ETA-Danmark A/S
Göteborg Plads 1
DK-2150 Nordhavn
Tel. +45 72 24 59 00
Fax +45 72 24 59 04
Internet www.etadanmark.dk

Authorised and notified according to Article 29 of the Regulation (EU) No 305/2011 of the European Parliament and of the Council of 9 March 2011

MEMBER OF EOTA

European Technical Assessment ETA-22/0683 of 2022/11/10

I General Part

Technical Assessment Body issuing the ETA and designated according to Article 29 of the Regulation (EU) No 305/2011: ETA-Danmark A/S

Trade name of the construction product:	CCX-UTILITY™ (CCX-U™), CCX-MAT™ (CCX-M™) GCCMs and CCX-BARRIER™ (CCX-B™) GCCB
Product family to which the above construction product belongs:	Geotextiles, geomembranes and related products
Manufacturer:	Concrete Canvas Ltd Cowbridge Road Talbot Green Pontyclun CF72 8HL United Kingdom Tel: +44 345 680 1908 website: www.concretecanvas.com
Manufacturing plant:	Concrete Canvas Ltd Cowbridge Road Talbot Green Pontyclun CF72 8HL United Kingdom
This European Technical Assessment contains:	16 pages including 1 annex which form an integral part of the document
This European Technical Assessment is issued in accordance with Regulation (EU) No 305/2011, on the basis of:	European Assessment document EAD 080009-00-0301 Geosynthetic Cementitious Composite Mats and Barriers
This version replaces:	

1 Technical description of the product

1.1 General

CCX™ Geosynthetic Cementitious Composite Mats and Barriers (GCCM/Bs) are flexible, concrete filled geosynthetics for use in a range of geotechnical applications. Three product variants of CCX™ are available: CCX-UTILITY™ (CCX-U™), CCX-MAT™ (CCX-M™) GCCMs and CCX-BARRIER™ (CCX-B™) GCCB.

CCX™ product variants consist of two interconnected layers of geotextile that encapsulate a specially formulated dry concrete mix that hardens when hydrated to form a thin, durable concrete layer. CCX-M™ and CCX-B™ include an integral LLDPE backing to provide a waterproofing capability.
CCX™ product variants can be hydrated either by spraying or by being fully immersed in water.

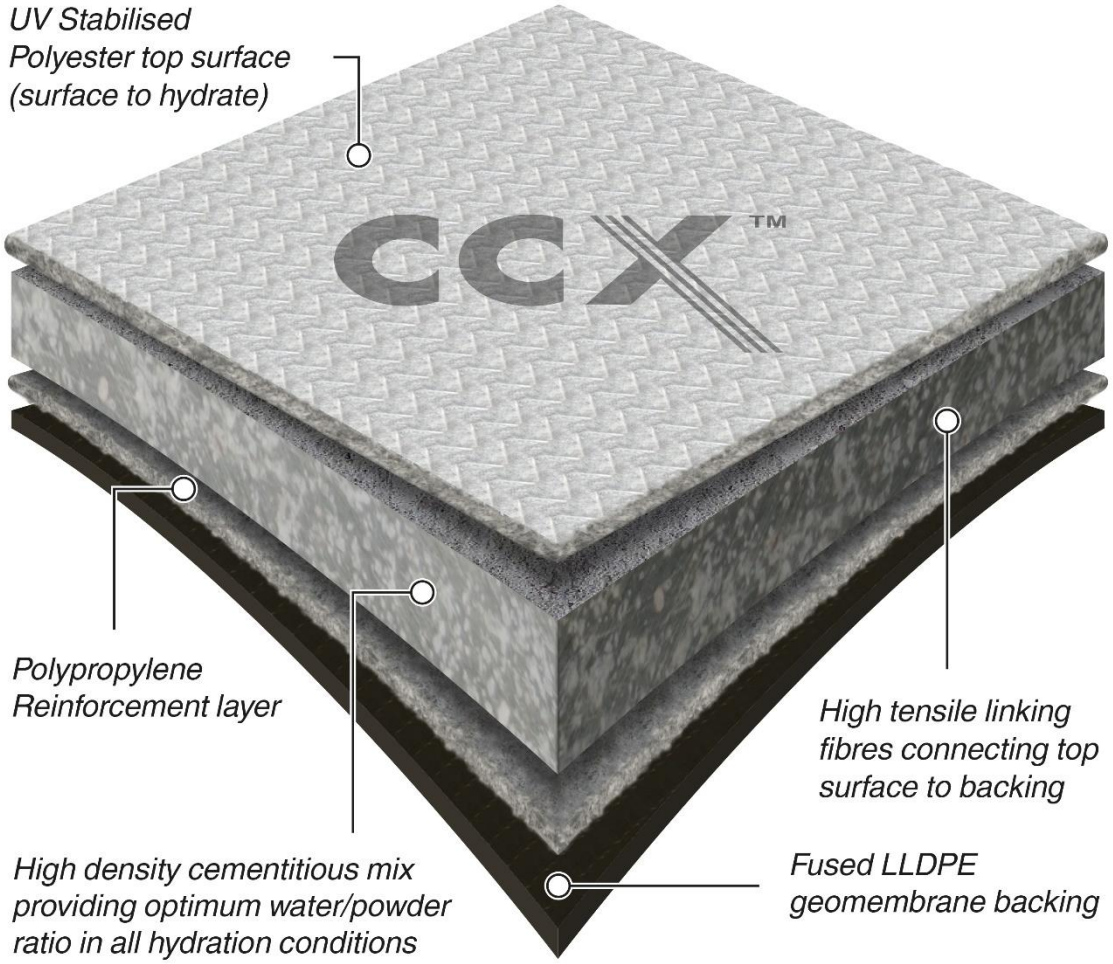

Figure 1 Overview of CCX-M™/ CCX-B™

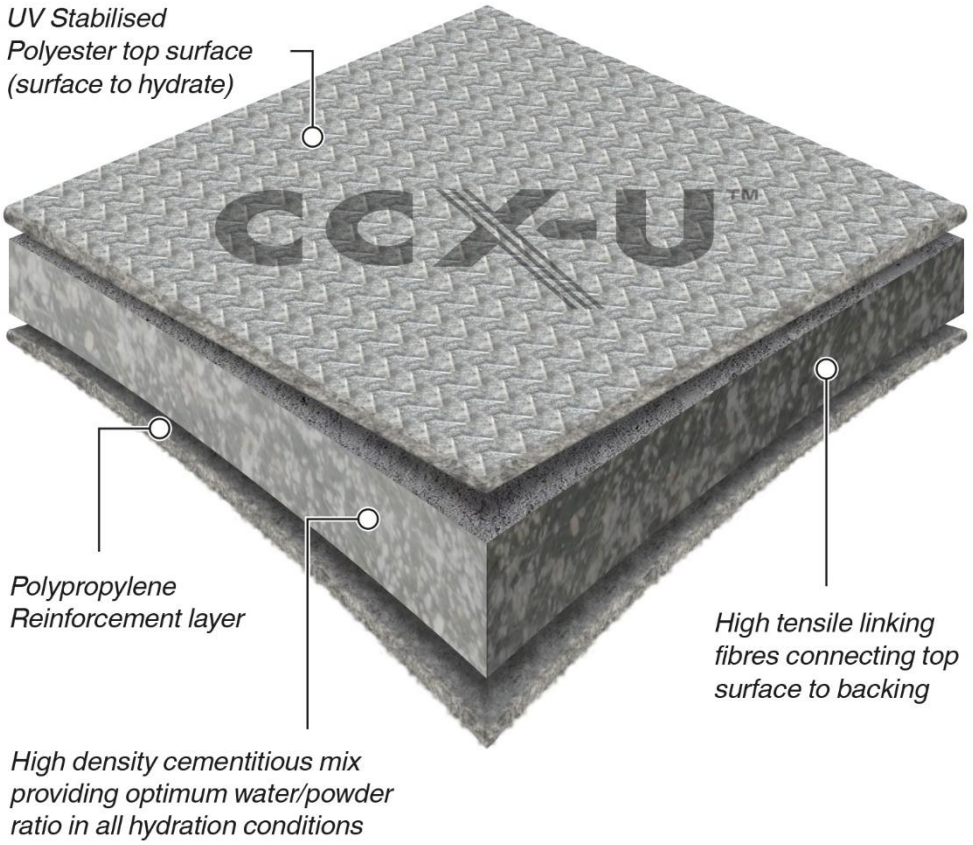

Figure 2 Overview of CCX-U™

The products comprise:

- A top polyester layer to contain the dry powder mix
- A bottom polypropylene layer to contain the dry powder mix
- Linking fibres connecting the top polyester to bottom polypropylene layers
- Specially formulated, high density concrete mix fill between the polyester and polypropylene layers
- (CCX-M™ and CCX-B™ only) a LLDPE geomembrane backing to the bottom layer to provide a low permeability liner. For CCX-B™ the geomembrane is thermally weldable for on site testing of containment critical GCCB applications.

The typical product properties are given in Table 1.

Product Type	Thickness (mm)	Bulk Roll size (m^2)	Roll Width (m)	Mass (unset) (kg/m^2)	Density (unset) (kg/m^3)	Change in density when set (%)
CCX-U™	10	97.5	1.95	14.5-15.5	1500-1600	20-25
CCX-M™	10.3	95	1.9	14.5-15.5	1500-1600	20-25
CCX-B™	11	95	1.9	14.5-15.5	1500-1600	20-25

2 Specification of the intended use(s) in accordance with the applicable European Assessment Document (hereinafter EAD)

2.1 Intended use

The products are for use as both erosion control (GGCMs) and containment applications (GGCBs) and the intended uses can be outlined as:

- Bulk Water Infrastructure Lining
- Slope Protection
- Remediation
- Weed Suppression
- Embankment and Dike Protection
- Secondary Containment Structures
- Lagoon Lining.

CCX-U™ and CCX-M™ are intended for use in erosion control applications. The products act as an effective weed suppressants and CCX-M™ provides additional impermeability.

CCX-B™ is intended for use as a combined impermeable liner and protection layer for containment applications.

2.2 Assumed working life

The provisions made in this ETA are based on an assumed intended working life of 50 years.

The indications given on the working life cannot be interpreted as a guarantee given by the producer or the Technical Assessment Body, but are to be used as a means for selecting the appropriate product in relation to the expected economically reasonable working life of the works.

2.3 Manufacture

The Manufacturer ensures that the manufacturing process is in conformance to ISO 9001 and is committed to manufacturing products to the highest quality standards to ensure all materials meet the stated material performance level.

2.4. Design

It is essential that CCX™ projects are properly designed in accordance with the Manufacturers guidelines taking into account project specific requirements and site conditions. The Manufacturer can provide standard design details, case studies and installation guidelines on request to facilitate this process. The design is carried out under the responsibility of a suitably qualified and experienced individual.

2.5. Packaging, transport and storage

CCX™ products are supplied in 25m or 50m long Bulk Rolls weighing approximately 750 or 1450kg respectively. Bulk Rolls are supplied individually wrapped in airtight polyethylene packaging and can be offloaded by pole handling, using slings or can be supplied palletised on request. Rolls are supplied on 110mm HDPE cores so they can be hung from a spreader beam and unrolled using standard plant equipment. All rolls are provided with a basic hydration guide in English. Details of typical container and truck loading quantities, weights and dimensions can be obtained from the manufacturer.

2.6. Installation, maintenance and repairs

CCX™ must be installed in accordance with the Manufacturer's installation guidelines. For details of sub-base preparation and on-site quality control and quality assurance procedures, a sample specification can be obtained from the Manufacturer.

In most instances, properly installed products will not require any cleaning or maintenance. However, applications which incorporate silt traps, baffling or for some site-specific conditions, some periodic maintenance will require the removal of accumulated silt. For all schemes, it is necessary to periodically inspect the lined asset for signs of structural or hydraulic compromise. Any maintenance or repair should be conducted in accordance with the Manufacturers guidelines.

3 Performance of the product and references to the methods used for its assessment

3.1 Essential characteristics of the product

Table 3 Essential characteristics of the product and product performance

No.	Essential characteristic	Product performance
Basic requirement for construction works 1: Mechanical resistance and stability		
1	Thickness	Annex 1
2	Mass per unit area and Density	Annex 1
3	Flexural strength	Annex 1
4	Static Puncture resistance	Annex 1
5	Dynamic Puncture resistance	Annex 1
6	Pyramid puncture resistance	Annex 1
7	Strength of internal linking fibres	Annex 1
Basic requirement for construction works 4: Safety and accessibility in use		
8	Resistance to chemicals	Annex 1 for CCX-B™ No performance assessed for CCX-M™ and CCX-U™
9	Resistance to environmental effects	Annex 1
	Durability	
10	Abrasion resistance	Annex 1
11	Freeze – Thaw	Annex 1
12	Water Permeability	Annex 1 for CCX-B™ No performance assessed for CCX-M™ and CCX-U™
13	Gas Permeability	Annex 1 for CCX-B™ No performance assessed for CCX-M™ and CCX-U™

3.2 Assessment methods

3.2.1 General

The assessment of the essential characteristics in Clause 3.1 for the intended use in the sense of the basic requirements for construction works No. 1, 4 and 7 of Regulation (EU) No 305/2011 has been made in accordance with European Assessment Document EAD 16-08-0009-03.01 *Geosynthetic Cementitious Composite Mats and Barriers*.

4 Assessment and verification of constancy of performance (hereinafter AVCP) system applied, with reference to its legal base

The applicable European legal act: 1998/214/EC as amended by Decision 2001/596/EC of the European Commission, the system of assessment and verification of constancy of performance [see Annex V to Regulation (EU) No 305/2011] is as follows:

System 2+:

5 Technical details necessary for the implementation of the AVCP system, as provided for in the applicable EAD

Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited at ETA-Danmark A/S prior to CE marking.

Issued in Copenhagen on 2022-11-10 by

Thomas Bruun
Managing Director, ETA-Danmark A/S

ANNEX 1 Essential characteristics

A.1 Mechanical resistance and stability (BWR 1)

A.1.1 Thickness *[dry (uncured) samples]*

Product type	Mean, mm	Standard deviation	Declared value, mean, mm
CCX-M™	10,63	0,18	8,5
CCX-B™	10,94	0,18	9,0
CCX-U™	10,32	0,3	8,5

A.1.2 Mass per unit area and Density *[dry (uncured) samples]*

Product type	Mass per unit (mean)(kg/m^2)	Standard deviation	Declared mass per unit area (mean)(kg/m^2)	Density (mean)(kg/m^3)	Declared value, mean
CCX-M™	16,49	0,23	12,5	1552	1250
CCX-B™	17,15	0,10	12,5	1587	1250
CCX-U™	16,06	0,14	12,5	1558	1250

A.1.3 Flexural strength *[tested at 24 hours (+/-4 hours) from hydration]*

CCX-M™	Mean value	Deviation	Declared value, mean
Machine Direction Initial Flexural Strength (MPa)	8,68	1,34	3,5
Deflection at Initial Break (mm)	1,08	0,15	
Final Flexural Strength (MPa)	15,48	1,37	4,0
Initial Modulus of Elasticity (MPa)	2160	629	
Cross Machine Direction Initial Flexural Strength (MPa)	6,55	1,03	3,5
Deflection at Initial Break (mm)	1,15	0,20	
Final Flexural Strength (MPa)	11,44	0,82	4,0
Initial Modulus of Elasticity (MPa)	1674	483	

CCX-B™	Mean value	Deviation	Declared value, mean
Machine Direction Initial Flexural Strength (MPa)	6,63	0,78	3,5
Deflection at Initial Break (mm)	1,09	0,30	
Final Flexural Strength (MPa)	15,64	1,26	4,0
Initial Modulus of Elasticity (MPa)	1937	434	
Cross Machine Direction Initial Flexural Strength (MPa)	6,17	1,39	3,5
Deflection at Initial Break (mm)	1,41	0,53	
Final Flexural Strength (MPa)	11,86	0,93	4,0
Initial Modulus of Elasticity (MPa)	1194	387	

CCX-U™	Mean value	Deviation	Declared value, mean
Machine Direction Initial Flexural Strength (MPa)	5,21	0,61	3,5
Deflection at Initial Break (mm)	0,74	0,18	
Final Flexural Strength (MPa)	8,99	0,96	4,0
Initial Modulus of Elasticity (MPa)	1255	318	
Cross Machine Direction Initial Flexural Strength (MPa)	4,29	0,63	3,5
Deflection at Initial Break (mm)	0,82	0,18	
Final Flexural Strength (MPa)	5,16	0,48	4,0
Initial Modulus of Elasticity (MPa)	910	357	

A.1.4 Static Puncture resistance *(tested no earlier than 28 days from hydration)*

Puncture resistance

Product type	Mean, kN	Standard Deviation	Declared value (mean)(kN)
CCX-M™	4,49	0,70	2,5
CCX-B™	3,99	0,60	2,5
CCX-U™	3,60	0,34	2,5

Puncture displacement

Product type	Mean, mm	Standard Deviation	Declared value (mean)(mm)
CCX-M™	42	5	20,0
CCX-B™	36	7	20,0
CCX-U™	36	5	20,0

A.1.5 Dynamic Puncture resistance *(tested no earlier than 28 days from hydration)*

From the five samples tested per product range the impact did not cause the concrete to crack. Therefore, the perforation depth was recorded as zero.

A.1.6 Pyramid puncture resistance *(tested no earlier than 28 days from hydration)*

Pyramid puncture resistance

Product type	Mean, N	Standard Deviation	Declared value (mean)(kN)
CCX-M™	26103	8599	10,0
CCX-B™	24502	2804	10,0
CCX-U™	43077	6762	10,0

A.1.7 Strength of internal linking fibres [dry (uncured) samples]

There is no difference between CCX-M™ and CCX-B™ values.

Strength of internal linking fibres

	Mean, N	Standard Deviation	Declared value (mean)(kN)
CCX-M™ and CCX-B™			3,5
- Machine Direction	4,45	0,47	
- Cross Machine Direction	4,02	0,36	
CCX-U™			2,0
- Machine Direction	3,11	0,76	
- Cross Machine Direction	5,07	0,89	

A.2 Safety and accessibility in use (BWR4)

A.2.1 Resistance to chemicals

Chemical resistance of hardened (cured) Concrete Canvas CCX. The evaluation is based on the change in flexural strength instead of by change in tensile strength. Samples are tested no earlier than 28 days from hydration**.**
Performance is assessed for CCX-B™ GCCB only, as CCX-U™ and CCX-M™ are GCCM's.

Resistance to chemicals

Test Method/Retained Values (%)	**CCX-B™**	
	Machine Direction	**Cross Machine Direction**
Method A; Test Liquid: 10% solution H_2SO_4		
Initial Flexural Strength	38,0	27,9
Deflection at Initial Break	147,0	187,2
Final Flexural Strength	36,9	28,4
Initial modulus of Elasticity	9,3	8,0
Retained initial flexural strength	25,0	
Method B; Test Liquid: Saturated suspension Ca(OH)2		
Initial Flexural Strength	100,3	120,9
Deflection at Initial Break	75,8	76,7
Final Flexural Strength	98,4	107,5
Initial modulus of Elasticity	139,9	235,8
Retained initial flexural strength	80,0	
Method C; Solvation & Swelling (35% vol diesel, 35% vol paraffin, 30% vol lubricating oil HD30),		
Initial Flexural Strength	82,9	114,9
Deflection at Initial Break	58,8	60,2
Final Flexural Strength	76,1	77,7
Initial modulus of Elasticity	152,7	252,9
Retained initial flexural strength	80,0	
Method D; Test Liquid: Synthetic Leachate		
Initial Flexural Strength	107,8	133,4
Deflection at Initial Break	70,2	72,7
Final Flexural Strength	102,1	104,5
Initial modulus of Elasticity	135,0	167,3
Retained initial flexural strength	80,0	

A.2.2 Resistance to environmental effects

Weathering (UV):

*A*ffects the top surface only which is the same for all products, so the values apply to all versions

Test Method/Retained Values (%)	CCX	
	Machine Direction	Cross Machine Direction
Resistance to Weathering (UV Resistance)		
Initial Flexural Strength	90,6	102,1
Deflection at Initial Break	56,6	50,9
Final Flexural Strength	86,0	80,9
Initial modulus of Elasticity	128,3	118,9
Retained initial flexural strength	85,0	

Microbiological Resistance

The LLDPE is the same on CCX-M™ and CCX-B™, just different thicknesses. So CCX-M™ results are conservatively considered the same for CCX-B™. As CCX-U™ is unbacked testing has been carried out separately.

Test Method/Retained Values (%)	CCX-B™/CCX-M™	
	Machine Direction	Cross Machine Direction
Microbiological Resistance		
Initial Flexural Strength	87,8	108,4
Deflection at Initial Break	79,6	88,2
Final Flexural Strength	104,5	98,4
Initial modulus of Elasticity	112,9	90,2
Retained initial flexural strength	85,0	

Test Method/Retained Values (%)	CCX-U™	
	Machine Direction	Cross Machine Direction
Microbiological Resistance		
Initial Flexural Strength	195,0	193,9
Deflection at Initial Break	109,1	107,9
Final Flexural Strength	124,2	173,9
Initial modulus of Elasticity	217,5	133,6
Retained initial flexural strength	100,0	

Leaching

The LLDPE is the same on CCX-M™ and CCX-B™, just different thicknesses. So CCX-M™ results are conservatively considered the same for CCX-B™. As CCX-U™ is unbacked testing has been carried out separately.

Test Method/Retained Values (%)	**CCX-B™/CCX-M™**	
	Machine Direction	**Cross Machine Direction**
Method A; leaching by hot (de-ionized) water		
Initial Flexural Strength	78,8	101,7
Deflection at Initial Break	58,0	59,0
Final Flexural Strength	90,7	100,5
Initial modulus of Elasticity	111,0	116,2
Retained initial flexural strength	75,0	

Test Method/Retained Values (%)	**CCX-U™**	
	Machine Direction	**Cross Machine Direction**
Method A; leaching by hot (de-ionized) water		
Initial Flexural Strength	151,3	114,1
Deflection at Initial Break	87,8	80,4
Final Flexural Strength	117,0	181,9
Initial modulus of Elasticity	200,1	162,9
Retained initial flexural strength	100,0	

Test Method/Retained Values (%)	**CCX-B™/CCX-M™**	
	Machine Direction	**Cross Machine Direction**
Method B; leaching by aqueous alkaline liquids : Saturated Ca(OH)2		
Initial Flexural Strength	64,4	89,6
Deflection at Initial Break	62,6	68,4
Final Flexural Strength	90,0	91,9
Initial modulus of Elasticity	84,2	90,2
Retained initial flexural strength	60,0	

Test Method/Retained Values (%)	**CCX-U™**	
	Machine Direction	**Cross Machine Direction**
Method B; leaching by aqueous alkaline liquids : Saturated Ca(OH)2		
Initial Flexural Strength	133,3	121,4
Deflection at Initial Break	106,4	83,1
Final Flexural Strength	133,7	159,3
Initial modulus of Elasticity	138,3	206,9
Retained initial flexural strength	100,0	

Test Method/Retained Values (%)	CCX-B™/CCX-M™	
	Machine Direction	Cross Machine Direction
Method C; leaching by organic alcohols (30% vol methanol, 30% vol isopropanol, 40% vol glycol)		
Initial Flexural Strength	97,0	97,3
Deflection at Initial Break	66,4	54,6
Final Flexural Strength	94,7	86,7
Initial modulus of Elasticity	108,4	109,4
Retained initial flexural strength	95,0	

Test Method/Retained Values (%)	CCX-U™	
	Machine Direction	Cross Machine Direction
Method C; leaching by organic alcohols (30% vol methanol, 30% vol isopropanol, 40% vol glycol)		
Initial Flexural Strength	148,7	98,2
Deflection at Initial Break	89,2	82,6
Final Flexural Strength	118,9	144,4
Initial modulus of Elasticity	168,2	201,5
Retained initial flexural strength	95,0	

A.2.2.3 Thermal ageing

The LLDPE is the same on CCX-M™ and CCX-B™, just different thicknesses. So CCX-M™ results are conservatively considered the same for CCX-B™. As CCX-U™ is unbacked testing has been carried out separetely.

Test Method/Retained Values (%)	CCX-B™/CCX-M™	
	Machine Direction	Cross Machine Direction
Thermal ageing		
Initial Flexural Strength	57,4	71,8
Deflection at Initial Break	53,6	60,9
Final Flexural Strength	80,9	92,5
Initial modulus of Elasticity	62,0	91,1
Retained initial flexural strength	55,0	

Test Method/Retained Values (%)	CCX-U™	
	Machine Direction	Cross Machine Direction
Thermal ageing		
Initial Flexural Strength	105,6	73,0
Deflection at Initial Break	84,1	72,0
Final Flexural Strength	118,0	145,0
Initial modulus of Elasticity	175,9	172,8
Retained initial flexural strength	70,0	

A.3 Durability

A.3.1 Abrasion resistance

Affects the top surface and cementitious core only which is the same for all products.

Product type	Mean	Standard deviation	Declared value (mean)
Fibrous Top Surface Abrasion - Mass loss (g/1000 cycles)	-3,55	0,01	
- Depth of wear (mm/1000 cycles)	1,637	0,035	
Cementitious Barrier Abrasion - Mass loss (g/1000 cycles)	-1,28	0,02	
- Depth of wear (mm/1000 cycles)	0,179	0,009	0,2

Notes:

Accessory weight per arm	1000 g
Number of wear cycles recorded	8000
Revolutions to wear surfaces of fabric	1000.

A.3.2 Freeze – Thaw

Affects the cementitious core, so CCX-U™ results can conservatively be considered the same for CCX-M™ and CCX-B™.

Test Method/Retained Values (%)	CCX	
	Machine Direction	Cross Machine Direction
Freeze - Thaw		
Initial Flexural Strength	153,8	149,3
Deflection at Initial Break	146,3	159,9
Final Flexural Strength	106,5	140,7
Initial modulus of Elasticity	215,7	269,0
Retained initial flexural strength	100,0	

A.3.3 Water Permeability for CCX-B™

Testing on the 1 mm LLDPE Geomembrane to CCX-B™ only.

Test (units)	Declared value
Water Permeability($m^3/m^2/d$)	5.0×10^{-12}

A.3.4 Gas Permeability for CCX-B™

Testing on 1 mm LLDPE Geomembrane to CCX-B™ only.

Test (units)	Declared value
Gas Permeability $(cm^3)\cdot(cm)\cdot(cm^{-2})\cdot(s^{-1})$ (Pa)	5.0×10^{-13}