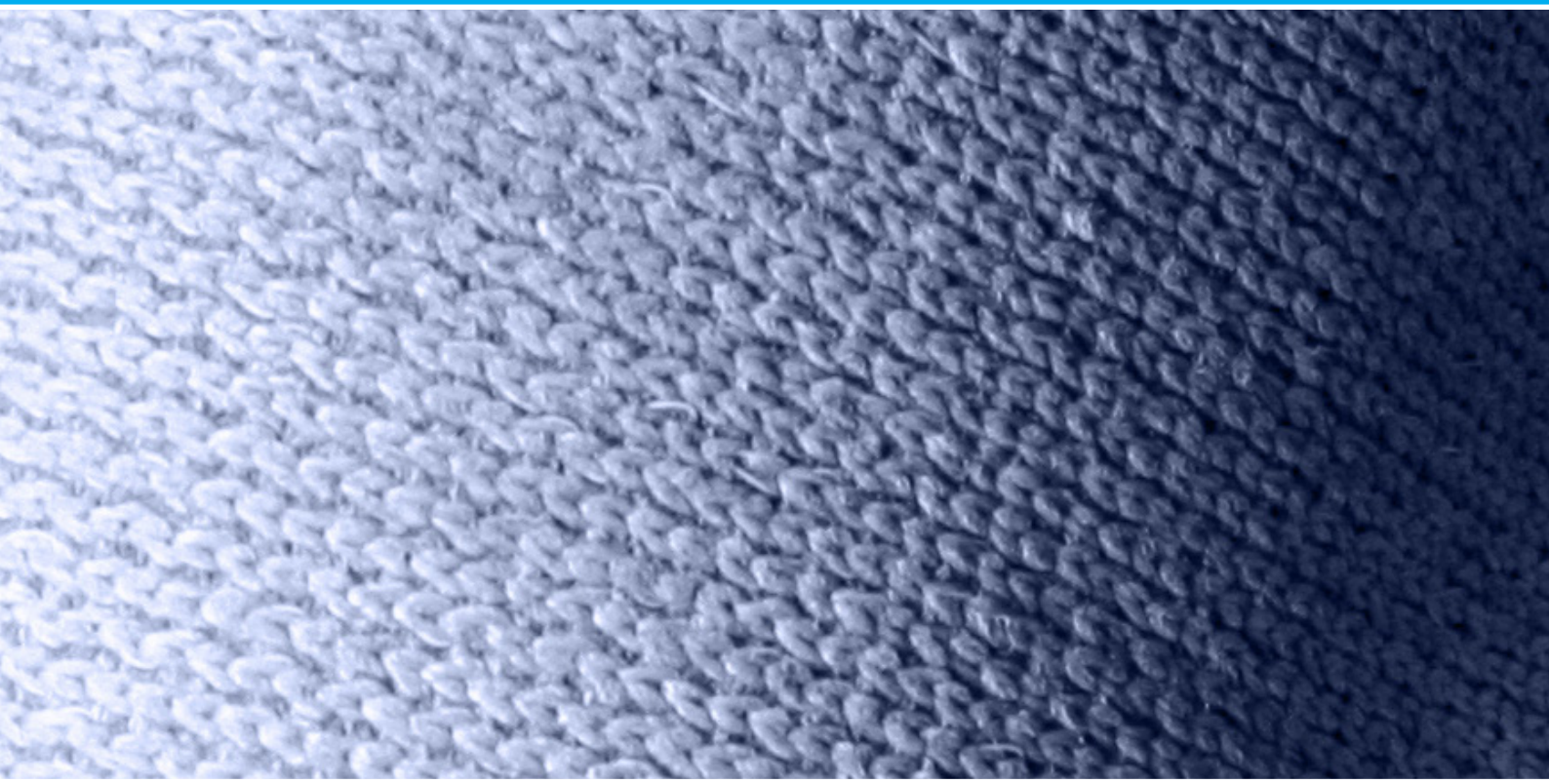
CONCRETE CANVAS®
Concrete on a Roll

1909.01.EN
MADE IN UK



CONCRETE CANVAS®
Concrete on a Roll

SULFATE RESISTANCE TESTING

The Queen's Awards for Enterprise: International Trade 2019

Board of Trade Winner 2018

Winner Technical Innovation Award

Innovation Award ICE Wales Cymru Awards 2017

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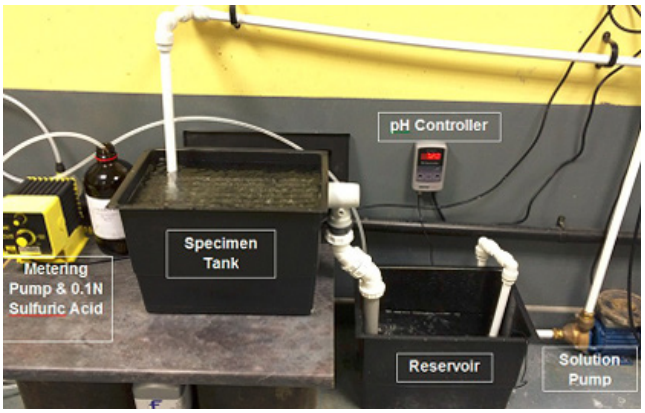
SULFATE RESISTANCE TESTING

Sulfate Resistance Testing

Based on Sulfate Resistance - Accelerated Test for Measuring Sulfate Resistance of Hydraulic Cements

Concrete Canvas® GCCM (Geosynthetic Cementitious Composite Mat) products have been independently tested by BICS Laboratories Ltd, UK, to assess the material's resistance to chemical sulfate attack. Testing was carried out on 5mm Concrete Canvas® GCCM (CC5™), and 13mm Concrete Canvas® GCCM (CC13™). The test method used is based on Sulfate Resistance - Accelerated Test for Measuring Sulfate Resistance of Hydraulic Cements (Pavement Research Center, Institute of Transportation Studies, University of California, Berkeley. April 2000)

The test method involves fully immersing a cured sample of CC5™ or CC13™ into a tank in which there is a circulating 4% NaSO4 solution (Sodium Sulfate) maintained at pH 7.2. The samples are left for 28 days and the solution is maintained at pH7.2 (±0.05) via the addition of H2SO4. (Sulfuric Acid).



Following the 28 day immersion period, the samples are subjected to a 3-point bend test and the flexural strength results compared to a set of control specimens. Twelve samples of both 5mm and 13mm Concrete Canvas® formats (CC5™ and CC13™) were tested.

Summary of Results

	CC5™	CC13™
Mean Strength (MPa)	5.89	5.75
Retained Strength (%)	106.8%	98.8%

Concrete Canvas® GCCM products show no loss of flexural strength following exposure to sulphate.

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Reliable testing, Superior service
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REPORT

CONCRETE CANVAS TEST REPORT

REPORT REFERENCE: BS-J887/a

Report Date	15/07/2014
Client	Concrete Canvas Ltd, Pontypridd, CF37 5SP
Contact	William Crawford
Contract Reference	N/A
Client PO/Ref No	TBA
Material Tested	Concrete Canvas CC5 & CC13
Date Received	09/06/2014
Sample IDs	See Test Report
Tests Requested	Sulfate Resistance - Accelerated Test for Measuring Sulfate Resistance of Hydraulic Cements *(Pavement Research Center, Institute of Transportation Studies, University of California, Berkeley. April 2000)* Bending Strength - Concrete Canvas Test Procedure 01

If you have any questions or require additional information, please do not hesitate to contact us.

Report Authorisation:

Ryan Hackney
Laboratory Manager
15/07/2014

ISOQAR REGISTERED UKAS MANAGEMENT SYSTEMS 0026
Cert No. 7495
ISO 9001

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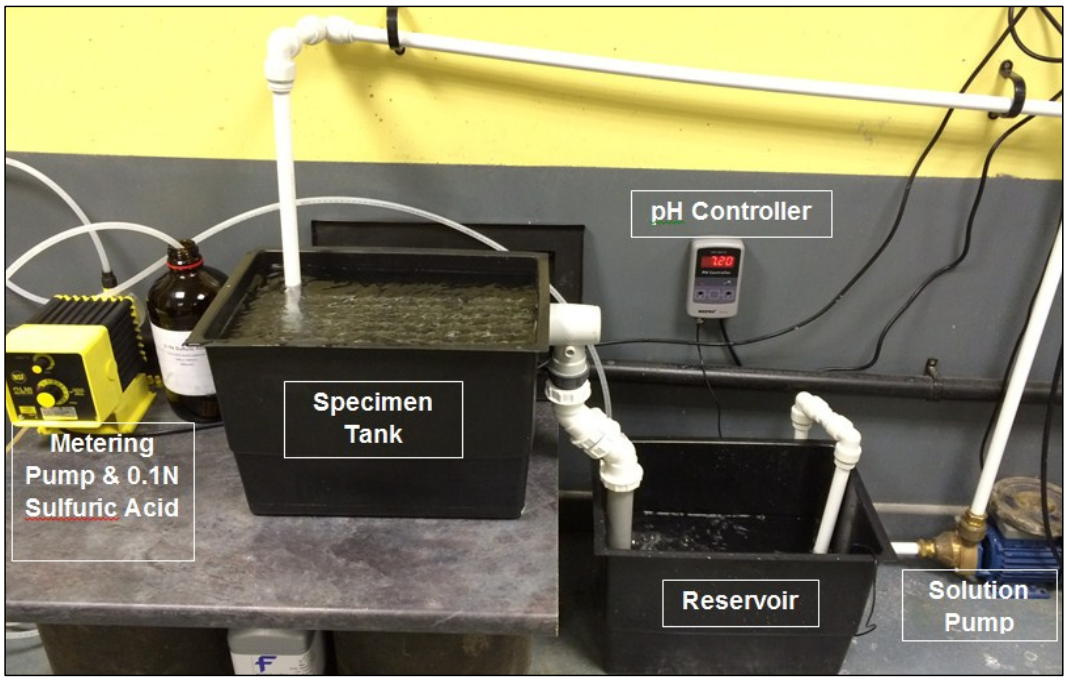
TEST RESULTS
CONCRETE CANVAS LTD
P.O NO: TBA

Contract Ref: N/A
Material: Concrete Canvas CC5 & CC13

Report Ref No: BS-J887/a
Dates Tested: 09/06-14/07/2014

Methodology - Sulfate Resistance



Test specimens of concrete canvas were immersed for 28 days in a circulating 4% Na_2SO_4 solution maintained at pH7.2. The sulfate solution was circulated between two tanks, one tank acting as a reservoir and the other tank contained the specimens. A controller monitored the pH of the sulfate solution and aliquots of 0.1N H_2SO_4 were pumped into the reservoir to maintain a pH of 7.2 (± pH 0.05).

The bending strength was carried out on a set of control samples that were cured for 6 days at 20^{o}C and 100%RH, and again on the set of 28 day exposed samples in order to evaluate the sulfate resistance.

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TEST RESULTS
CONCRETE CANVAS LTD
P.O NO: TBA

Contract Ref: N/A **Report Ref No: BS-J887/a**
Material: Concrete Canvas CC5 **Dates Tested: 09/06-14/07/2014**
Test Methods: Sulfate Resistance & Concrete Canvas Test Procedure 01 - Bending Strength

Parameter

Sample ID: CC5 uncoated - 7 day strength test

BICS Sample Ref: 01

Conditioning: 6 days at 20° C, 100% humidity

Specimen No	CC Specimen ID	Ave. Width	Ave. Thick	Load at Failure	Bend Strength
		mm	mm	N	MPa
Specimen 1	28	39.50	5.52	53.5	6.67
Specimen 2	24	39.49	5.48	43.4	5.48
Specimen 3	21	39.62	5.49	49.1	6.16
Specimen 4	23	39.56	5.51	44.5	5.55
Specimen 5	22	39.40	5.46	42.9	5.48
Specimen 6	34	39.73	5.49	54.2	6.79
Specimen 7	20	39.68	5.58	52.7	6.40
Specimen 8	18	39.80	4.84	37.7	6.07
Specimen 9	16	39.64	4.87	37.7	6.02
Specimen 10	13	39.61	4.91	44.8	7.05
Specimen 11	11	39.61	4.91	40.8	6.42
Specimen 12	8	40.06	4.88	36.6	5.76
Average		39.64	5.24	44.8	**6.15**

Sample ID: CC5 uncoated - 28 day strength test

BICS Sample Ref: 01

Conditioning: 6 days at 20° C, 100% humidity followed by 28 days in 4% N_2SO_4 solution maintained at pH 7.2

Specimen No	CC Specimen ID	Ave. Width	Ave. Thick	Load at Failure	Bend Strength
		mm	mm	N	MPa
Specimen 1	30	39.12	5.58	45.3	5.58
Specimen 2	36	39.40	5.55	40.4	4.99
Specimen 3	51	39.42	5.53	37.2	4.63
Specimen 4	3	40.01	5.49	34.1	4.24
Specimen 5	54	38.66	5.57	47.0	5.88
Specimen 6	43	39.81	5.66	48.1	5.66
Specimen 7	44	39.03	5.69	42.9	5.09
Specimen 8	4	39.76	5.30	33.3	4.47
Specimen 9	53	39.50	5.60	41.0	4.96
Specimen 10	55	39.85	5.40	41.2	5.32
Specimen 11	37	39.61	5.22	35.9	4.99
Specimen 12	52	39.33	5.62	37.3	4.50
Average		39.46	5.52	40.3	**5.03**

% Strength Loss	**18.3**

CONFIDENTIAL TEST REPORT

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TEST RESULTS
CONCRETE CANVAS LTD
P.O NO: TBA

Contract Ref: N/A **Report Ref No: BS-J887/a**
Material: Concrete Canvas CC5 **Dates Tested: 09/06-14/07/2014**
Test Methods: Sulfate Resistance & Concrete Canvas Test Procedure 01 - Bending Strength

Parameter

Sample ID: CC5 coated - 7 day strength test

BICS Sample Ref: 02

Conditioning: 6 days at 20° C, 100% humidity

Specimen No	CC Specimen ID	Ave. Width	Ave. Thick	Load at Failure	Bend Strength
		mm	mm	N	MPa
Specimen 1	39	39.54	5.22	31.7	4.42
Specimen 2	7	39.99	4.83	28.0	4.50
Specimen 3	35	39.63	5.60	43.2	5.21
Specimen 4	60	39.60	5.46	38.0	4.82
Specimen 5	59	39.48	5.44	40.7	5.23
Specimen 6	5	39.81	5.26	28.8	3.92
Specimen 7	58	39.89	5.29	32.3	4.34
Specimen 8	57	39.56	5.26	28.9	3.96
Specimen 9	33	39.56	5.52	49.8	6.20
Specimen 10	50	39.76	5.55	33.3	4.08
Specimen 11	31	39.90	5.44	50.5	6.42
Specimen 12	29	40.10	5.52	50.5	6.20
Average		39.74	5.37	38.0	**4.94**

Sample ID: CC5 coated - 28 day strength test

BICS Sample Ref: 02

Conditioning: 6 days at 20° C, 100% humidity followed by 28 days in 4% N_2SO_4 solution maintained at pH 7.2

Specimen No	CC Specimen ID	Ave. Width	Ave. Thick	Load at Failure	Bend Strength
		mm	mm	N	MPa
Specimen 1	26	39.73	5.48	39.6	4.98
Specimen 2	27	39.75	5.48	35.7	4.49
Specimen 3	25	40.05	5.31	33.3	4.42
Specimen 4	17	39.90	4.82	32.0	5.18
Specimen 5	9	39.20	4.99	34.9	5.36
Specimen 6	15	39.77	5.11	36.3	5.24
Specimen 7	46	39.60	5.56	40.9	5.01
Specimen 8	45	39.92	5.60	51.5	6.17
Specimen 9	12	39.87	4.97	37.3	5.68
Specimen 10	40	39.52	5.53	41.5	5.15
Specimen 11	14	40.10	4.87	35.4	5.58
Specimen 12	10	39.78	4.97	39.6	6.05
Average		39.77	5.22	38.2	**5.28**

% Strength Gain **6.8**

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TEST RESULTS
CONCRETE CANVAS LTD
P.O NO: TBA

Contract Ref: N/A **Report Ref No: BS-J887/a**
Material: Concrete Canvas CC13 **Dates Tested: 09/06-14/07/2014**
Test Methods: Sulfate Resistance & Concrete Canvas Test Procedure 01 - Bending Strength

Parameter

Sample ID: CC13 uncoated - 7 day strength test

BICS Sample Ref: 03

Conditioning: 6 days at 20° C, 100% humidity

Specimen No	CC Specimen ID	Ave. Width mm	Ave. Thick mm	Load at Failure N	Bend Strength MPa
Specimen 1	11	39.43	11.83	251.7	6.84
Specimen 2	10	39.58	11.78	233.4	6.37
Specimen 3	5	39.85	11.91	298.6	7.92
Specimen 4	2	39.40	11.88	311.2	8.39
Specimen 5	24	39.66	12.15	252.0	6.46
Specimen 6	26	39.71	11.79	242.9	6.60
Specimen 7	29	39.90	11.98	270.0	7.07
Specimen 8	35	38.77	11.84	241.7	6.67
Specimen 9	58	39.96	11.77	276.9	7.50
Specimen 10	34	38.58	11.90	270.6	7.43
Specimen 11	47	38.76	12.10	305.6	8.08
Specimen 12	50	38.88	11.88	250.9	6.86
Average		39.37	11.90	267.1	**7.18**

Sample ID: CC13 uncoated - 28 day strength test

BICS Sample Ref: 03

Conditioning: 6 days at 20° C, 100% humidity followed by 28 days in 4% N_2SO_4 solution maintained at pH 7.2

Specimen No	CC Specimen ID	Ave. Width mm	Ave. Thick mm	Load at Failure N	Bend Strength MPa
Specimen 1	17	39.86	11.81	223.6	6.03
Specimen 2	13	40.50	12.05	233.3	5.95
Specimen 3	14	39.70	11.90	227.6	6.07
Specimen 4	45	38.68	12.01	200.2	5.38
Specimen 5	60	38.85	11.80	249.2	6.91
Specimen 6	46	36.69	12.01	253.8	7.19
Specimen 7	59	38.97	11.82	271.9	7.49
Specimen 8	40	38.94	12.15	206.4	5.39
Specimen 9	21	39.21	12.11	216.0	5.63
Specimen 10	38	38.11	11.75	208.9	5.96
Specimen 11	22	39.78	12.09	250.5	6.46
Specimen 12	42	38.77	12.27	208.8	5.37
Average		39.01	11.98	229.2	**6.15**

% Strength Loss	**14.3**

CONFIDENTIAL TEST REPORT

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TEST RESULTS
CONCRETE CANVAS LTD
P.O NO: TBA

Contract Ref: N/A **Report Ref No: BS-J887/a**
Material: Concrete Canvas CC13 **Dates Tested: 09/06-14/07/2014**
Test Methods: Sulfate Resistance & Concrete Canvas Test Procedure 01 - Bending Strength

Parameter

Sample ID: CC13 coated - 7 day strength test

BICS Sample Ref: 04

Conditioning: 6 days at 20° C, 100% humidity

Specimen No	CC Specimen ID	Ave. Width mm	Ave. Thick mm	Load at Failure N	Bend Strength MPa
Specimen 1	18	39.69	11.75	225.5	6.17
Specimen 2	16	40.41	11.92	250.6	6.55
Specimen 3	12	39.84	11.87	203.3	5.43
Specimen 4	9	40.27	11.85	200.3	5.31
Specimen 5	8	40.16	11.68	177.7	4.87
Specimen 6	7	40.48	11.66	205.1	5.59
Specimen 7	4	40.37	12.06	215.1	5.50
Specimen 8	3	40.17	11.78	220.8	5.94
Specimen 9	1	40.30	11.72	219.0	5.93
Specimen 10	52	38.56	11.83	243.9	6.78
Specimen 11	48	39.47	11.93	212.7	5.68
Specimen 12	44	39.43	11.93	229.3	6.13
Average		39.93	11.83	216.9	**5.82**

Sample ID: CC13 coated - 28 day strength test

BICS Sample Ref: 04

Conditioning: 6 days at 20° C, 100% humidity followed by 28 days in 4% N_2SO_4 solution maintained at pH 7.2

Specimen No	CC Specimen ID	Ave. Width mm	Ave. Thick mm	Load at Failure N	Bend Strength MPa
Specimen 1	19	40.43	12.21	228.3	**5.68**
Specimen 2	20	40.37	12.21	258.2	**6.44**
Specimen 3	28	40.18	11.78	211.4	**5.69**
Specimen 4	30	40.19	11.80	199.8	**5.36**
Specimen 5	23	40.39	12.18	258.5	**6.47**
Specimen 6	27	39.44	11.91	182.8	**4.90**
Specimen 7	32	38.34	11.92	214.5	**5.91**
Specimen 8	36	39.64	11.88	199.7	**5.35**
Specimen 9	41	39.70	12.10	220.9	**5.70**
Specimen 10	55	39.26	12.06	203.5	**5.35**
Specimen 11	56	38.74	11.75	221.0	**6.20**
Specimen 12	39	39.40	12.02	226.9	**5.98**
Average		39.67	11.99	218.8	**5.75**

% Strength Loss	**1.2**

CONFIDENTIAL TEST REPORT