 %/min

Test Results

Tensile Strength	1,60 MPa	Failure Type	Brittle Failure
Strain at Failure	0,0119 %	Point of Failure	0 cm from 1



Remarks:

Test Report: Uniaxial Tensile Stress Test (UTST)
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Client	Österreichische Vialit GmbH
Date	08.02.2018
Project	17435
Project Manager	David Valentin
Tester	Bernhard Hadler
Standard	EN 12697-46, Version 2012

Sample Data

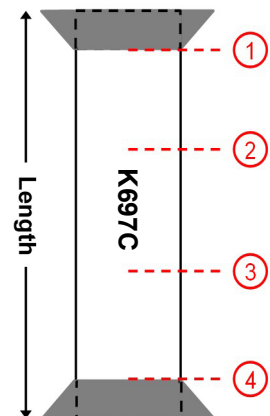
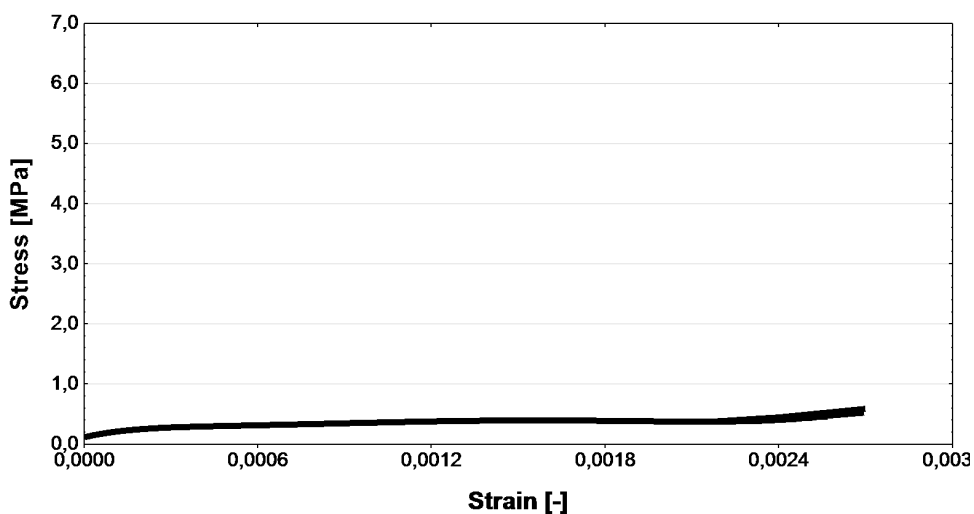
Lab Code	K697C	Production	Produced in lab
Mix Production	EN 12697-35	Slab Production	EN 12697-33
Bulk Density	2,203 Mg/m ³ Method B	Air void content	
Length	226,8 mm		
Width	50,9 mm	Height	51,9 mm
Asphalt Type	Viacore AC 8		

Device Data & Test Parameters

Device	Elektromechanische Prüfmaschine LFMZ 50		
Software	DionPro V4.10	Test Program	Zugversuch_alleTemp_080923
Test Temp.	5,0 °C	Deformation Rate	1,4 mm/min \Leftrightarrow 1,7 %/min

Test Results

Tensile Strength	0,76 MPa	Failure Type	Brittle Failure
Strain at Failure	0,27 %	Point of Failure	0 cm from 3



Remarks:

Test Report: Uniaxial Tensile Stress Test (UTST)
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Client	Österreichische Vialit GmbH
Date	07.02.2018
Project	17435
Project Manager	David Valentin
Tester	Bernhard Hadler
Standard	EN 12697-46, Version 2012

Sample Data

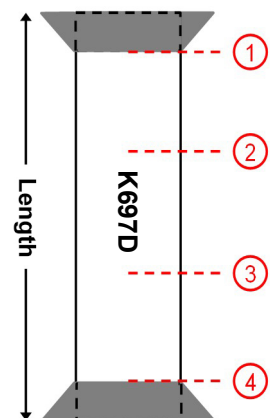
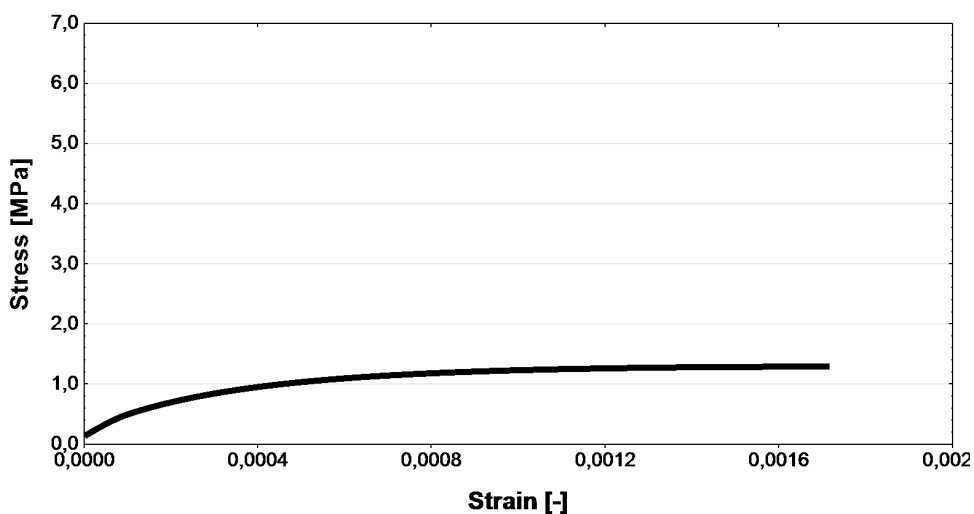
Lab Code	K697D	Production	Produced in lab
Mix Production	EN 12697-35	Slab Production	EN 12697-33
Bulk Density	2,214 Mg/m ³ Method B	Air void content	
Length	226,8 mm		
Width	51,0 mm	Height	51,9 mm
Asphalt Type	Viacore AC 8		

Device Data & Test Parameters

Device	Elektromechanische Prüfmaschine LFMZ 50		
Software	DionPro V4.10	Test Program	Zugversuch_alleTemp_080923
Test Temp.	-10,1 °C	Deformation Rate	1,4 mm/min \Leftrightarrow 1,7 %/min

Test Results

Tensile Strength	1,30 MPa	Failure Type	Brittle Failure
Strain at Failure	0,172 %	Point of Failure	2 cm from 2



Remarks:

Test Report: Uniaxial Tensile Stress Test (UTST)
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Client	Österreichische Vialit GmbH
Date	08.02.2018
Project	17435
Project Manager	David Valentin
Tester	Bernhard Hadler
Standard	EN 12697-46, Version 2012

Sample Data

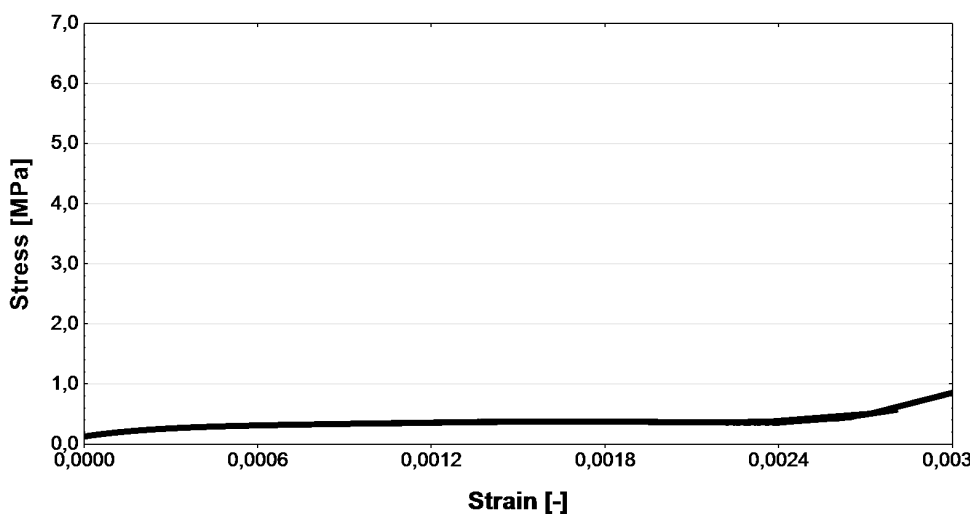
Lab Code	K697E	Production	Produced in lab
Mix Production	EN 12697-35	Slab Production	EN 12697-33
Bulk Density	2,214 Mg/m ³ Method B	Air void content	
Length	226,9 mm		
Width	51,0 mm	Height	51,9 mm
Asphalt Type	Viacore AC 8		

Device Data & Test Parameters

Device	Elektromechanische Prüfmaschine LFMZ 50		
Software	DionPro V4.10	Test Program	Zugversuch_alleTemp_080923
Test Temp.	5,0 °C	Deformation Rate	1,4 mm/min <=> 1,7 %/min

Test Results

Tensile Strength	0,83 MPa	Failure Type	Brittle Failure
Strain at Failure	0,301 %	Point of Failure	0 cm from 2



Remarks:

Test Report: Uniaxial Tensile Stress Test (UTST)
P516
Page 1 of 1

Client	Österreichische Vialit GmbH
Date	08.02.2018
Project	17435
Project Manager	David Valentin
Tester	Bernhard Hadler
Standard	EN 12697-46, Version 2012

Sample Data

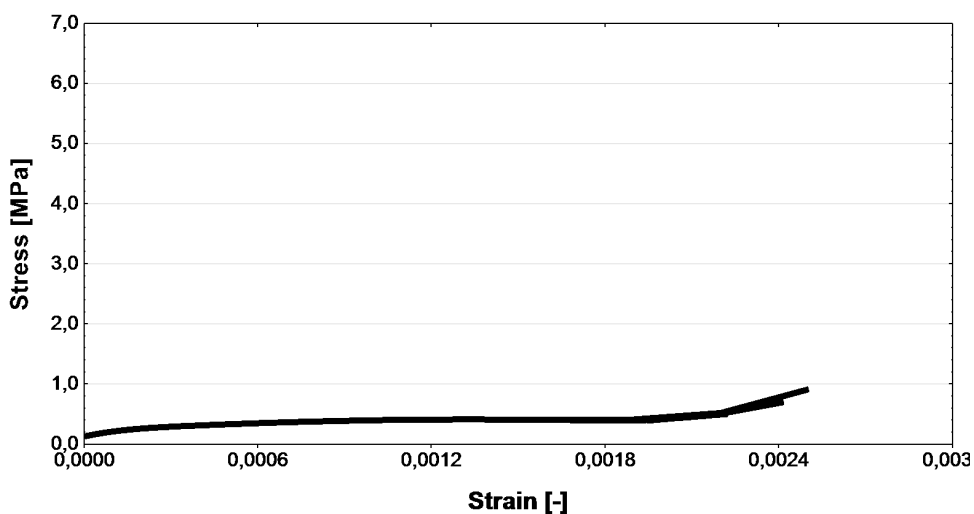
Lab Code	K697G	Production	Produced in lab
Mix Production	EN 12697-35	Slab Production	EN 12697-33
Bulk Density	2,196 Mg/m ³ Method B	Air void content	
Length	226,6 mm		
Width	51,0 mm	Height	52,1 mm
Asphalt Type	Viacore AC 8		

Device Data & Test Parameters

Device	Elektromechanische Prüfmaschine LFMZ 50		
Software	DionPro V4.10	Test Program	Zugversuch_alleTemp_080923
Test Temp.	5,0 °C	Deformation Rate	1,4 mm/min <=> 1,7 %/min

Test Results

Tensile Strength	0,87 MPa	Failure Type	Brittle Failure
Strain at Failure	0,25 %	Point of Failure	2 cm from 1



Remarks:

Test Report: Uniaxial Tensile Stress Test (UTST)
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Page 1 of 1

Client	Österreichische Vialit GmbH
Date	12.02.2018
Project	17435
Project Manager	David Valentin
Tester	Bernhard Hadler
Standard	EN 12697-46, Version 2012

Sample Data

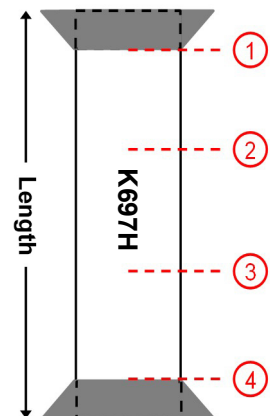
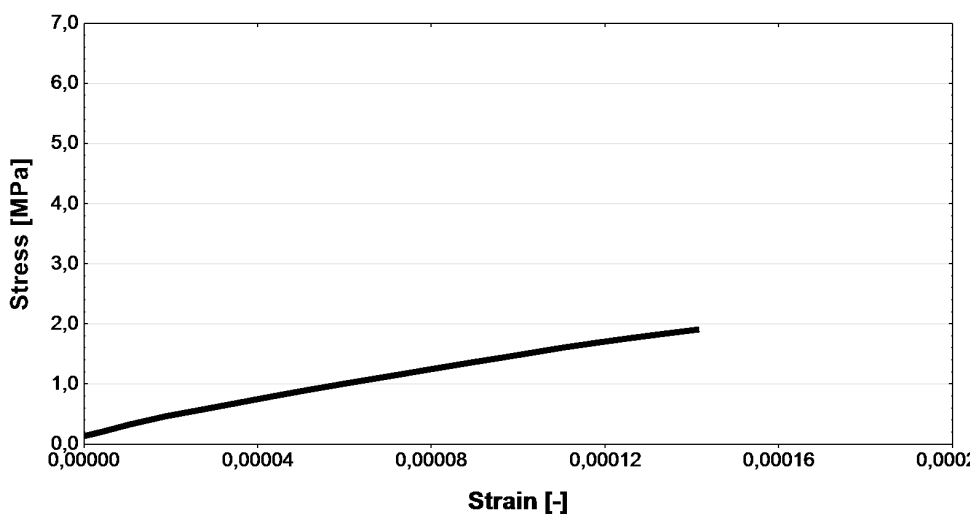
Lab Code	K697H	Production	Produced in lab
Mix Production	EN 12697-35	Slab Production	EN 12697-33
Bulk Density	2,164 Mg/m ³ Method B	Air void content	
Length	226,7 mm		
Width	51,4 mm	Height	52,1 mm
Asphalt Type	Viacore AC 8		

Device Data & Test Parameters

Device	Elektromechanische Prüfmaschine LFMZ 50		
Software	DionPro V4.10	Test Program	Zugversuch_alleTemp_080923
Test Temp.	-35,1 °C	Deformation Rate	1,4 mm/min <=> 1,7 %/min

Test Results

Tensile Strength	1,92 MPa	Failure Type	Brittle Failure
Strain at Failure	0,0142 %	Point of Failure	0 cm from 1



Remarks: