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Email: info@geospec.uk.com

TEST REPORT

F.A.O. Paul Clayden
Caulmert Ltd
8 St. George Court
Altrincham Business Park
Dairy House Lane
Altrincham Business Park
WA14 5UA

Geospec Ref: GS/6259-02
Project/Site: Bryn Posteg
Product/Materials Received: A sample of geocomposite and several bags of soil were received.
Date Received: 17/05/18
Date Test Completed: 06/06/18
Date Report Completed: 07/06/18

Tests Requested/Details :

ASTM D5321-17 Procedure B - Soil on Geosynthetic Interface Friction
Determination of the Shear Strength by Direct Shear in the Large Shear box.
To determine the shear strength between Capping soil and Geofabrics GPT3 geotextile (MD, geotextile only tested) with normal loads of 20, 40 & 80kPa. The geotextile was fixed onto the lower part of the shearbox by the clamp plate & nut method and overlying an abrasive support plate. The soil was compacted into the upper part of the shearbox to a target bulk density of 1.75 Mg/m^3. Each test was conducted on a virgin specimen of geotextile. The nominal dimensions of the bottom shearbox are 407 X 305mm. The nominal dimensions of the upper/top box are 305 X 305mm. The shear box was arranged to be used as a constant contact area shear box. The normal load was applied using a piston acting on a top loading plate. The measurements of shear stress and shear displacement were recorded at a frequency of every 0.25mm displacement. The displacement and pressure is measured using digital transducers. The shear force is measured using a S-type load cell. The shear box test was conducted in a laboratory maintained at a temperature of 20 ± 2°C and 60 ± 10% relative humidity.

Customer Specified parameters/information

Material name(s)	1) Capping soil
	2) Geofabrics GPT3 (geotextile only tested)
Side/face	1) N/A
	2) N/A
Orientation	1) N/A
	2) machine direction
Test pressures	20, 40 & 80kPa
Compaction criteria	Moisture Content - as received
	Bulk density - 1.75 Mg/m^3
Consolidation	24 hours
Rate of displacement	0.5 mm/min
Dry/Submerged	Dry

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TEST REPORT

Determination of the Shear Strength by Direct Shear in the Large Shear box ASTM D5321- 17 Procedure B - Soil on Geosynthetic Interface Friction

Geospec Ref: GS/6259-02
Customer: Caulmert Ltd
Project/Site: Bryn Posteg
Soil: Capping soil (customer description)
Geosynthetic: Geofabrics GPT3 (geotextile only tested) (customer description)

	Test 1	Test 2	Test 3
Normal Stress	20kPa	40kPa	80kPa
"Peak" Shear Stress, kPa	**20.7**	**38.2**	**75.8**
Horizontal Displacement (at "Peak" Shear Stress), mm	17.26	30.55	33.96
Rate of Horizontal Displacement, mm/min	0.50	0.50	0.50
Tested Dry/Submerged	Dry	Dry	Dry
Particle Density (assumed), Mg/m^3	2.65	2.65	2.65
Bulk Density, Mg/m^3	1.75	1.75	1.75
Moisture Content, %	13	13	13
Dry Density, Mg/m^3	1.55	1.55	1.55
Initial Voids Ratio e_0	0.711	0.711	0.711
Degree of Saturation, %	48	48	48
Comments	None	None	None
Angle of Friction, Peak	**42.7^O**		
Cohesion Intercept, Peak	**1.9kPa**		

Shear box/Interface shear testing - Note
The Angle of Friction and the Cohesion intercept are derived from a mathematical line of best fit between the measured shear strengths. The values reported are factual and may not be an appropriate description of the shear behaviour of the soil/interface. Determination of appropriate shear behaviour parameters should be undertaken by a suitably qualified geotechnical engineer.

Date: 7th June 2018

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H Aswat
Technical Manager

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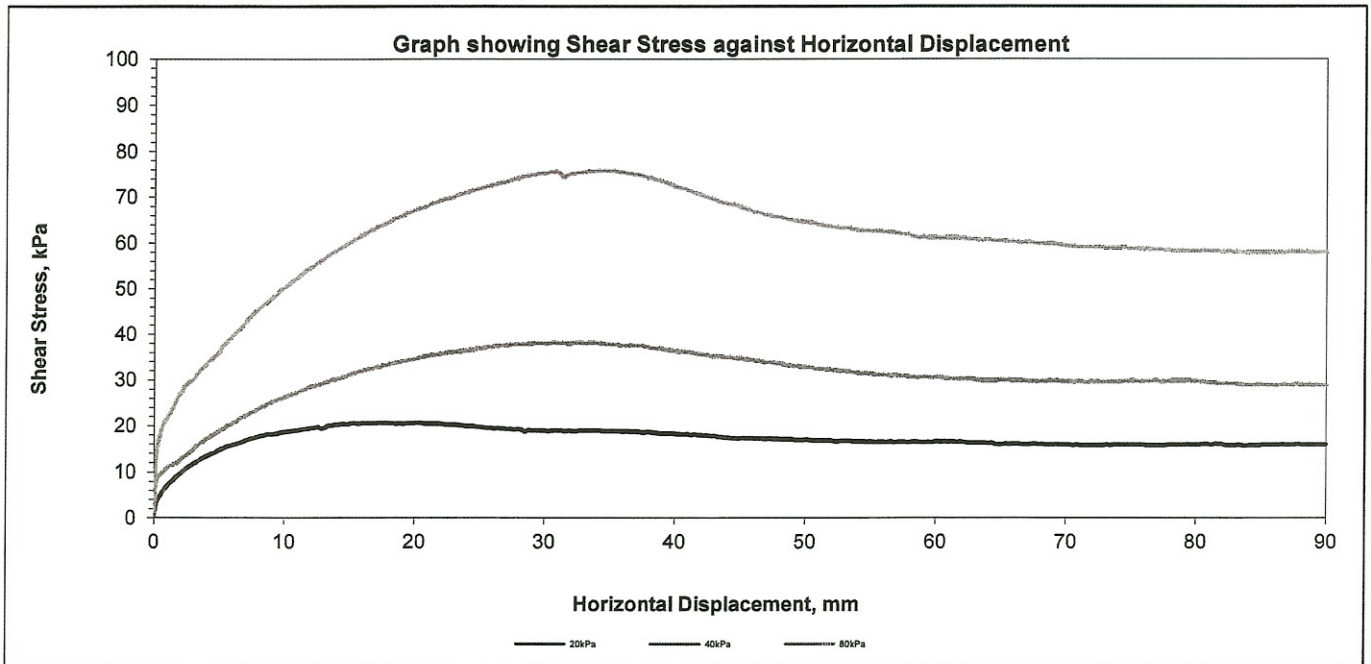
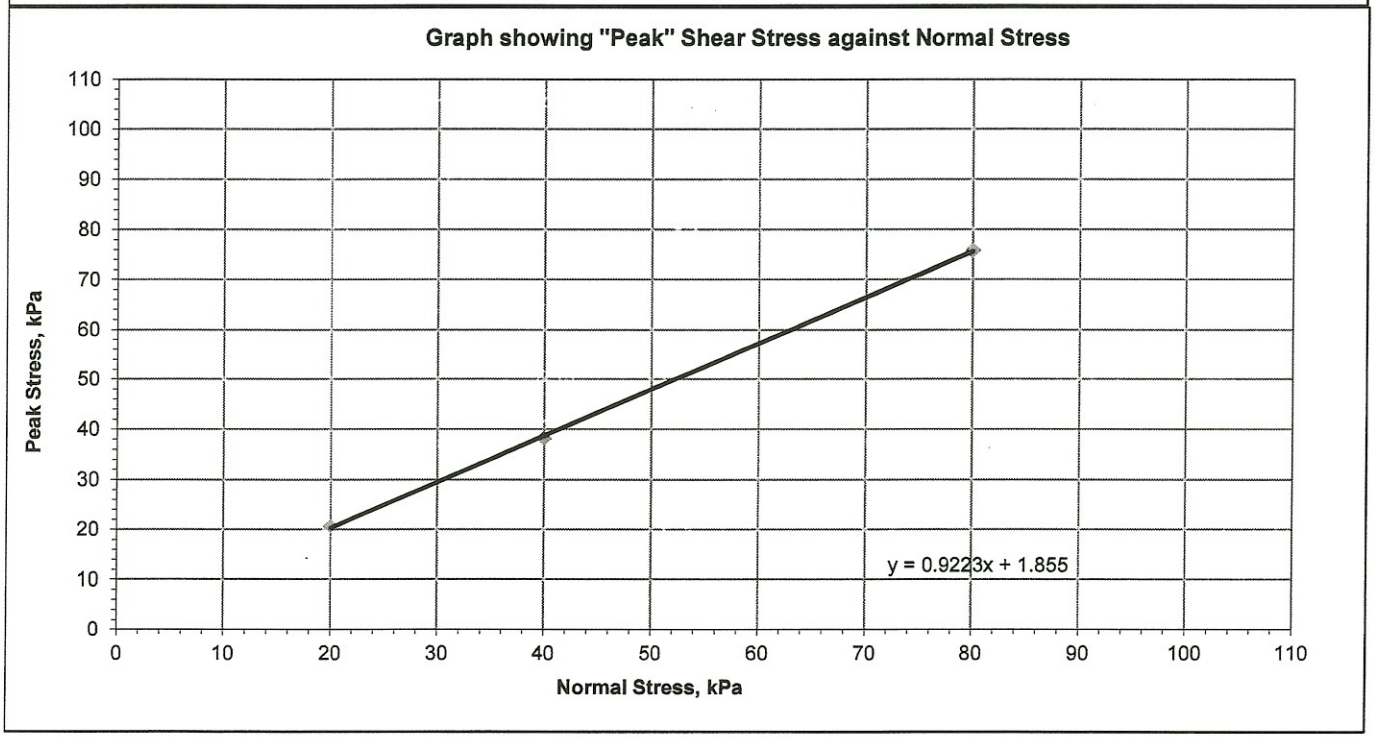
Determination of the Shear Strength by Direct Shear in the Large Shear box ASTM D5321- 17 Procedure B - Soil on Geosynthetic Interface Friction

Geospec Ref: GS/6259-02
Customer: Caulmert Ltd
Project/Site: Bryn Posteg
Soil: Capping soil (customer description)
Geosynthetic: Geofabrics GPT3 (geotextile only tested) (customer description)





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Customer: Caulmert Ltd
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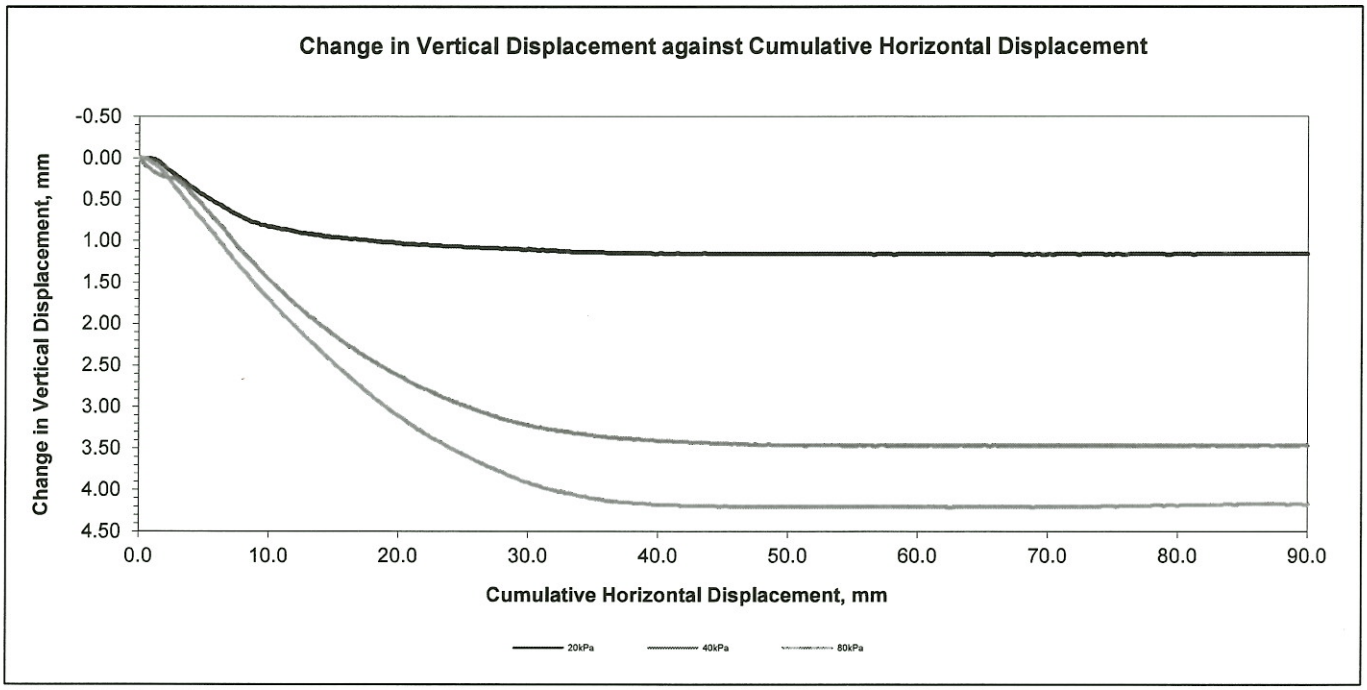
Soil: Capping soil (customer description)
Geosynthetic: Geofabrics GPT3 (geotextile only tested) (customer description)



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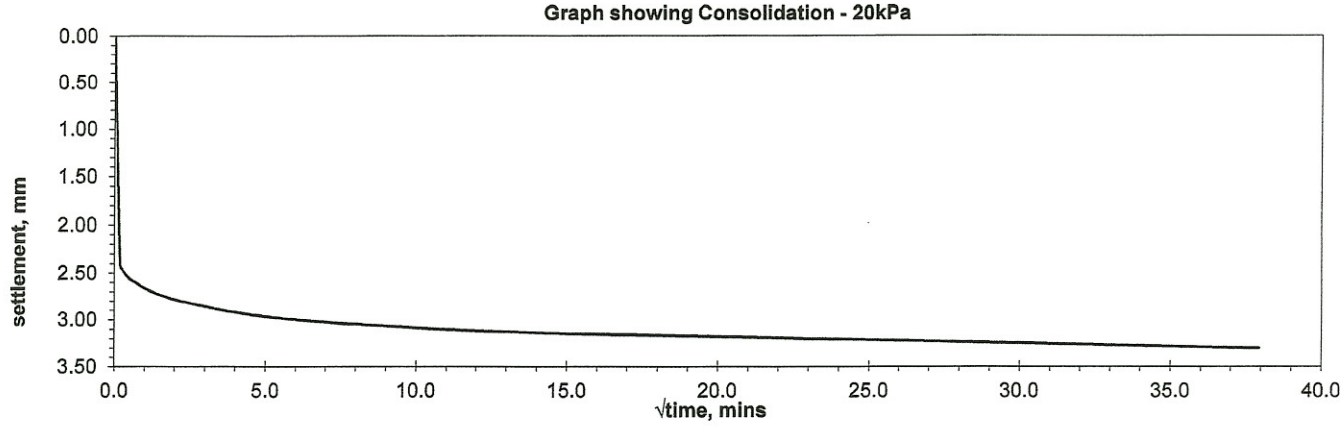
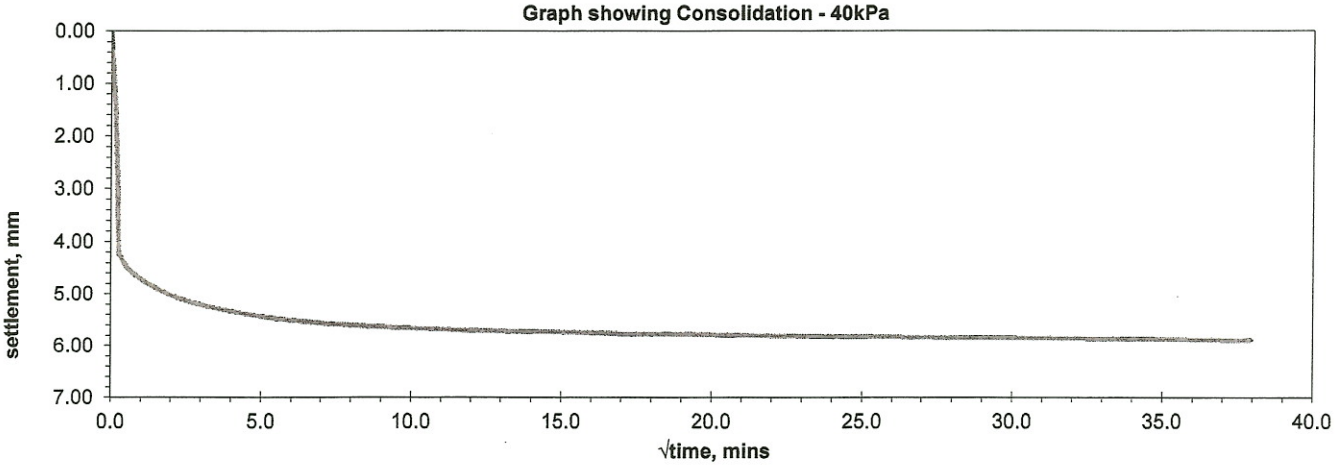
Determination of the Shear Strength by Direct Shear in the Large Shearbox
ASTM D5321- 17 Procedure B - Soil on Geosynthetic Interface Friction

Geospec Ref: GS/6259-02
Customer: Caulmert Ltd
Project/Site: Bryn Posteg
Soil: Capping soil (customer description)
Geosynthetic: Geofabrics GPT3 (geotextile only tested) (customer description)

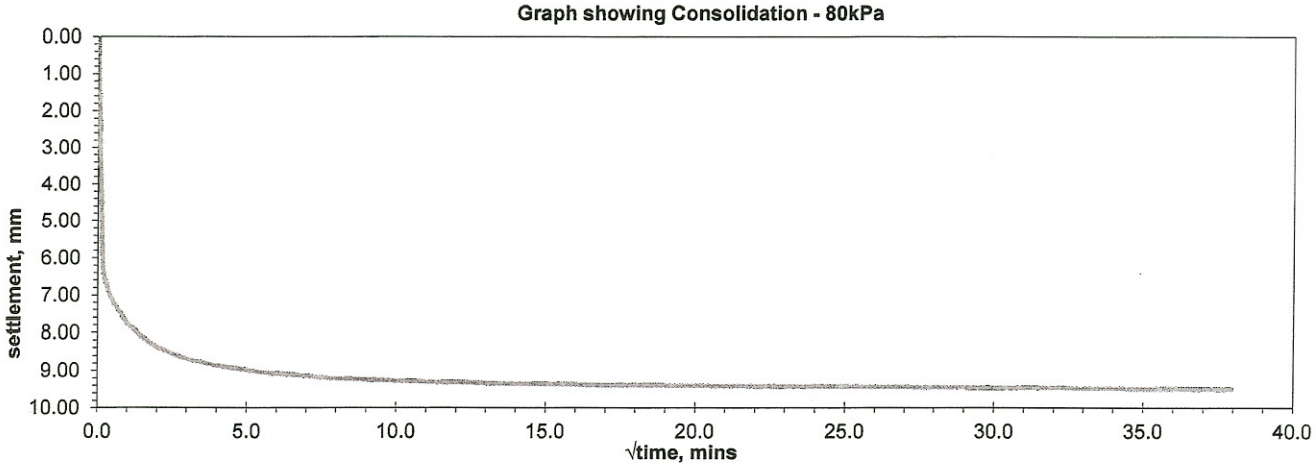
Graph showing Consolidation - 20kPa



Graph showing Consolidation - 40kPa



Graph showing Consolidation - 80kPa



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TEST REPORT

F.A.O. Paul Clayden
Caulmert Ltd
8 St. George Court
Altrincham Business Park
Dairy House Lane
Altrincham
WA14 5UA

Geospec Ref: GS/6259-03
Project/Site: Bryn Posteg
Product/Materials Received: A sample of geocomposite and several bags of soil were received.
Date Received: 17/05/18
Date Test Completed: 30/05/18
Date Report Completed: 31/05/18

Tests Requested/Details :

ASTM D5321-17 Procedure B - Soil on Geosynthetic Interface Friction
Determination of the Shear Strength by Direct Shear in the Large Shear box.
To determine the shear strength between Capping soil and ABG Pozidrain 6S250D/NW8 geocomposite (MD, cuspate side) with normal loads of 20, 40 & 80kPa. The geocomposite was fixed onto the lower part of the shearbox by the clamp plate & nut method and overlying an abrasive support plate. The soil was compacted into the upper part of the shearbox to a target bulk density of 1.75 Mg/m^3. Each test was conducted on a virgin specimen of geocomposite. The nominal dimensions of the bottom shearbox are 407 X 305mm. The nominal dimensions of the upper/top box are 305 X 305mm. The shear box was arranged to be used as a constant contact area shear box. The normal load was applied using a piston acting on a top loading plate. The measurements of shear stress and shear displacement were recorded at a frequency of every 0.25mm displacement. The displacement and pressure is measured using digital transducers. The shear force is measured using a S-type load cell. The shear box test was conducted in a laboratory maintained at a temperature of 20 ± 2°C and 60 ± 10% relative humidity.

Customer Specified parameters/information

Material name(s)	1) Capping soil
	2) ABG Pozidrain 6S250D/NW8 geocomposite
Side/face	1) N/A
	2) Cuspate side
Orientation	1) N/A
	2) machine direction
Test pressures	20, 40 & 80kPa
Compaction criteria	Moisture Content - as received
	Bulk density - 1.75 Mg/m^3
Consolidation	24 hours
Rate of displacement	0.5 mm/min
Dry/Submerged	Dry

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TEST REPORT

Determination of the Shear Strength by Direct Shear in the Large Shear box ASTM D5321- 17 Procedure B - Soil on Geosynthetic Interface Friction

Geospec Ref: GS/6259-03
Customer: Caulmert Ltd
Project/Site: Bryn Posteg
Soil: Capping soil (customer description)
Geosynthetic: ABG Pozidrain 6S250D/NW8 geocomposite (customer description)

	Test 1	Test 2	Test 3
Normal Stress	20kPa	40kPa	80kPa
"Peak" Shear Stress, kPa	**27.8**	**36.2**	**70.9**
Horizontal Displacement (at "Peak" Shear Stress), mm	30.09	36.56	21.13
Rate of Horizontal Displacement, mm/min	0.50	0.50	0.50
Tested Dry/Submerged	Dry	Dry	Dry
Particle Density (assumed), Mg/m^3	2.65	2.65	2.65
Bulk Density, Mg/m^3	1.75	1.75	1.75
Moisture Content, %	13	13	13
Dry Density, Mg/m^3	1.55	1.55	1.55
Initial Voids Ratio e_0	0.711	0.711	0.711
Degree of Saturation, %	48	48	48
Comments	None	Partial delamination of cuspate side geotextile	Considerable delamination of cuspate side geotextile
Angle of Friction, Peak	**36.5^O**		
Cohesion Intercept, Peak	**10.4kPa**		

Shear box/Interface shear testing - Note
The Angle of Friction and the Cohesion intercept are derived from a mathematical line of best fit between the measured shear strengths. The values reported are factual and may not be an appropriate description of the shear behaviour of the soil/interface. Determination of appropriate shear behaviour parameters should be undertaken by a suitably qualified geotechnical engineer.

Date: 31st May 2018

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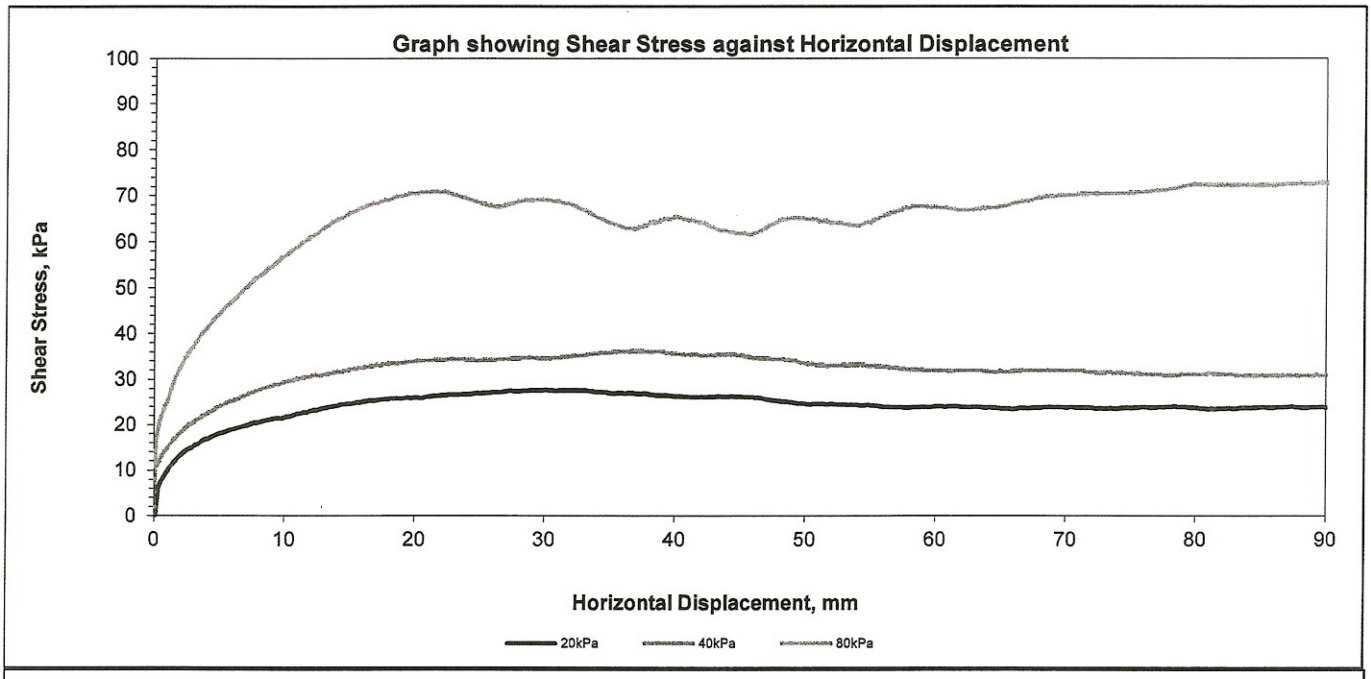
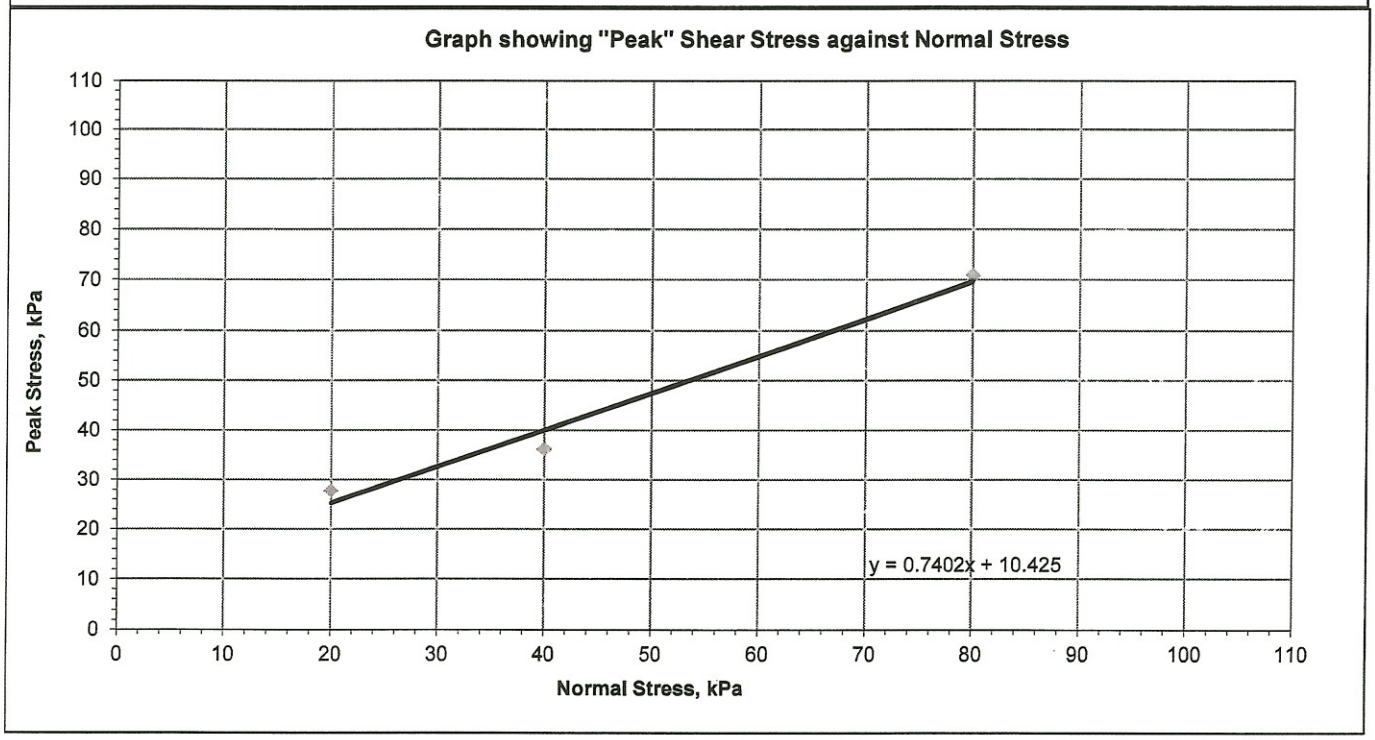
Determination of the Shear Strength by Direct Shear in the Large Shear box ASTM D5321- 17 Procedure B - Soil on Geosynthetic Interface Friction

Geospec Ref: GS/6259-03
Customer: Caulmert Ltd
Project/Site: Bryn Posteg
Soil: Capping soil (customer description)
Geosynthetic: ABG Pozidrain 6S250D/NW8 geocomposite (customer description)





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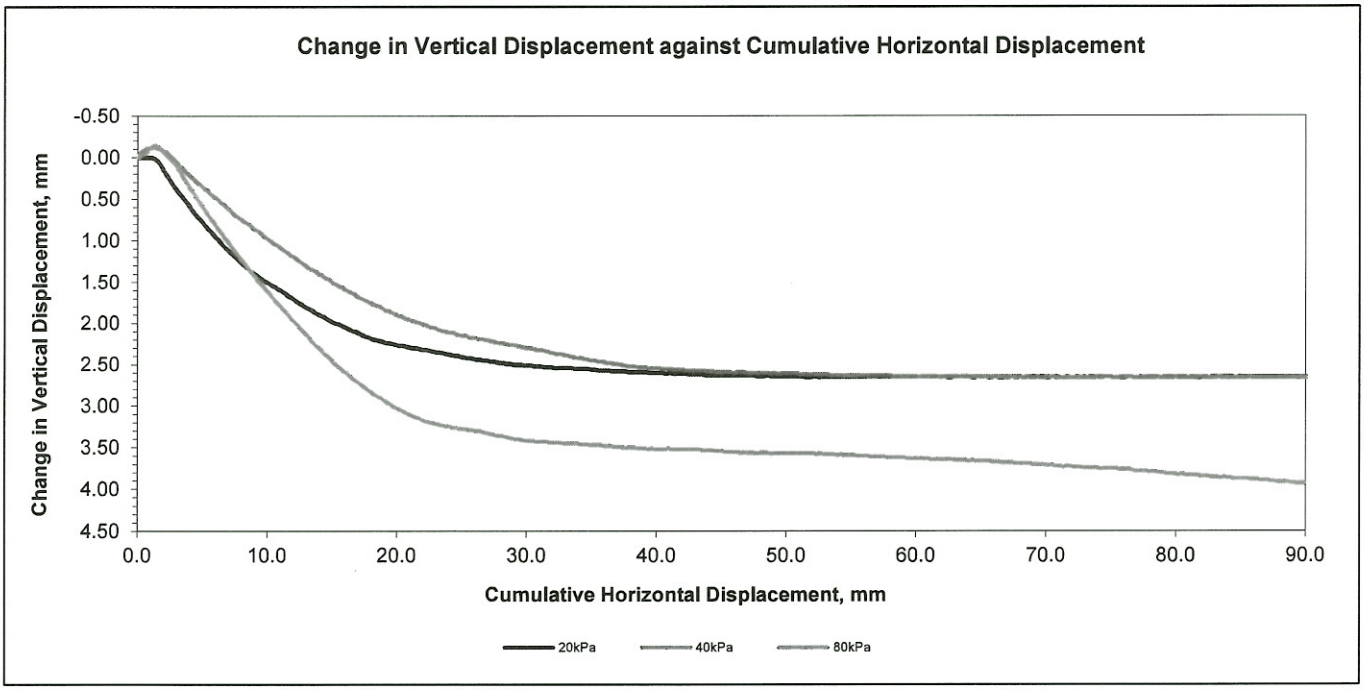
Determination of the Shear Strength by Direct Shear in the Large Shear box ASTM D5321- 17 Procedure B - Soil on Geosynthetic Interface Friction

Geospec Ref: GS/6259-03
Customer: Caulmert Ltd
Project/Site: Bryn Posteg
Soil: Capping soil (customer description)
Geosynthetic: ABG Pozidrain 6S250D/NW8 geocomposite (customer description)



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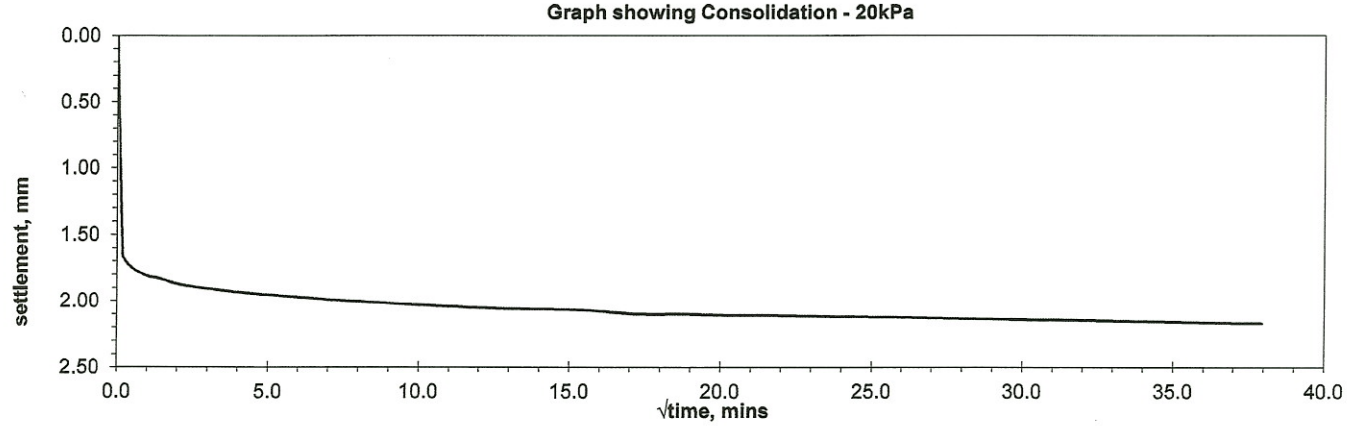
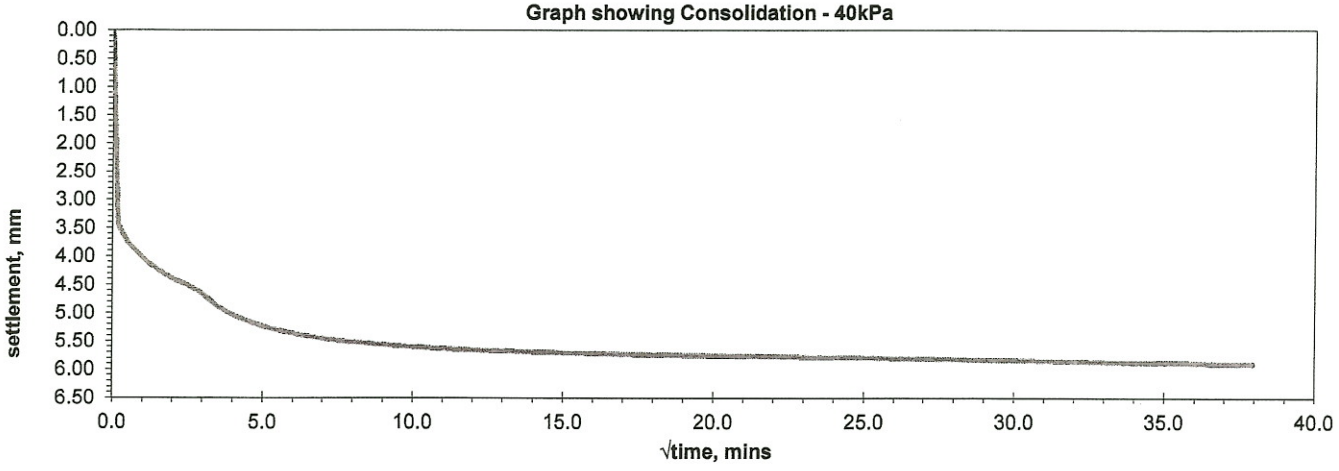
Determination of the Shear Strength by Direct Shear in the Large Shearbox
ASTM D5321- 17 Procedure B - Soil on Geosynthetic Interface Friction

Geospec Ref: GS/6259-03
Customer: Caulmert Ltd
Project/Site: Bryn Posteg
Soil: Capping soil (customer description)
Geosynthetic: ABG Pozidrain 6S250D/NW8 geocomposite (customer description)

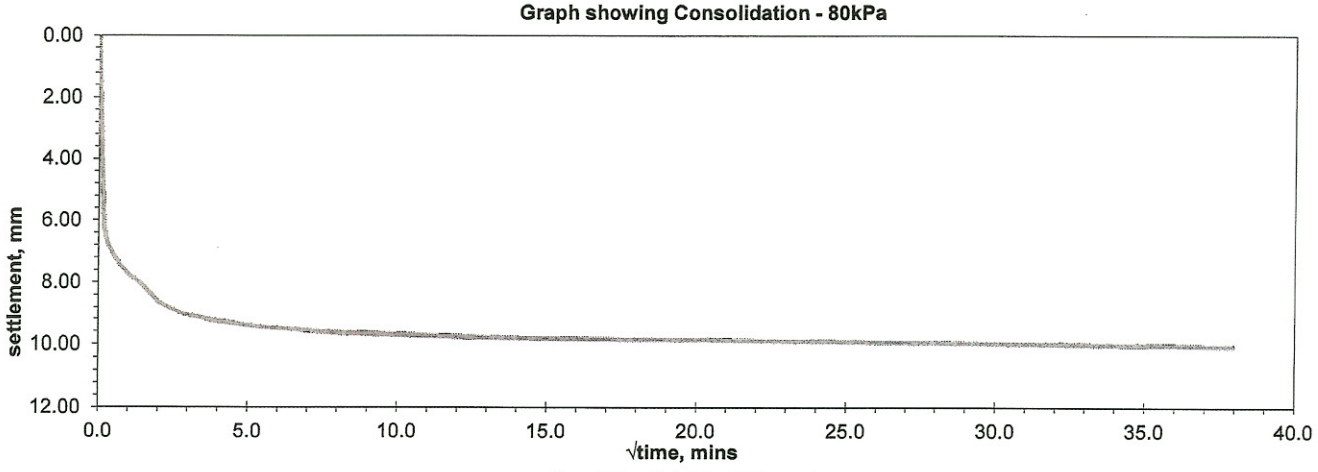
Graph showing Consolidation - 20kPa



Graph showing Consolidation - 40kPa



Graph showing Consolidation - 80kPa



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TEST REPORT

F.A.O. Paul Clayden
Caulmert Ltd
8 St. George Court
Altrincham Business Park
Dairy House Lane
Altrincham
WA14 5UA

Geospec Ref: GS/6259-04
Project/Site: Bryn Posteg
Product/Materials Received: A sample of geocomposite and several bags of soil were received.
Date Received: 17/05/18
Date Test Completed: 06/06/18
Date Report Completed: 07/06/18

Tests Requested/Details :

ASTM D5321-17 Procedure B - Soil on Geosynthetic Interface Friction
Determination of the Shear Strength by Direct Shear in the Large Shear box.
To determine the shear strength between Capping soil and ABG Pozidrain G4SD/NW8 geocomposite (MD, cuspate side) with normal loads of 20, 40 & 80kPa. The geocomposite was fixed onto the lower part of the shearbox by the clamp plate & nut method and overlying an abrasive support plate. The soil was compacted into the upper part of the shearbox to a target bulk density of 1.75 Mg/m^3. Each test was conducted on a virgin specimen of geocomposite. The nominal dimensions of the bottom shearbox are 407 X 305mm. The nominal dimensions of the upper/top box are 305 X 305mm. The shear box was arranged to be used as a constant contact area shear box. The normal load was applied using a piston acting on a top loading plate. The measurements of shear stress and shear displacement were recorded at a frequency of every 0.25mm displacement. The displacement and pressure is measured using digital transducers. The shear force is measured using a S-type load cell. The shear box test was conducted in a laboratory maintained at a temperature of 20 ± 2°C and 60 ± 10% relative humidity.

Customer Specified parameters/information

Material name(s)	1) Capping soil
	2) ABG Pozidrain G4SD/NW8 geocomposite
Side/face	1) N/A
	2) Cuspate side
Orientation	1) N/A
	2) machine direction
Test pressures	20, 40 & 80kPa
Compaction criteria	Moisture Content - as received
	Bulk density - 1.75 Mg/m^3
Consolidation	24 hours
Rate of displacement	0.5 mm/min
Dry/Submerged	Dry

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TEST REPORT

Determination of the Shear Strength by Direct Shear in the Large Shear box ASTM D5321- 17 Procedure B - Soil on Geosynthetic Interface Friction

Geospec Ref: GS/6259-04
Customer: Caulmert Ltd
Project/Site: Bryn Posteg
Soil: Capping soil (customer description)
Geosynthetic: ABG Pozidrain G4SD/NW8 geocomposite (customer description)

	Test 1	Test 2	Test 3
Normal Stress	20kPa	40kPa	80kPa
"Peak" Shear Stress, kPa	**39.1**	**48.3**	**80.2**
Horizontal Displacement (at "Peak" Shear Stress), mm	39.17	46.31	46.79
Rate of Horizontal Displacement, mm/min	0.50	0.50	0.50
Tested Dry/Submerged	Dry	Dry	Dry
Particle Density (assumed), Mg/m^3	2.65	2.65	2.65
Bulk Density, Mg/m^3	1.75	1.75	1.75
Moisture Content, %	13	13	13
Dry Density, Mg/m^3	1.55	1.55	1.55
Initial Voids Ratio e_0	0.711	0.711	0.711
Degree of Saturation, %	48	48	48
Comments	None	None	Partial delamination of cuspate side geotextile
Angle of Friction, Peak	**35.0°**		
Cohesion Intercept, Peak	**23.1kPa**		

Shear box/Interface shear testing - Note
The Angle of Friction and the Cohesion intercept are derived from a mathematical line of best fit between the measured shear strengths. The values reported are factual and may not be an appropriate description of the shear behaviour of the soil/interface. Determination of appropriate shear behaviour parameters should be undertaken by a suitably qualified geotechnical engineer.

Date: 7th June 2018

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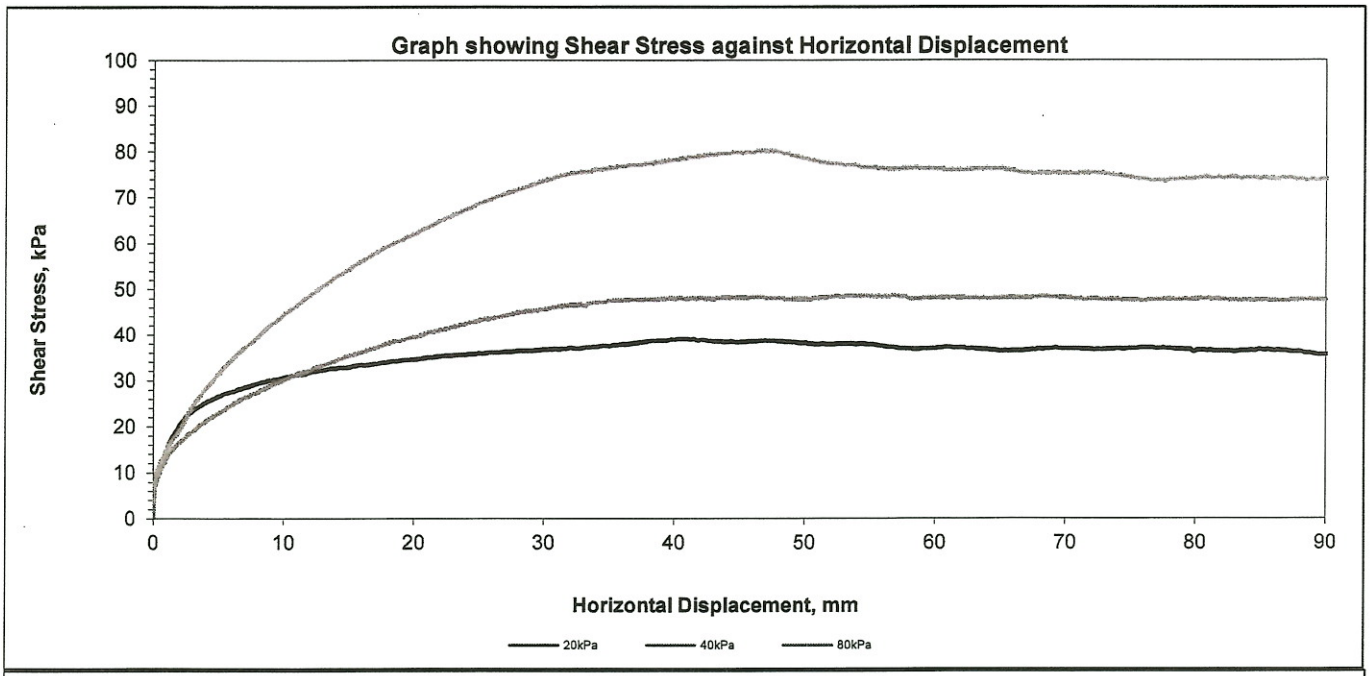
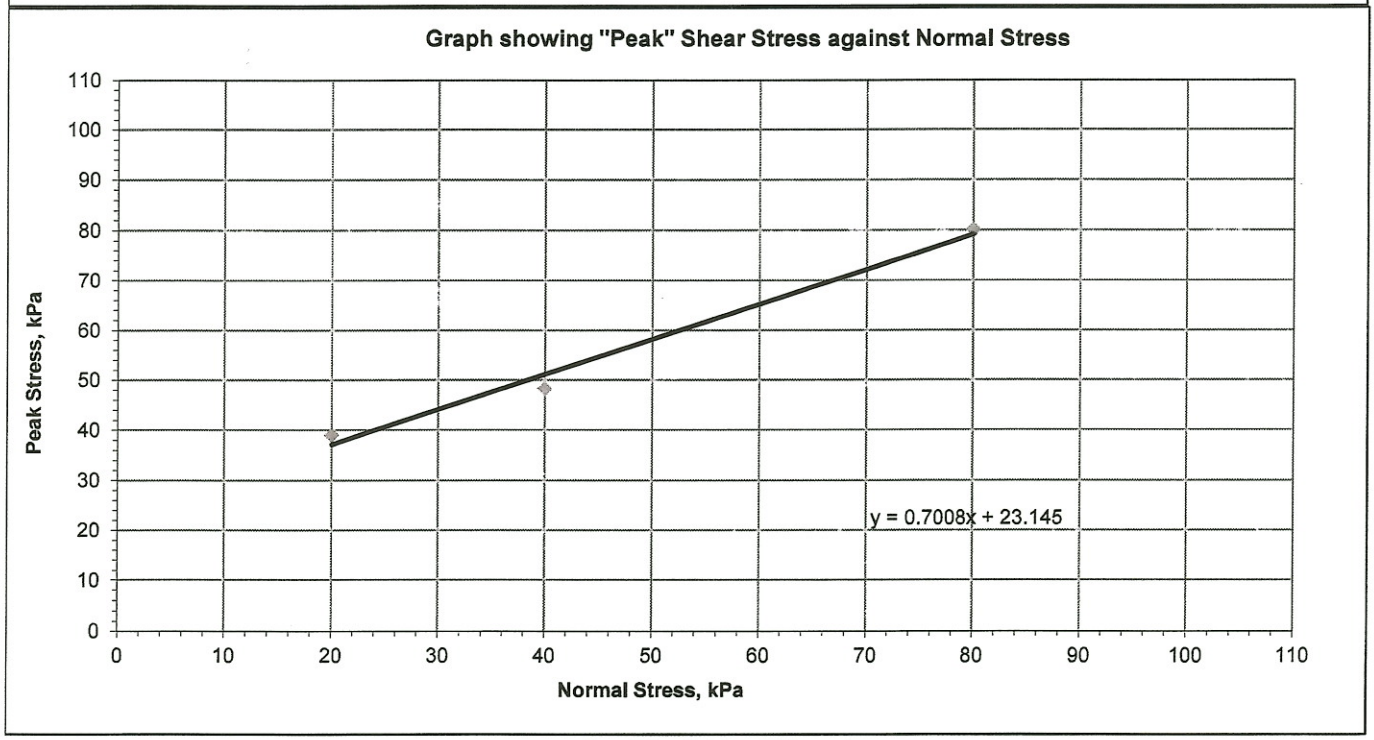
TEST REPORT

Determination of the Shear Strength by Direct Shear in the Large Shear box ASTM D5321- 17 Procedure B - Soil on Geosynthetic Interface Friction

Geospec Ref: GS/6259-04
Customer: Caulmert Ltd
Project/Site: Bryn Posteg
Soil: Capping soil (customer description)
Geosynthetic: ABG Pozidrain G4SD/NW8 geocomposite (customer description)





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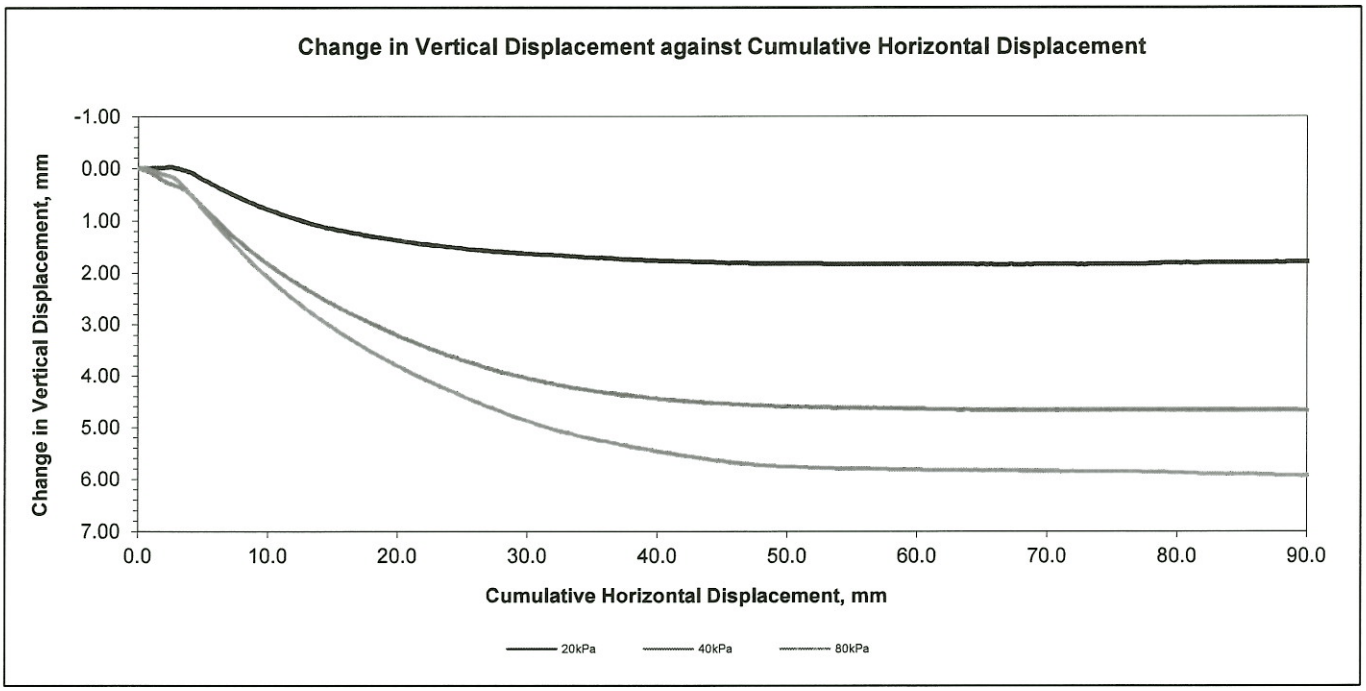
Geospec Ref: GS/6259-04
Customer: Caulmert Ltd
Project/Site: Bryn Posteg
Soil: Capping soil (customer description)
Geosynthetic: ABG Pozidrain G4SD/NW8 geocomposite (customer description)



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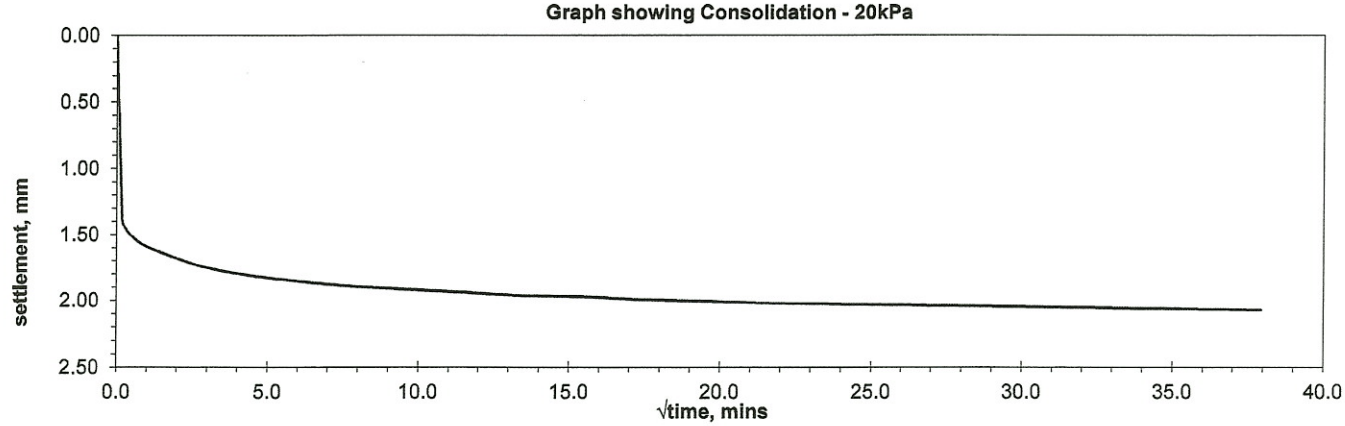
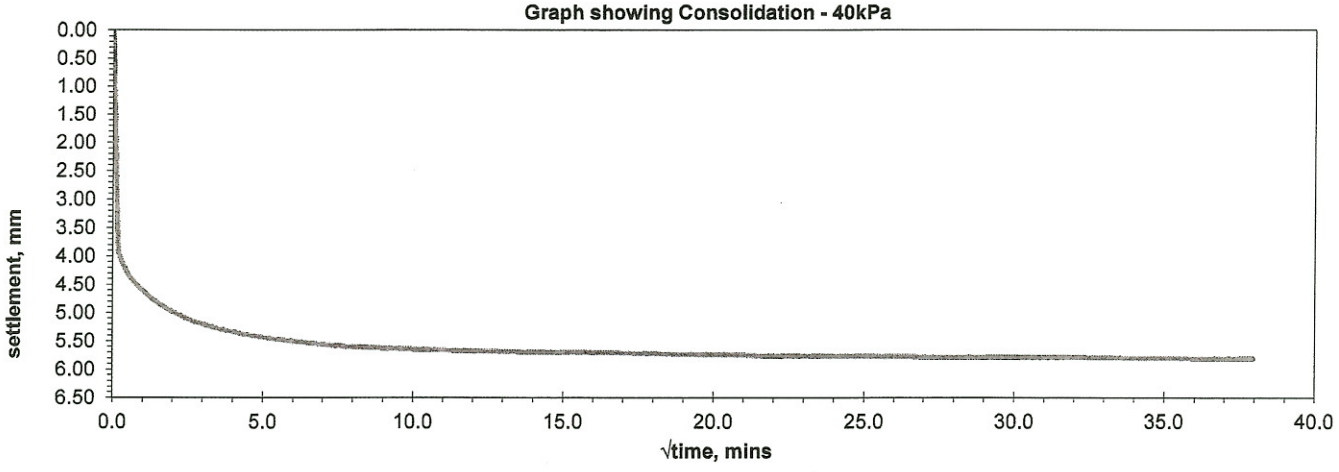
Determination of the Shear Strength by Direct Shear in the Large Shearbox
ASTM D5321- 17 Procedure B - Soil on Geosynthetic Interface Friction

Geospec Ref: GS/6259-04
Customer: Caulmert Ltd
Project/Site: Bryn Posteg
Soil: Capping soil (customer description)
Geosynthetic: ABG Pozidrain G4SD/NW8 geocomposite (customer description)

Graph showing Consolidation - 20kPa



Graph showing Consolidation - 40kPa



Graph showing Consolidation - 80kPa