Traynor
Environmental Ltd.

Belturbet Business Park,
Creeny,
Belturbet,
Co. Cavan.

Tel: 049 9522236
Fax: 049 9522808
Web: www.traynorenvironmental.com

23/236 TE

20.06.23

Daniel Leong
186 Whitehall Road,
Terenure,
Dublin 12

Re: Soakaway design as per BRE 365 for 186 Whitehall Road, Terenure, Dublin 12

Dear Daniel,

We have designed per BRE Digest 365 based on the total impermeable area as supplied and Met Eireann's Extreme Rainfall Return Periods for 186 Whitehall Road, Terenure, Dublin 12.

Site Information Supplied as part of the layout provided by Architects Drawings

Total Impermeable area to be drained = 180m2

Total Permeable area to be drained = 71.50 m2

Rainfall Information as Per Met Eireann (30 Year Rainfall Returns)

Storm dur.	Rainfall	20% Allowance for Climate Change
mins.	mm.	mm.
5	11.7	14.04
10	16.2	19.44
15	19.1	22.92
30	23.9	28.68
60	30	36.00

Void Ratio

The void ratio for the trench fill was set at 30% (0.3) to accommodate the use of granular fill material i.e. rounded gravel. The safety factor was taken as 1.

Soil infiltration rate

Tests carried out at 1.00m below ground level.

Calculated as per BRE365 = 0.0145mm/sec

The Base of the soakaway trial pit is set at 1.00 m Below the invert of the inlet drain According to BRE Digest 365 method

Traynor Environmental Ltd – BRE Digest 365 Calculations

Infiltration Rate	
Test Hole Dimension	
Length (l)	***1.00m***
Width (m)	***1.00m***
Depth (m)	***1.00m***
Drop Time (Sec)	***37920 sec***

Soil Infiltration Rate, $f = V_{p75-25} / a_{p50} \times t_{p75-25}$

Where

V_{p75-25} *= the effective storage volume of water in the trial pit between 75% and 25% effective depth;*

a_{p50} = *the internal surface area of the trial pit up to 50% effective depth and including the base area;*

t_{p75-25} *= the time for the water level to fall from 75% to 25% effective depth*

V_{p75-25} *= 1.00 x 1.00 x (0.825– 0.275) = 0.55m^3*

*0.55 / (1.00*37920) *1000*

= 0.0145mm/sec

Traynor Environmental Ltd.

We have designed as per BRE Digest 365 based on the total impermeable area, total permeable area and Met Eireann's Extreme Rainfall Return

Permeable Paving Design

CLIENT:	Daniel Leong 186 Whitehall Road, Terenure, Dublin 12
ATCE JOB NO.:	Traynor Env
JOB DESCRIPTION:	Proposed Development at 186 Whitehall Road, Terenure, Dublin 12
Paving Design	Overall

Input Data

Impermeable Area to be drained	**Ai**	180	m2		Soil permeability	1.45E-05	m/s
Permeable area to be drained	**Ap**	71.5	m2		Factor of Safety	3	
Ratio of 60min-2day M5 - r	**r**	0.4			Stone Void Ratio	0.300	

	M10-5min	M10-10min	M10-15min	M10-30min	M10-60min					
Design Rainfall-R (mm)	14.0	19.4	22.9	28.7	36.0					
Storage depth (mm)	165	228	268	336	421					

Figure 1: Site Layout 186 Whitehall Road, Terenure, Dublin 12 showing Location of Tested Area

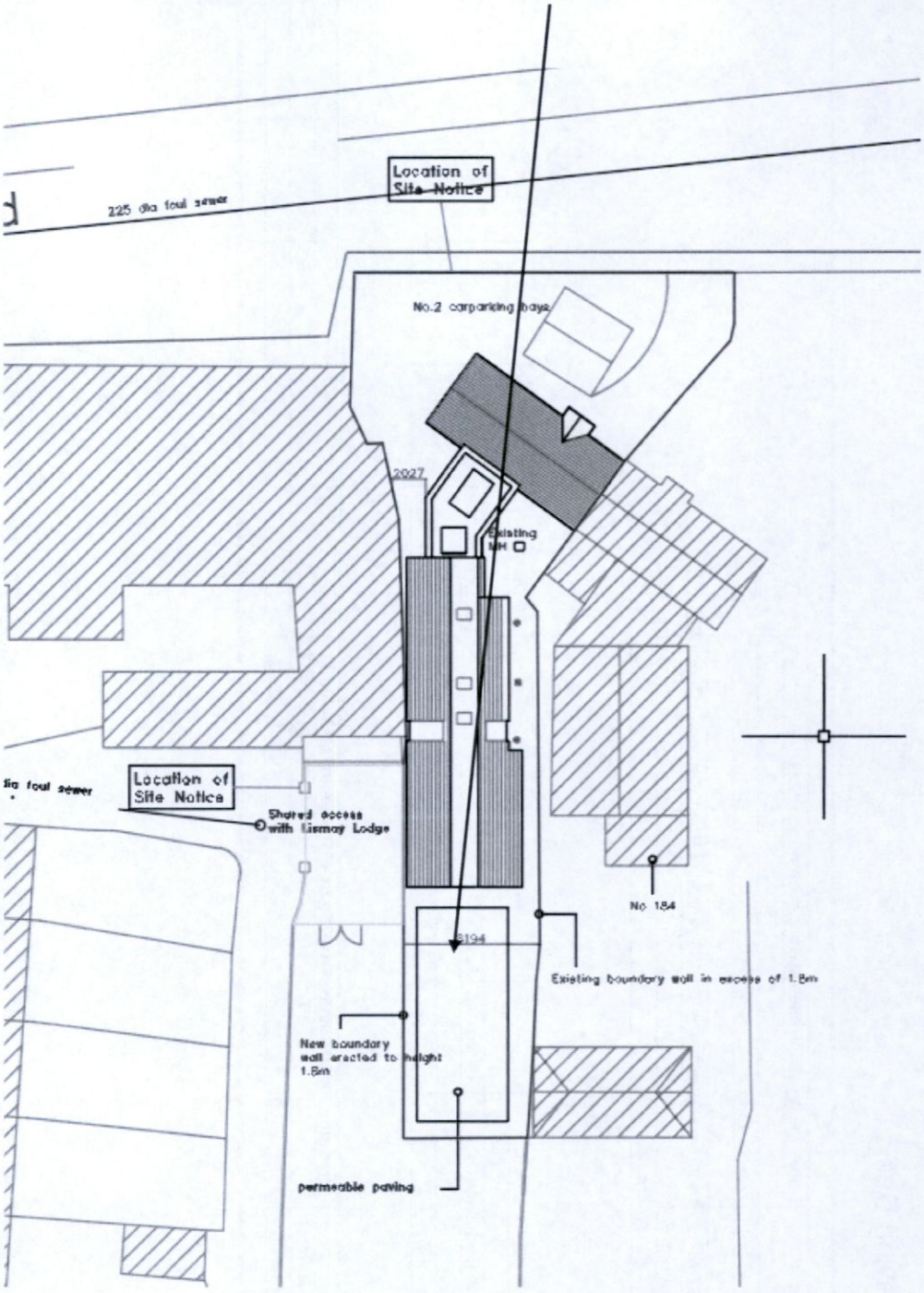
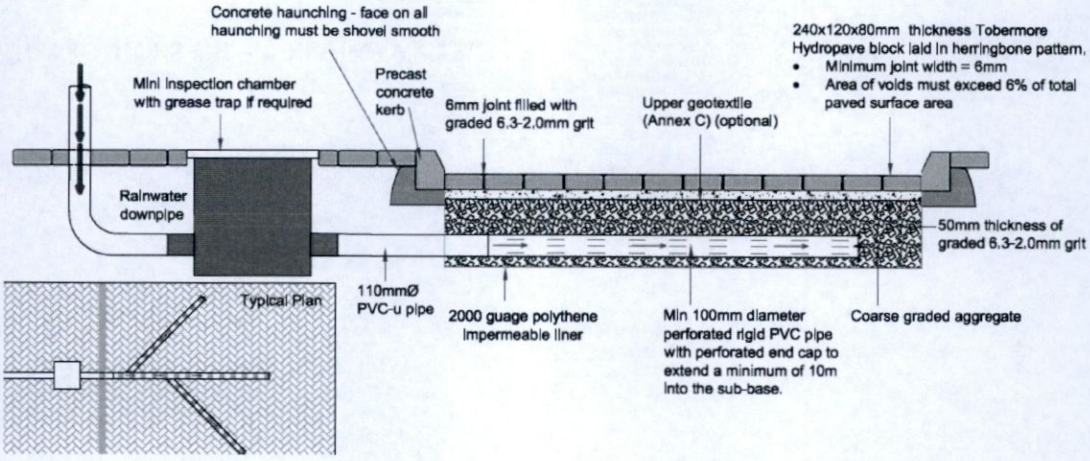


Figure 2: Cross Section

Downpipe Drainage into Attenuation System



NB:
During the design process, a Silt Trap **must** be incorporated into any drains discharging into the permeable paving system.

NB:

Please note for the purpose of the design, that the fill material used must have no less free volume than 30%.

NB:

All elements of the permeable paving **must** be maintained by suitably qualified professionals *i.e. Silt traps must be regularly cleaned.*

Should you have any queries on this, do not hesitate to contact me.

Yours sincerely

Nevin Traynor

BSc. Env, H.Dip I.T, Cert SHWW, EPA/FAS Cert.

For **Traynor Environmental Ltd**

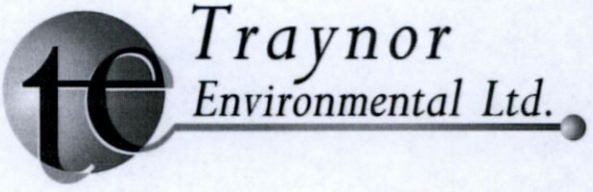
Encl – Appendices A-E

SOAKAWAY TESTING TO BRE DIGEST 365

COMPLETED BY

TRAYNOR ENVIRONMENTAL LTD

APPENDIX A – SITE PHOTOGRAPHS



Surface Photo of the Soakaway	Soakaway Under Test
	

SOAKAWAY TESTING TO BRE DIGEST 365

COMPLETED BY

TRAYNOR ENVIRONMENTAL LTD

APPENDIX B – TRIAL PIT LOG

Traynor Environmental Ltd.

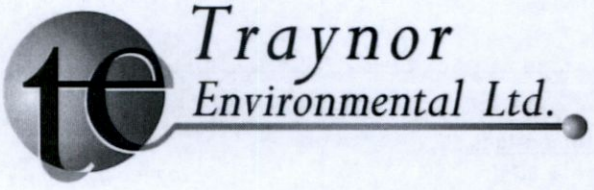
Trial Pit Number TP 1	Traynor Environmental Ltd Unit 6, Belturbet Business Park Creeny Belturbet Co. Cavan			Sheet 1 of 1		
Project *Proposed Development Site at 186, Whitehall Road, Terenure, Dublin 12*			**Client** *Daniel Leong*			
Method 3 ton digger	**Ground Level**			**Start Date** *26th May 2023*		
Description	**Legend**	**Reduced Level**	**Depth**	**Installation Backfill**	**Sample Test**	**Notes**
Silt/Clay, Crumb Nature, Low Density Brown Colour			*0.00m - 0.40m*			
Clay intermixed with stone Blocky Nature, Blocky Density Brown Colour			*0.40m- 1.10m*			
Winter Water Table			*1.10m- 1.50m*			
Groundwater Table			*1.50m- 2.10m*			
Trial Pit Completed at 2.1m BGL.						
Remarks: *Bedrock None Encountered Winter Water Table: 1.10m BGL Groundwater Table: 1.50m BGL Average soakage characteristics of the subsoil.*	**Pit Dimensions** Depth: 2.20m Length: 3.0m Width: 1.20m Orientation of Long Side: 000 Degrees			Logged by Nevin Traynor		

SOAKAWAY TESTING TO BRE DIGEST 365

COMPLETED BY

TRAYNOR ENVIRONMENTAL LTD

APPENDIX C – MET EIREANN RAINFALL RETURN PERIODS



Met Eireann
Return Period Rainfall Depths for sliding Durations
Irish Grid: Easting: 312189, Northing: 229874,

	Interval		Years												
DURATION	6months,	1year,	2,	3,	4,	5,	10,	20,	30,	50,	75,	100,	150,	200,	250,	500,
5 mins	2.5,	3.6,	4.3,	5.3,	5.9,	6.5,	8.2,	10.3,	11.7,	13.6,	15.4,	16.8,	19.0,	20.7,	22.1,	N/A ,
10 mins	3.5,	5.1,	6.0,	7.3,	8.3,	9.0,	11.5,	14.3,	16.2,	19.0,	21.5,	23.4,	26.4,	28.8,	30.8,	N/A ,
15 mins	4.1,	6.0,	7.0,	8.6,	9.7,	10.6,	13.5,	16.9,	19.1,	22.3,	25.3,	27.5,	31.1,	33.9,	36.2,	N/A ,
30 mins	5.4,	7.8,	9.1,	11.1,	12.5,	13.6,	17.1,	21.2,	23.9,	27.8,	31.3,	34.0,	38.3,	41.6,	44.4,	N/A ,
1 hours	7.1,	10.2,	11.8,	14.3,	16.0,	17.3,	21.7,	26.7,	30.0,	34.6,	38.8,	42.1,	47.1,	51.1,	54.3,	N/A ,
2 hours	9.4,	13.2,	15.3,	18.4,	20.5,	22.1,	27.5,	33.5,	37.5,	43.1,	48.2,	52.0,	58.0,	62.7,	66.5,	N/A ,
3 hours	11.1,	15.5,	17.8,	21.3,	23.7,	25.6,	31.6,	38.3,	42.8,	49.1,	54.6,	58.9,	65.5,	70.6,	74.9,	N/A ,
4 hours	12.4,	17.3,	19.9,	23.7,	26.3,	28.3,	34.8,	42.2,	47.0,	53.7,	59.7,	64.3,	71.4,	76.9,	81.5,	N/A ,
6 hours	14.6,	20.2,	23.1,	27.5,	30.4,	32.7,	40.0,	48.2,	53.6,	61.1,	67.7,	72.8,	80.7,	86.7,	91.7,	N/A ,
9 hours	17.2,	23.6,	26.9,	31.9,	35.2,	37.7,	46.0,	55.1,	61.1,	69.5,	76.8,	82.5,	91.1,	97.7,	103.2,	N/A ,
12 hours	19.3,	26.3,	30.0,	35.4,	39.0,	41.8,	50.7,	60.6,	67.1,	76.1,	84.0,	90.0,	99.3,	106.4,	112.3,	N/A ,
18 hours	22.8,	30.7,	34.9,	41.0,	45.1,	48.2,	58.3,	69.4,	76.5,	86.5,	95.2,	101.9,	112.1,	120.0,	126.4,	N/A ,
24 hours	25.5,	34.3,	38.9,	45.6,	50.0,	53.4,	64.3,	76.3,	84.0,	94.8,	104.1,	111.3,	122.3,	130.6,	137.5,	161.2,
2 days	31.7,	41.7,	46.8,	54.2,	59.1,	62.8,	74.7,	87.5,	95.7,	107.0,	116.8,	124.2,	135.5,	144.1,	151.1,	175.2,
3 days	36.7,	47.7,	53.2,	61.3,	66.5,	70.5,	83.1,	96.7,	105.3,	117.2,	127.4,	135.1,	146.8,	155.6,	162.9,	187.5,
4 days	41.1,	52.9,	58.8,	67.4,	73.0,	77.2,	90.5,	104.7,	113.7,	126.0,	136.6,	144.7,	156.7,	165.8,	173.3,	198.5,
6 days	48.8,	62.0,	68.6,	78.0,	84.1,	88.8,	103.2,	118.6,	128.3,	141.5,	152.7,	161.2,	174.0,	183.6,	191.4,	217.8,
8 days	55.5,	70.0,	77.1,	87.3,	93.9,	98.9,	114.3,	130.7,	141.0,	154.9,	166.8,	175.7,	189.0,	199.1,	207.2,	234.7,
10 days	61.8,	77.2,	84.9,	95.8,	102.8,	108.0,	124.4,	141.6,	152.5,	167.0,	179.4,	188.7,	202.6,	213.1,	221.5,	250.0,
12 days	67.6,	84.0,	92.2,	103.6,	111.0,	116.5,	133.7,	151.8,	163.0,	178.2,	191.1,	200.7,	215.1,	225.9,	234.7,	264.0,
16 days	78.3,	96.5,	105.5,	118.1,	126.1,	132.1,	150.7,	170.2,	182.3,	198.5,	212.3,	222.6,	237.9,	249.3,	258.6,	289.5,
20 days	88.3,	108.1,	117.7,	131.3,	139.9,	146.4,	166.3,	187.0,	199.8,	217.0,	231.5,	242.4,	258.4,	270.5,	280.2,	312.5,
25 days	99.9,	121.5,	131.9,	146.6,	155.9,	162.9,	184.2,	206.3,	220.0,	238.2,	253.6,	265.1,	282.0,	294.7,	304.9,	338.8,

NOTES:
N/A Data not available
These values are derived from a Depth Duration Frequency (DDF) Model
For details refer to:
'Fitzgerald D. L. (2007), Estimates of Point Rainfall Frequencies, Technical Note No. 61, Met Eireann, Dublin',
Available for download at www.met.ie/climate/dataproducts/Estimation-of-Point-Rainfall-Frequencies_TN61.pdf

SOAKAWAY TESTING TO BRE DIGEST 365

COMPLETED BY

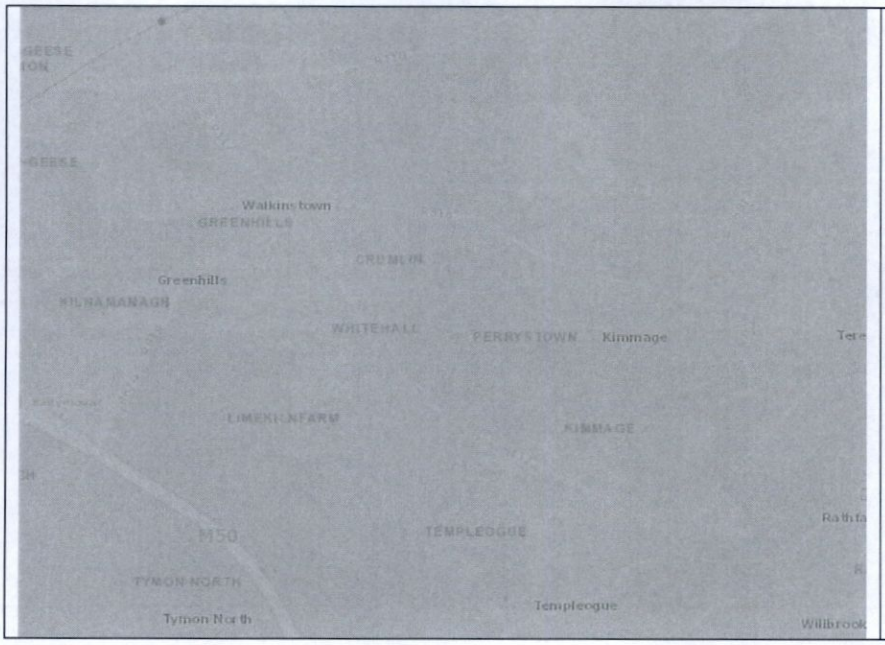
TRAYNOR ENVIRONMENTAL LTD

APPENDIX D – MAPS USED AS PART OF THE DESK STUDY

Traynor Environmental Ltd.

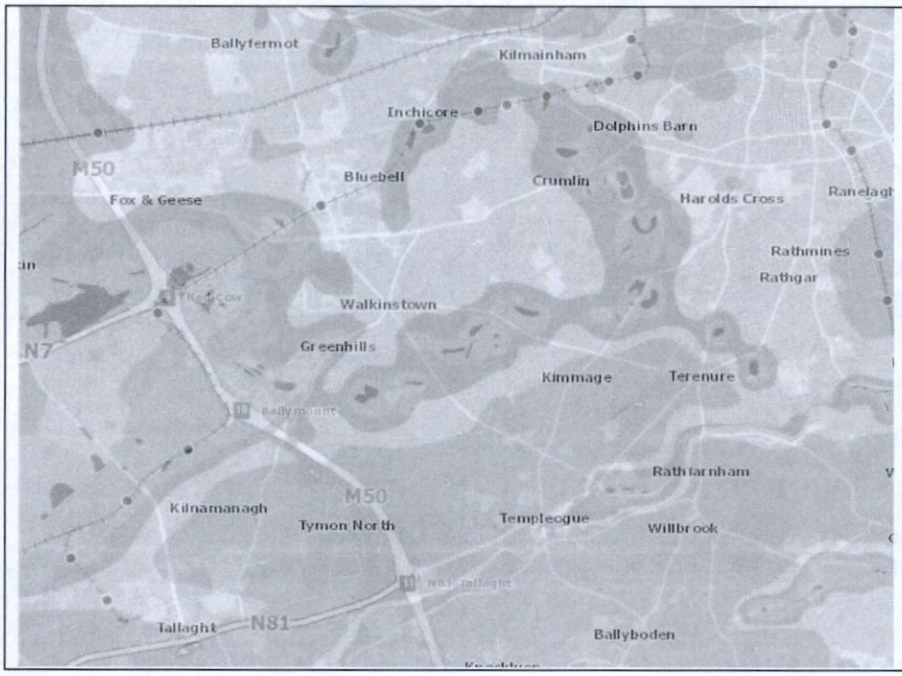
Maps Used As Part of the EPA Site Suitability Assessment

Groundwater/Aquifer Map



From the GSI Groundwater Aquifer Map Site is classified as Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones

Vulnerability Map



From the GSI Vulnerability Map Site is classified as Low

Bedrock Map

From the GSI Bedrock Map Site is classified as Dinantian Upper Impure Limestones

Teagasc Subsoil Map

From the GSI Teagasc Subsoil Map Site is classified as Urban

Traynor Environmental Ltd.

SOAKAWAY TESTING TO BRE DIGEST 365

COMPLETED BY

TRAYNOR ENVIRONMENTAL LTD

APPENDIX E – INSURANCE

Griffiths & Armour Europe DAC
Alexandra House
The Sweepstakes
Ballsbridge
Dublin 4
+353 (0)1 664 1400
+353 (0)1 634 9001
info@griffithsandarmour.com
griffithsandarmour.com

Griffiths & Armour

PROFESSIONAL INDEMNITY INSURANCE

We confirm the following details relating to our client's Professional Indemnity Insurance:

Insured:	Traynor Environmental Ltd
Address:	Belturbet Business Park Creeny Belturbet Co. Cavan H14AY94
Lead Insurer(s):	Axis Specialty Europe SE
Period of Insurance:	12 July 2022 to 11 July 2023
Policy Number:	21/1/06611
Limit of Indemnity:	€1,500,000 any one claim and unlimited in the period of insurance

Signed:

Graeme Tinney
Chief Executive Officer
Griffiths & Armour Europe DAC

Date: **11 July 2022**

The policy is subject to the insuring agreements, exceptions, exclusions, limitations, conditions and declarations contained therein. The above is accurate at the date of signature. No obligation is imposed herein on the signatory to advise of any alteration.

v **1.2**
March 2018

hydropave permeable paving

www.**tobermore**.co.uk | 0844 800 5736 |

Hydropave Pedesta Charcoal & Natural | VW Showroom, Chester

contents

Hydropave Tegula Duo Bracken | Campbell College Junior School, Belfast

world class

hydropave permeable paving

Tobermore offer an extensive variety of Hydropave Permeable Paving products. With all the versatility and aesthetic qualities of our standard and most popular paving products, the Hydropave range allows the creation of spectacular hard landscaping features with environmentally friendly products that reduce the risk of flooding and pollution.

specification sheets

hydropave tegula

ISO 9001:2008

ISO 14001:2004

timeless elegance

- Functions as a SUDS paving system
- Tumbled to give an aged, antique appearance
- Evokes timeless style and elegance
- Vibrant long-lasting colours
- Significantly reduced efflorescence
- Suitable for both modern or period properties

product specifications

Product type	Concrete Paving Block
Manufactured to	BS EN 1338:2003
Frost Protection	Yes
Efflorescence	Minimum 12 hour vapour curing to significantly reduce the possibility of efflorescence
Drainage Void Width	**60mm:** 5% to accommodate correct grit grading, reduced maintenance and maximise drainage flow rate **80mm:** 6% to accommodate correct grit grading, reduced maintenance and maximise drainage flow rate
Permeability	**60mm:** 29,000 litres/sec/hectare **80mm:** 35,000 litres/sec/hectare
Strength	> 3.6MPa
Slip/Skid resistance	Extremely Low (>75 USRV)
Installed to	BS 7533-3:2005
NSSPlus	Q24 115
Applications	Residential and Commercial when used in conjunction with the correct sub-base design in accordance with the latest British Standard.
Energy used	100% renewable energy
Water used	100% water used from rainwater harvesting system
Carbon Footprint	**60mm:** 24kgCo^2e/m^2 **80mm:** 34kgCo^2e/m^2
Recyclable	100% of this product can be recycled
Design Life	25 years - The correct design and aggregates must be used in accordance with the relevant British Standard or any design guidance provided.
Manufacturing location	Produced in the UK with locally sourced materials
breeam rating www.bre.co.uk	**60mm:** **A**, according to the Green Guide to Specification, 4th Edition 2009. **A+**, can be achieved by using a recycled sub-base. **80mm:** **B**, according to the Green Guide to Specification, 4th Edition 2009. **A**, can be achieved by using a recycled sub-base.

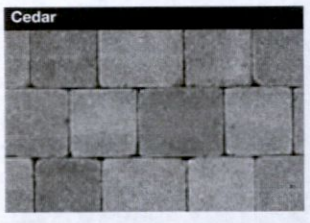
Tobermore products are manufactured in accordance with an accredited ISO 9001:2008 quality system. Manufacturing facilities are accredited to ISO14001:2004 Environmental Management. The company publish Environmental labels and declarations in accordance with BS EN ISO 14021:2001.

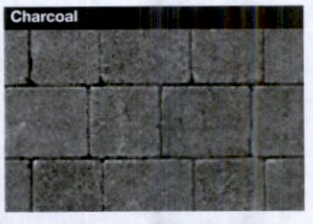
colours

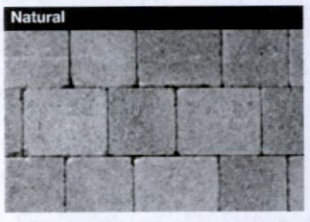

Bracken

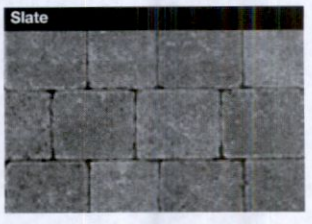

Heather

The swatches below are for colour reference only. The actual block profile for Hydropave Tegula Duo will be as per swatches above.


Cedar


Charcoal


Natural


Slate


Hydropave Tegula Duo Bracken

product	size (mm)	colours available	in stock	m^2 per pack	m^2 per slice	no. per m^2	no. per pack	weight (kg) per pack
HYDROPAVE TEGULA 200	200 x 100 x 80	Bracken, Charcoal, Heather	MADE TO ORDER	9.6	1.6	50	480	1732
HYDROPAVE TEGULA 240 BIM	240 x 120 x 80	Bracken, Charcoal, Slate	YES	10.08	2.02	34.72	350	1781
HYDROPAVE TEGULA DUO BIM (both sizes in one pack)	208 x 173 x 60	Bracken, Cedar, Charcoal, Heather, Natural, Slate	YES	12.87	0.99	30	195	1721
	173 x 173 x 60						195	

BIM This product is available to download from our website in **BIM Level 2** format.

Refer to all instructions and warnings on our website

hydropave fusion

modular granite paving

ISO 9001:2008 ISO 14001:2004

- Functions as a SUDS paving system
- Vibrant, granite appearance
- Manufactured with sparkling natural granite aggregates
- Superb hard-wearing granite surface
- Vibrant long-lasting colours
- Significantly reduced efflorescence
- Creates a striking, contemporary look

Important Information

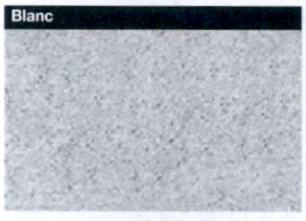
Tobermore recommend that you separate product groups using contrasting bands of colour as each product is manufactured separately and may have slight variations in colour.

product specifications

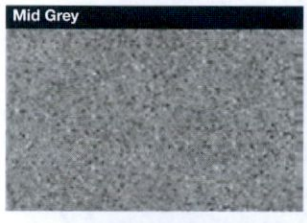
Product type	Concrete Paving Block
Manufactured to	BS EN 1338:2003
Surface Layer	Hard wearing surface layer with a minimum layer of 4mm and >350kgs/m³ cement
Granite Content in Surface Layer	Not less than 53% of granite aggregate in surface layer for Silver, Graphite and Mid Grey; not less than 45% of granite aggregate in surface layer for Sandstone.
Frost Protection	Yes
Efflorescence	Minimum 12 hour vapour curing to significantly reduce the possibility of efflorescence
Drainage Void Width	5.5% to accommodate correct grit grading, reduced maintenance and maximise drainage flow rate
Permeability	32,000 litres/sec/hectare
Strength	> 3.6MPa
Slip/Skid resistance	Extremely Low (>75 USRV)
Installed to	BS 7533-3:2005
NSSPlus	Q24 115
Applications	Residential and Commercial when used in conjunction with the correct sub-base design in accordance with the latest British Standard.
Energy used	100% renewable energy
Water used	100% water used from rainwater harvesting system
Carbon Footprint	34kgCo²e/m²
Recyclable	100% of this product can be recycled
Recycled Content	Not less than 8% (Azure Blue, Graphite, Jade Green, Mid Grey, Russet, Silver)
Design Life	25 years - The correct design and aggregates must be used in accordance with the relevant British Standard or any design guidance provided.
Manufacturing location	Produced in the UK with locally sourced materials
breeam rating www.bre.co.uk	**B**, according to the Green Guide to Specification, 4th Edition 2009. **A,** can be achieved by using a recycled sub-base.

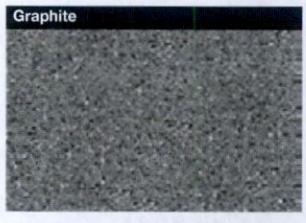
Tobermore products are manufactured in accordance with an accredited ISO 9001:2008 quality system. Manufacturing facilities are accredited to ISO14001:2004 Environmental Management. The company publish Environmental labels and declarations in accordance with BS EN ISO 14021:2001.

colours

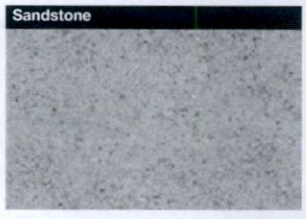

Blanc


Silver


Mid Grey


Graphite


Noir


Sandstone


Hydropave Fusion Sandstone & Silver

product	size (mm)	colours available	in stock	m² per pack	m² per slice	no. per m²	no. per pack	weight (kg) per pack
HYDROPAVE FUSION	200 x 100 x 80	Graphite, Mid Grey, Silver	YES	9.6	1.6	50	480	1739
	300 x 200 x 80	Blanc, Graphite, Mid Grey, Noir, Sandstone, Silver	MADE TO ORDER	9.6	2.4	16.66	160	1756
	300 x 300 x 80	Blanc, Graphite, Mid Grey, Noir, Sandstone, Silver	MADE TO ORDER	10.8	2.7	11.11	120	1973
	600 x 300 x 80	Blanc, Graphite, Mid Grey, Noir, Sandstone, Silver	MADE TO ORDER	10.8	5.4	5.55	60	1973

Refer to all instructions and warnings on our website

hydropave sienna

ISO 9001:2008 ISO 14001:2004

vibrant granite appearance

- Functions as a SUDS paving system
- Manufactured with sparkling natural granite aggregates
- Superb hard-wearing granite surface
- Vibrant long-lasting colours
- Significantly reduced efflorescence
- Creates a striking, contemporary look

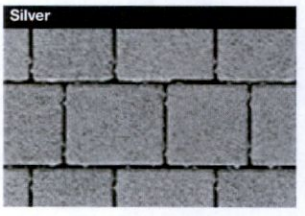
product specifications

Product type	Concrete Paving Block
Manufactured to	BS EN 1338:2003
Surface Layer	Hard wearing surface layer with a minimum layer of 4mm and >350kgs/m³ cement
Granite Content	Not less than 53% of granite aggregate in surface layer for Silver and Graphite; not less than 45% of granite aggregate in surface layer for Sandstone.
Frost Protection	Yes
Efflorescence	Minimum 12 hour vapour curing to significantly reduce the possibility of efflorescence
Drainage Void Width	5% to accommodate correct grit grading, reduced maintenance and maximise drainage flow rate
Permeability	29,000 litres/sec/hectare
Strength	> 3.6MPa
Slip/Skid resistance	Extremely Low (>75 USRV)
Installed to	BS 7533-3:2005
NSSPlus	Q24 115
Applications	Residential and Commercial when used in conjunction with the correct sub-base design in accordance with the latest British Standard.
Energy used	100% renewable energy
Water used	100% water used from rainwater harvesting system
Carbon Footprint	**Silver:** 24kgCo²e/m² **Sandstone:** 26kgCo²e/m² **Graphite:** 26kgCo²e/m²
Recyclable	100% of this product can be recycled
Recycled Content	Not less than 6% recycled materials included (Silver & Graphite only)
Design Life	25 years - The correct design and aggregates must be used in accordance with the relevant British Standard or any design guidance provided.
Manufacturing location	Produced in the UK with locally sourced materials
breeam rating www.**bre**.co.uk	**A**, according to the Green Guide to Specification, 4th Edition 2009. **A+**, can be achieved by using a recycled sub-base.

Tobermore products are manufactured in accordance with an accredited ISO 9001:2008 quality system. Manufacturing facilities are accredited to ISO14001:2004 Environmental Management. The company publish Environmental labels and declarations in accordance with BS EN ISO 14021:2001.

colours

Silver

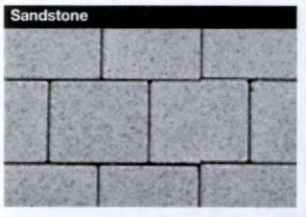


Important Information

Light coloured blocks emphasis tyre marks and oil spills. It must be accepted that these products will need more maintenance if the overall appearance is to be maintained.

The swatches below are for colour reference only. The actual block profile will be as per swatch above.

Sandstone



Graphite

Hydropave Sienna Duo Silver

product	size (mm)	colours available	in stock	m² per pack	m² per slice	no. per m²	no. per pack	weight (kg) per pack
HYDROPAVE SIENNA DUO BIM (both sizes in one pack)	208 x 173 x 60	Graphite, Sandstone, Silver	YES	12.87	0.99	30	195	1800
	173 x 173 x 60						195	

BIM This product is available to download from our website in **BIM Level 2** format.

Refer to all instructions and warnings on our website

hydropave shannon

ISO 9001:2008 ISO 14001:2004

delightful smooth finish

- Functions as a SUDS paving system
- Superb hard-wearing smooth surface
- Vibrant long-lasting colours
- Significantly reduced efflorescence

product specifications

Product type	Concrete Paving Block
Manufactured to	BS EN 1338:2003
Surface Layer	Hard wearing surface layer with a minimum layer of 4mm and >350kgs/m³ cement
Frost Protection	Yes
Efflorescence	Minimum 12 hour vapour curing to significantly reduce the possibility of efflorescence
Drainage Void Width	5% to accommodate correct grit grading, reduced maintenance and maximise drainage flow rate
Permeability	29,000 litres/sec/hectare
Strength	> 3.6MPa
Slip/Skid resistance	Extremely Low (>75 USRV)
Installed to	BS 7533-3:2005
NSSPlus	Q24 115
Applications	Residential and Commercial when used in conjunction with the correct sub-base design in accordance with the latest British Standard.
Energy used	100% renewable energy
Water used	100% water used from rainwater harvesting system
Carbon Footprint	22kgCo²e/m²
Recyclable	100% of this product can be recycled
Design Life	25 years - The correct design and aggregates must be used in accordance with the relevant British Standard or any design guidance provided.
Manufacturing location	Produced in the UK with locally sourced materials
breeam rating www.bre.co.uk	**A**, according to the Green Guide to Specification, 4th Edition 2009. **A+**, can be achieved by using a recycled sub-base.

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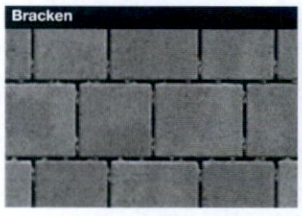
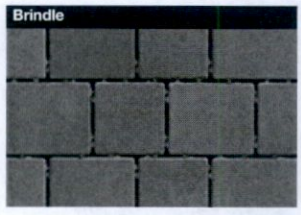
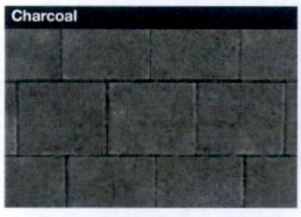
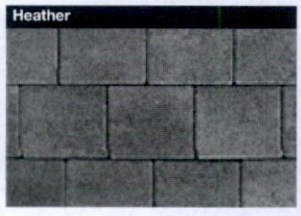
colours

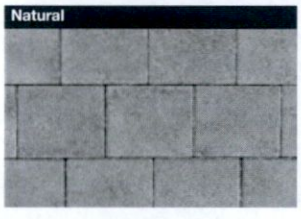

Bracken


Brindle

The swatches below are for colour reference only. The actual block profile will be as per swatches above.


Charcoal


Heather


Natural


Hydropave Shannon Duo Bracken

product	size (mm)	colours available	in stock	m² per pack	m² per slice	no. per m²	no. per pack	weight (kg) per pack
HYDROPAVE SHANNON DUO BIM (both sizes in one pack)	208 x 173 x 60	Bracken, Charcoal, Heather	YES	12.87	0.99	30	195	1764
	173 x 173 x 60						195	

BIM This product is available to download from our website in **BIM Level 2** format.

Refer to all instructions and warnings on our website

hydropave pedesta

ISO 9001:2008

ISO 14001:2004

beautiful vibrant colours

- Functions as a SUDS paving system
- Superb hard-wearing smooth surface
- Vibrant long-lasting colours
- Significantly reduced efflorescence

product specifications

Product type	Concrete Paving Block
Manufactured to	BS EN 1338:2003
Surface Layer	Hard wearing surface layer with a minimum layer of 4mm and >350kgs/m³ cement
Frost Protection	Yes
Efflorescence	Minimum 12 hour vapour curing to significantly reduce the possibility of efflorescence
Drainage Void Width	5.5% to accommodate correct grit grading, reduced maintenance and maximise drainage flow rate
Permeability	32,000 litres/sec/hectare
Strength	> 3.6MPa
Slip/Skid resistance	Extremely Low (>75 USRV)
Installed to	BS 7533-3:2005
NSPlus	Q24 115
Applications	Residential and Commercial when used in conjunction with the correct sub-base design in accordance with the latest British Standard.
Energy used	100% renewable energy
Water used	100% water used from rainwater harvesting system
Carbon Footprint	**60mm:** 22kgCo²e/m² **80mm:** 34kgCo²e/m²
Recyclable	100% of this product can be recycled
Design Life	25 years - The correct design and aggregates must be used in accordance with the relevant British Standard or any design guidance provided.
Manufacturing location	Produced in the UK with locally sourced materials
breeam **rating** www.**bre**.co.uk	**60mm:** **A**, according to the Green Guide to Specification, 4th Edition 2009. **A+**, can be achieved by using a recycled sub-base. **80mm:** **B**, according to the Green Guide to Specification, 4th Edition 2009. **A**, can be achieved by using a recycled sub-base.

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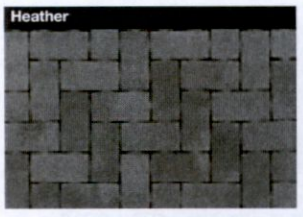
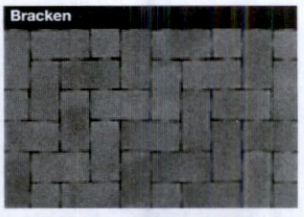
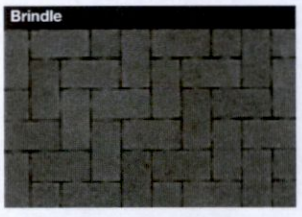
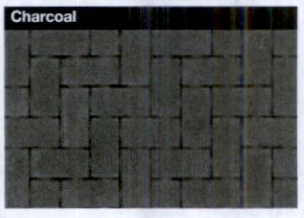
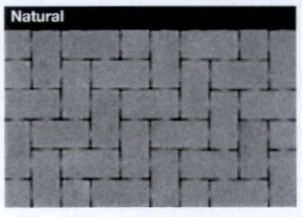
colours


Heather


Bracken


Brindle


Charcoal


Natural


Hydropave Pedesta Brindle & Natural

product	size (mm)	colours available	in stock	m² per pack	m² per slice	no. per m²	no. per pack	weight (kg) per pack
HYDROPAVE PEDESTA BIM	200 x 100 x 60	Bracken, Brindle, Charcoal, Heather, Natural	YES	13.44	2.24	50	672	1808
	200 x 100 x 80	Bracken, Brindle, Charcoal, Heather, Natural	YES	9.6	1.6	50	480	1732

BIM This product is available to download from our website in **BIM Level 2** format.

Refer to all instructions and warnings on our website

hydropave 240

large block size

ISO 9001:2008 ISO 14001:2004

- Functions as a SUDS paving system
- Superb hard-wearing smooth surface
- Vibrant long-lasting colours
- Significantly reduced efflorescence

product specifications

Product type	Concrete Paving Block
Manufactured to	BS EN 1338:2003
Surface Layer	Hard wearing surface layer with a minimum layer of 4mm and >350kgs/m³ cement
Frost Protection	Yes
Efflorescence	Minimum 12 hour vapour curing to significantly reduce the possibility of efflorescence
Drainage Void Width	6% to accommodate correct grit grading, reduced maintenance and maximise drainage flow rate
Permeability	35,000 litres/sec/hectare
Strength	> 3.6MPa
Slip/Skid resistance	Extremely Low (>75 USRV)
Installed to	BS 7533-3:2005
nssPlus	Q24 115
Applications	Residential and Commercial when used in conjunction with the correct sub-base design in accordance with the latest British Standard.
Energy used	100% renewable energy
Water used	100% water used from rainwater harvesting system
Carbon Footprint	34kgCo²e/m²
Recyclable	100% of this product can be recycled
Design Life	25 years - The correct design and aggregates must be used in accordance with the relevant British Standard or any design guidance provided.
Manufacturing location	Produced in the UK with locally sourced materials
breeam rating www.bre.co.uk	**B**, according to the Green Guide to Specification, 4th Edition 2009. **A**, can be achieved by using a recycled sub-base.

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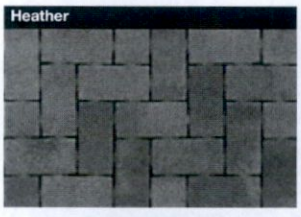
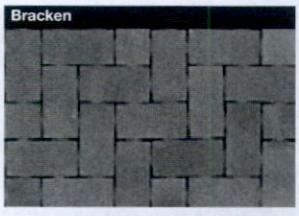
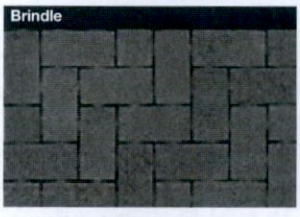
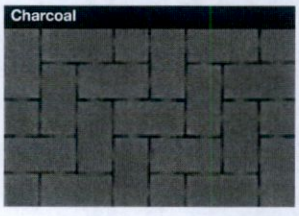
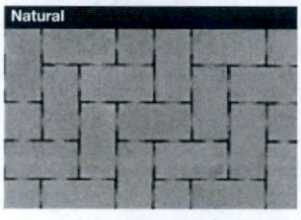
colours


Heather


Bracken


Brindle


Charcoal


Natural

Hydropave 240 Charcoal & Natural

product	size (mm)	colours available	in stock	m² per pack	m² per slice	no. per m²	no. per pack	weight (kg) per pack
HYDROPAVE 240 BIM	240 x 120 x 80	Bracken, Charcoal	YES	10.08	2.02	34.72	350	1810

BIM This product is available to download from our website in **BIM Level 2** format.

Refer to all instructions and warnings on our website

hydropave mayfair flags

ISO 9001:2008 ISO 14001:2004

vibrant granite appearance

- Functions as a SUDS paving system
- Manufactured with sparkling natural granite aggregates
- Superb hard-wearing granite surface
- Vibrant long-lasting colours
- Significantly reduced efflorescence
- Creates a striking, contemporary look

product specifications

Product type	Concrete Paving Flag
Manufactured to	BS EN 1339:2003
Surface layer	Hard wearing surface layer with a minimum of 4mm and >390kgs/m³ cement
Frost Protection	Yes
Granite content	Not less than 57% of granite aggregate in surface layer for Graphite, Mid Grey & Silver
Efflorescence	Minimum 12 hour vapour curing to significantly reduce the possibility of efflorescence
Drainage Void Width	2.7% to accommodate correct grit grading, reduced maintenance and maximise drainage flow rate
Permeability	15,000 litres/sec/hectare
Strength	> 3.5MPa
Slip/Skid resistance	Extremely Low (>75 USRV)
Installed to	BS 7533-4:2006
NBSPlus	Q25 315
Applications	Suitable for all pedestrian areas and traffic-free zones. Some of these specific sizes are suitable for occasional vehicular overrun. Always refer to BS 7533-8:2003 for guidance on the correct flag size to suit your application.
Energy used	100% renewable energy
Water used	100% water used from rainwater harvesting system
Carbon Footprint	24kgCo²e/m²
Recyclable	100% of this product can be recycled
Recycled content	Not less than 12%
Design Life	25 years - The correct design and aggregates must be used in accordance with the relevant British Standard or any design guidance provided.
Manufacturing location	Produced in the UK with locally sourced materials
breeam rating www.**bre**.co.uk	**A**, according to the Green Guide to Specification, 4th Edition 2009. **A+**, can be achieved by using a recycled sub-base.

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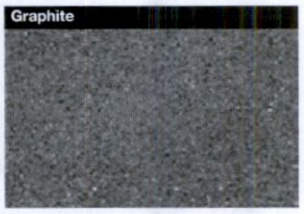
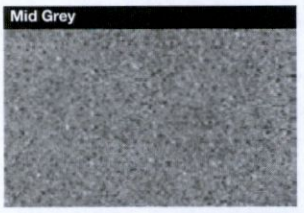
colours

Silver

Graphite



Mid Grey



Mayfair Flags Silver (for colour reference only)

product	size (mm)	finish	edge	colours available	in stock	m² per pack	m² per slice	no. per m²	no. per pack	weight (kg) per pack
HYDROPAVE MAYFAIR FLAGS	400 x 400 x 65	GRANITE TEXTURED	CHAMFERED	Graphite, Mid Grey, Silver	SPECIAL ORDER	10.56	3.52	6.25	66	1556

Refer to all instructions and warnings on our website

hydropave textured flags

ISO 9001:2008 ISO 14001:2004

beautiful granular surface

- Functions as a SUDS paving system
- Superb hard-wearing textured surface
- Vibrant long-lasting colours
- Significantly reduced efflorescence
- Manufactured with a unique granular surface
- Natural appearance

product specifications

Product type	Concrete Paving Flag
Manufactured to	BS EN 1339:2003
Surface layer	Hard wearing surface layer with a minimum of 4mm and >390kgs/m³ cement
Frost Protection	Yes
Efflorescence	Minimum 12 hour vapour curing to significantly reduce the possibility of efflorescence
Drainage Void Width	2.7% to accommodate correct grit grading, reduced maintenance and maximise drainage flow rate
Permeability	15,000 litres/sec/hectare
Strength	> 3.5MPa
Slip/Skid resistance	Extremely Low (>75 USRV)
Installed to	BS 7533-4:2006
NSSPlus	Q25 315
Applications	Suitable for all pedestrian areas and traffic-free zones. Some of these specific sizes are suitable for occasional vehicular overrun. Always refer to BS 7533-8:2003 for guidance on the correct flag size to suit your application.
Energy used	100% renewable energy
Water used	100% water used from rainwater harvesting system
Carbon Footprint	28kgCo²e/m²
Recyclable	100% of this product can be recycled
Design Life	25 years - The correct design and aggregates must be used in accordance with the relevant British Standard or any design guidance provided.
Manufacturing location	Produced in the UK with locally sourced materials
breeam rating www.bre.co.uk	**A**, according to the Green Guide to Specification, 4th Edition 2009. **A+**, can be achieved by using a recycled sub-base.

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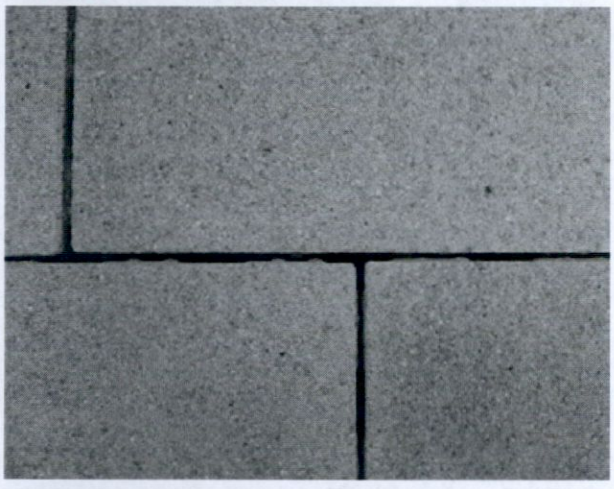
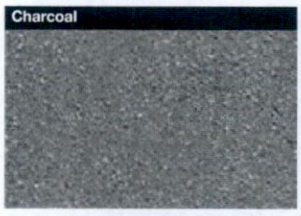
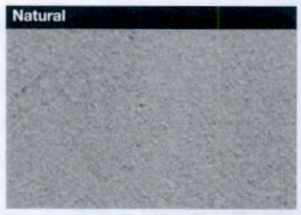


colours

Charcoal



Natural



Textured Flags Natural (for colour reference only)

product	size (mm)	finish	edge	colours available	in stock	m² per pack	m² per slice	no. per m²	no. per pack	weight (kg) per pack
HYDROPAVE TEXTURED FLAGS	400 x 400 x 65	TEXTURED	CHAMFERED	Charcoal, Natural	SPECIAL ORDER	10.56	3.52	6.25	66	1556

Refer to all instructions and warnings on our website

hydropave standard flags

ISO 9001:2008 ISO 14001:2004

smooth finish

- Functions as a SUDS paving system
- Non-slip finish
- Superb hard-wearing surface
- Vibrant long-lasting colours
- Significantly reduced efflorescence

product specifications

Product type	Concrete Paving Flag
Manufactured to	BS EN 1339:2003
Surface layer	Hard wearing surface layer with a minimum of 4mm and >390kgs/m^3 cement
Frost Protection	Yes
Efflorescence	Minimum 12 hour vapour curing to significantly reduce the possibility of efflorescence
Drainage Void Width	2.7% to accommodate correct grit grading, reduced maintenance and maximise drainage flow rate
Permeability	15,000 litres/sec/hectare
Strength	> 3.5MPa
Slip/Skid resistance	Extremely Low (>75 USRV)
Installed to	BS 7533
nbsPlus	Q25 315
Applications	Suitable for all pedestrian areas and traffic-free zones. Some of these specific sizes are suitable for occasional vehicular overrun. Always refer to BS 7533-8:2003 for guidance on the correct flag size to suit your application.
Energy used	100% renewable energy
Water used	100% water used from rainwater harvesting system
Carbon Footprint	28kgCo^2e/m^2
Recyclable	100% of this product can be recycled
Design Life	25 years - The correct design and aggregates must be used in accordance with the relevant British Standard or any design guidance provided.
Manufacturing location	Produced in the UK with locally sourced materials
breeam rating www.bre.co.uk	**A**, according to the Green Guide to Specification, 4th Edition 2009. **A+**, can be achieved by using a recycled sub-base.

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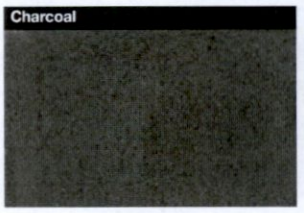
colours



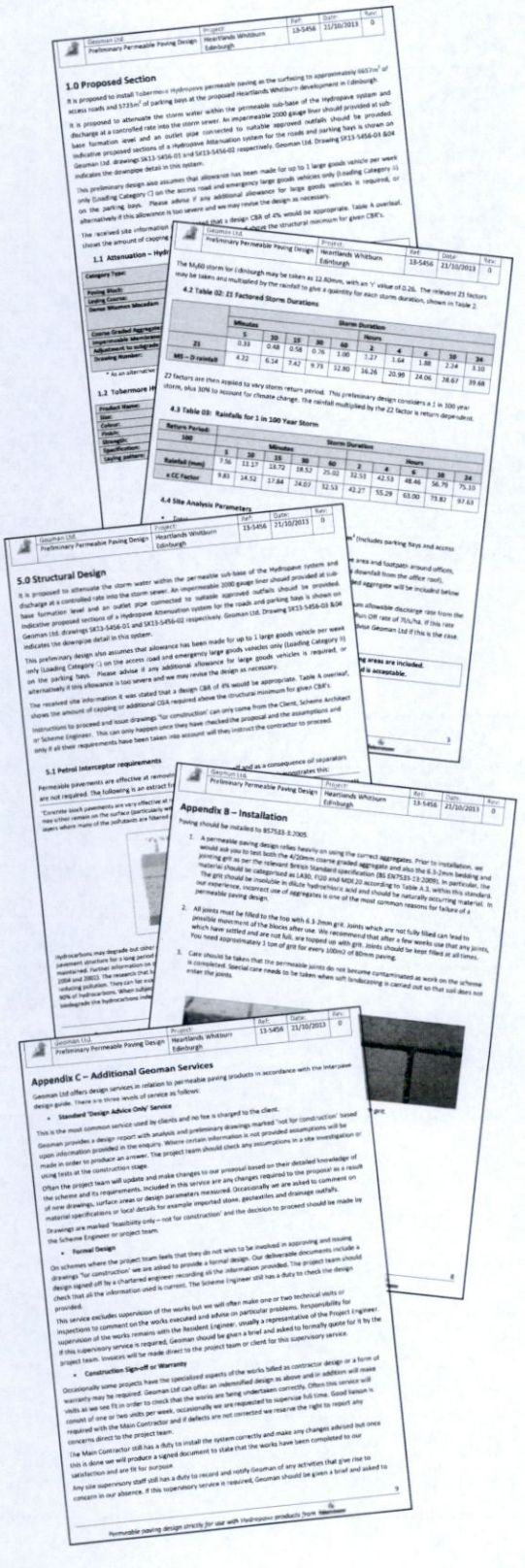
Standard Flags Non-Slip Charcoal (for colour reference only)

product	size (mm)	finish	edge	colours available	in stock	m^2 per pack	m^2 per slice	no. per m^2	no. per pack	weight (kg) per pack
HYDROPAVE STANDARD FLAGS	400 x 400 x 65	NON-SLIP SMOOTH	CHAMFERED	Charcoal, Natural	SPECIAL ORDER	10.56	3.52	6.25	66	1556

Refer to all instructions and warnings on our website

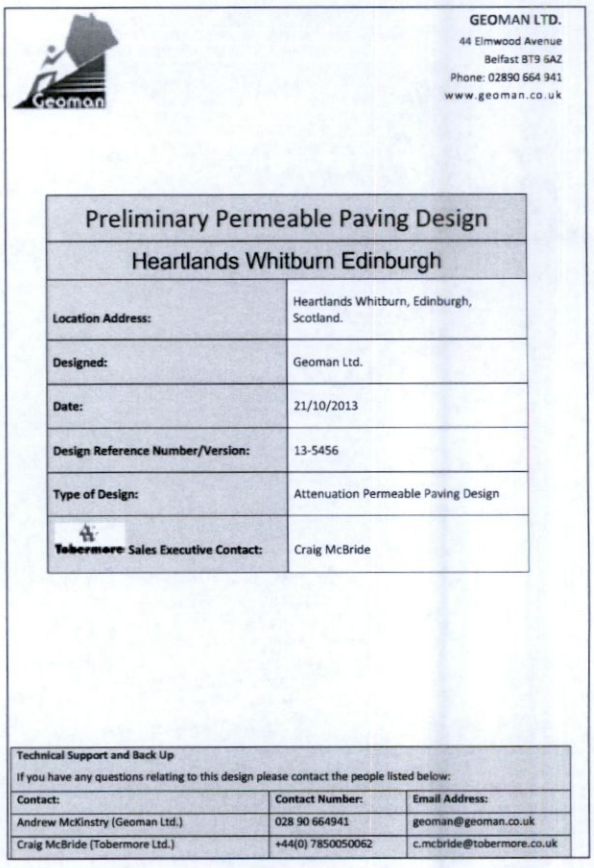
GEOMAN LIMITED

permeable paving design service



hydropave design service

Tobermore work with a UK based geotechnical and civil engineering partner who specialise in permeable pavement design. They can provide a preliminary design for appraisal or a formal PI design if required. As part of their service they will provide full specification details for the sub-base design and the aggregates required for a successful scheme.



GEOMAN LTD.
44 Elmwood Avenue
Belfast BT9 6AZ
Phone: 02890 664 941
www.geoman.co.uk

Preliminary Permeable Paving Design

Heartlands Whitburn Edinburgh

Location Address:	Heartlands Whitburn, Edinburgh, Scotland.
Designed:	Geoman Ltd.
Date:	21/10/2013
Design Reference Number/Version:	13-5456
Type of Design:	Attenuation Permeable Paving Design
Tobermore Sales Executive Contact:	Craig McBride

Technical Support and Back Up

If you have any questions relating to this design please contact the people listed below:

Contact:	Contact Number:	Email Address:
Andrew McKinstry (Geoman Ltd.)	028 90 664941	geoman@geoman.co.uk
Craig McBride (Tobermore Ltd.)	+44(0) 7850050062	c.mcbride@tobermore.co.uk

Contents

1.0 Proposed Section

It is proposed to install Tobermore Hydropave permeable paving as the surfacing to approximately 6657m² of access roads and 5723m² of parking bays at the proposed Heartlands Whitburn development in Edinburgh.

It is proposed to attenuate the storm water within the permeable sub-base of the Hydropave system and discharge at a controlled rate into the storm sewer. An impermeable 2000 gauge liner should provided at sub-base formation level and an outlet pipe connected to suitable approved outfalls should be provided. Indicative proposed sections of a Hydropave Attenuation system for the roads and parking bays is shown on Geoman Ltd. drawings SK13-5456-01 and SK13-5456-02 respectively. Geoman Ltd. Drawing SK13-5456-03 &04 indicates the downpipe detail in this system.

This preliminary design also assumes that allowance has been made for up to 1 large goods vehicle per week only [Loading Category C] on the access road and emergency large goods vehicles only [Loading Category B] on the parking bays. Please advise if any additional allowance for large goods vehicles is required, or alternatively if this allowance is too severe and we may revise the design as necessary.

The received site information it was stated that a design CBR of 4% would be appropriate. Table A overleaf, shows the amount of capping or additional CGA required above the structural minimum for given CBR's.

1.1 Attenuation – Hydropave Summary

Category Type:	**Access Road C** – Allowance for 1 large goods vehicle per week only **Parking Bays B** – Allowance for emergency large goods vehicles only
Paving Block:	Tobermore Hydropave 240 [240x120x80mm] | T.B.C by Client]
Laying Course:	50mm thickness of 6.3 2mm grit to BS EN13242 :2002
Dense Bitumen Macadam	**Access Road** - 70mm of DBM50 with 75mm diameter holes punctured on a 750mm orthogonal grid* **Parking Bays** – Not required
Coarse Graded Aggregate:	Minimum 350mm depth
Impermeable Membrane:	Required - (2000 gauge impermeable liner)
Adjustment to subgrade depth	Assumed CBR=4% (Refer to table A for details)
Drawing Number:	**Access Road** - SK13-5456-01 **Parking Bays** - SK13-5456-02

* As an alternative to 70mm of DBM50 150mm of cement bound coarse graded aggregate could be used.

1.2 Tobermore Hydropave Product to be used on Scheme

Product Name:	Tobermore Hydropave 240
Size:	240x120x80mm
Colour:	TBC
Finish:	Standard
Strength:	> 3.6MPa or 250 N/m
Specification:	BS EN7533-13:2009
Laying pattern:	Herringbone

2.0 Table A - CBR for Pavement Design

For adjustment to pavement design for low CBR sub grades:

CBR of sub-grade	Adjustment to thickness of course graded aggregate (mm)	Alternatively depth of Class 6F2 capping required (mm)
1%	+300mm	600
2%	+175mm	350
3%	+125mm	250
4%	+100mm	200
5-10%	+50mm	150
>10%	Use design thickness	Use design thickness

3.0 Site Levels

The Hydropave surface should have no slopes at gradients greater than 1:20 to insure efficient infiltration of water through the joints in the blocks to the sub-base.

The formation level of the permeable sub-base should gently slope (<1:200) towards the outlet points from the CGA to avoid excessive loss of available storage. We have assumed that several outlet points will be provided to the storm sewer manholes along the access road.

4.0 Hydraulic Design

The thickness of a permeable pavement's crushed rock base has to be calculated on the basis of the need to store water and also on structural requirements. In this section, the thickness calculation based on the storage of water is set out.

The thickness of the sub-base necessary for water storage depends upon the factor r, which is the ratio of the 60-minute storm rainfall depth to the 2-day maximum rainfall depth. This factor varies across the UK and implies a 5-year storm return period. For greater return periods a correction factor, Z2, given in Table 4 should be applied to the five-year return period rainfall value and the sub-base calculated in accordance with Table 2.

4.1 Table 01: Hydraulic Design Parameters

Town/ City	M60 (mm)	r Value	SAAR (mm)	WRAP	Soil Index	Return Period	Climate Change
Edinburgh	12.80	0.26	730.00	4.00	0.45	100 years	Factor 1.30

The method undertaken to vary the storm return period for any duration is as follows:

It is assumed that the depth of rainfall occurring during a 60 minute storm recurring every 5 years is 12.80mm in the area. The depth of rainfall occurring every five years over storm durations other than 60 minutes is obtained as follows:

The design rainfall depth for any given return period and storm duration can be found by multiplying 12.80mm by a factor Z1, which requires knowledge of 'r', the ratio of 60-minute to 2 day rainfalls for a 5 years return period.

The M_{60} storm for Edinburgh may be taken as 12.80mm, with an 'r' value of 0.26. The relevant Z1 factors may be taken and multiplied by the rainfall to give a quantity for each storm duration, shown in Table 2.

4.2 Table 02: Z1 Factored Storm Durations

	Storm Duration									
	Minutes					Hours				
	5	10	15	30	60	2	4	6	10	24
Z1	0.33	0.48	0.58	0.76	1.00	1.27	1.64	1.88	2.24	3.10
M5 – D rainfall	4.22	6.14	7.42	9.73	12.80	16.26	20.99	24.06	28.67	39.68

Z2 factors are then applied to vary storm return period. This preliminary design considers a 1 in 100 year storm, plus 30% to account for climate change. The rainfall multiplied by the z2 factor is return dependent.

4.3 Table 03: Rainfalls for 1 in 100 Year Storm

Return Period:	Storm Duration									
100	Minutes					Hours				
	5	10	15	30	60	2	4	6	10	24
Rainfall (mm)	7.56	11.17	13.72	18.52	25.02	32.51	42.53	48.46	56.79	75.10
x CC Factor	9.83	14.52	17.84	24.07	32.53	42.27	55.29	63.00	73.82	97.63

4.4 Site Analysis Parameters

- Total area of Tobermore Hydropave = approximately **12380m²** [Includes parking Bays and access roads]
- Catchment area = approximately **19541m²** [Includes Hydropave area and footpath around offices, additional allowance of 20% for surrounding hardstanding, plus downfall from the office roof].
- It was assumed that a minimum depth of 350mm of coarse graded aggregate will be included below the Hydropave areas.
- For this preliminary design we have been advised that the minimum allowable discharge rate from the site is 14.0l/s. This value has been assumed using the Green Field Run Off rate of 7l/s/ha. If this rate can be increased the depth of the CGA can be decreased. Please advise Geoman Ltd if this is the case.

Please check these areas and which, if any, of the building areas are included.
Please also check the design discharge rate assumed is acceptable.

4.5 Critical Storm Duration Calculation

The following table indicates the Factors of Safety for the proposed Hydropave system for storm durations up to 24 hours. The void ratio of the coarse graded aggregate was assumed to be is 0.32, with the minimum depth of the CGA to be 350mm under Hydropave blocks. See the proposed sections on drawing SK13-5456-01 and 02.

Storm Duration	Depth of rainfall (mm) 100 year storm	Volume entering Hydropave (m^3)	Outlet to storm sewer (m^3)	Storage Required (m^3)	Storage Capacity (m^3)	Factor of Safety
5 minutes	9.83	192.07	4.20	187.87	970.59	5.17
10 minutes	14.52	283.66	8.40	275.26	970.59	3.53
15 minutes	17.84	348.56	12.60	335.96	970.59	2.89
30 minutes	24.07	470.39	25.20	445.19	970.59	2.18
1 hour	32.53	635.63	50.40	585.23	970.59	1.66
2 hours	42.27	825.93	100.80	725.13	970.59	1.34
4 hours	55.29	1080.41	201.60	878.81	970.59	1.10
6 hours	63.00	1231.01	302.40	928.61	970.59	1.05
10 hours	73.82	1442.61	504.00	938.61	970.59	1.03
24 hours	97.63	1907.71	1209.60	698.11	970.59	1.39

The critical storm duration is therefore 10 hours.

5.0 Structural Design

It is proposed to attenuate the storm water within the permeable sub-base of the Hydropave system and discharge at a controlled rate into the storm sewer. An impermeable 2000 gauge liner should provided at sub-base formation level and an outlet pipe connected to suitable approved outfalls should be provided. Indicative proposed sections of a Hydropave Attenuation system for the roads and parking bays is shown on Geoman Ltd. drawings SK13-5456-01 and SK13-5456-02 respectively. Geoman Ltd. Drawing SK13-5456-03 &04 indicates the downpipe detail in this system.

This preliminary design also assumes that allowance has been made for up to 1 large goods vehicle per week only [Loading Category C] on the access road and emergency large goods vehicles only [Loading Category B] on the parking bays. Please advise if any additional allowance for large goods vehicles is required, or alternatively if this allowance is too severe and we may revise the design as necessary.

The received site information it was stated that a design CBR of 4% would be appropriate. Table A overleaf, shows the amount of capping or additional CGA required above the structural minimum for given CBR's.

Instructions to proceed and issue drawings 'for construction' can only come from the Client, Scheme Architect or Scheme Engineer. This can only happen once they have checked the proposal and the assumptions and only if all their requirements have been taken into account will they instruct the contractor to proceed.

5.1 Petrol Interceptor requirements

Permeable pavements are effective at removing pollution from runoff and as a consequence oil separators are not required. The following is an extract from the Interpave Guidelines which demonstrates this:

"Concrete block pavements are very effective at removing pollution from runoff, unlike attenuation tanks. The pollutants may either remain on the surface (particularly with zero gradients) or may be flushed into the underlying pavement layers where many of the pollutants are filtered and trapped or degrade over time.

Hydrocarbons may degrade but other contaminants, such as heavy metals, do not break down and remain within the pavement structure for a long period of time, making permeable pavements ideal for areas where vehicles are stored or maintained. Further information on pollution removal is provided in CIRIA Reports C 697, C 609 and C 582 (CIRIA 2007, 2004 and 2001). The research that has been undertaken demonstrates the effectiveness of permeable pavements in reducing pollution. They can for example remove between 60% and 95% of total suspended solids (i.e. silt) and 70% to 90% of hydrocarbons. When subjected to low level oil drips, such as in car parks, the pavements can continue to biodegrade the hydrocarbons indefinitely.

'Pollution Prevention Guidelines' PPG 3 (Environment Agency, 2006) identifies the beneficial performance of permeable pavements in removing pollution from runoff. It states that: *"Techniques that control pollution close to the source, such as permeable surfaces or infiltration trenches, can offer a suitable means of treatment for runoff from low risk areas such as roofs, car parks, and nonoperational areas."*

Oil separators are not required when permeable pavements are used. Indeed permeable pavements are more effective at removing a wider range of pollutants from runoff than oil separators (CIRIA, 2004). If additional treatment is required for higher risk areas it is normally more effective to use green SUDS methods such as swales or wetlands, as these also treat a wider range of pollutants."

5.2 Rainwater down pipes

It is proposed to include all the roof drainage from the adjacent buildings within the permeable sub-base. The roof drainage should enter the porous sub base through a series of perforated drainage pipes with perforated branches and perforated end caps, see SK13-5456-03 & 04 for typical downpipe sections. This is to ensure water does not enter the sub-base at a concentrated point, which could result in local wash out of the aggregates.

5.3 Construction Considerations

Sub base material [coarse graded aggregate] should be placed in layers not exceeding 150mm in thickness or twice the nominal maximum aggregate size. Unlike traditional pavement construction, the open graded materials should not be fully compacted to eliminate any voids, as this will compromise the performance of the system.

It is likely that excessive compaction will result in the displacement of the open graded aggregate by the compaction equipment. The open-graded material should be compacted such that its maximum density is achieved for the particular aggregate type and grading without compromising the final void percentage offered by the material.

Each layer should be suitably compacted before the next layer is placed to prevent any potential settlement of the pavement after completion.

Due to the nature of both the sub-layers and the block paving, care should be taken during the construction process to prevent dirt or detritus contaminating the sub-base and compromising the permeability of the system. For example, the trafficking of the sub base as a site access route should not be undertaken. Should other construction or maintenance work take place close to the pavement which may affect the infiltration of the pavement, suitable protective measures should be implemented.

Edge restraints should be sufficiently robust to resist the lateral displacement from imposed loadings placed upon the pavement. The edge restraint may take the form of associated fittings, walls or buildings or be formed from precast concrete, clay or natural stone kerb systems, either existing or newly constructed features. The restraint must provide a consistent vertical face to a level below the laying course material.

Appendix A – Aggregates

Please Refer to BS7533-13 2009 Guide for the design of permeable pavements constructed with concrete paving blocks and flags, natural stone slabs and setts and clay pavers.

Laying Course and jointing material

- Laying course requires 6.3-2mm sized grit to BS EN7533-13:2009. In particular, the material should be categorised as LA30, FI20 and MDE20 according to this standard. The grit should be insoluble in dilute hydrochloric acid and should be naturally occurring material. In our experience, incorrect use of aggregates is one of the most common reasons for failure of a permeable paving design.

Course Graded Aggregate (CGA)

- Requires minimum 32% of voids spacing for the storage of water. CGA should comply with the requirements of BS EN7533-13:2009. The material should be designated Type 4/20 (4mm minimum and 20mm maximum particle size). In our experience, incorrect use of aggregates is one of the most common reasons for failure of a permeable paving design.

Hydraulically Bound Course Graded Aggregate (No fines Concrete)

- Used to strengthen and stiffen the pavement, strength class = C_{35}
- Refer to the Interpave guidelines.

Dense Bitumen Macadam (DBM)

- Normally used for temporary Road Surface. Should be installed in accordance with BS 4987 1:2005, 0/32mm size dense base. DBM should be punched prior to commencing construction of the Tobermore Hydropave paving block; typical holes should be 75mm diameter on an orthogonal grid of 750mm. All debris shall be removed and the holes in the DBM shall be filled with CGA.

Capping

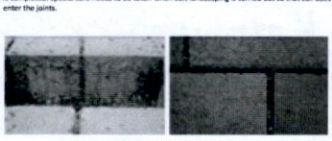
- Capping material is included in order to achieve a firm working platform so that the overlying layers can be correctly installed. The permeable paving designs are normally designed for 5% CBR, If not then the appropriate increase in capping material should be used. All capping materials should meet the requirements of either 6F1 or 6F2 of Table 6.1 of Highways Agency's *'Specification for Highway Works Series 600 Earthworks'*

Please note: If you obtain the appropriate technical information for the aggregates which you plan to use on a permeable paving scheme please send them to us so we can give feedback on if they meet BS 7533-13:2009 requirements. Depending on the project size we would strongly advise customers that aggregates used in the construction of a permeable paving system should be tested to ensure conformity during the construction of the project.

Appendix B – Installation

Paving should be installed to BS7533-3:2005.

1. A permeable paving design relies heavily on using the correct aggregates. Prior to installation, we would ask you to test both the 4/20mm coarse graded aggregate and also the 6.3-2mm bedding and jointing grit as per the relevant British Standard specification (BS EN7533-13:2009). In particular, the material should be categorised as LA30, FI20 and MDE20 according to Table A.3, within this standard. The grit should be insoluble in dilute hydrochloric acid and should be naturally occurring material. In our experience, incorrect use of aggregates is one of the most common reasons for failure of a permeable paving design.
2. All joints must be filled to the top with 6.3-2mm grit. Joints which are not fully filled can lead to possible movement of the blocks after use. We recommend that after a few weeks use that any joints, which have settled and are not full, are topped up with grit. Joints should be kept filled at all times. You need approximately 1 ton of grit for every 100m2 of 80mm paving.
3. Care should be taken that the permeable joints do not become contaminated as work on the scheme is completed. Special care needs to be taken when soft landscaping is carried out so that soil does not enter the joints.



All joints must be filled to the top with 6.3-2mm grit.

Appendix C – Additional Geoman Services

Geoman Ltd offers design services in relation to permeable paving products in accordance with the interpave design guide. There are three levels of service as follows:

- **Standard 'Design Advice Only' Service**

This is the most common service used by clients and no fee is charged to the client.

Geoman provides a design report with analysis and preliminary drawings marked 'not for construction' based upon information provided in the enquiry. Where certain information is not provided assumptions will be made in order to produce an answer. The project team should check any assumptions in a site investigation or using tests at the construction stage.

Often the project team will update and make changes to our proposal based on their detailed knowledge of the scheme and its requirements. Included in this service are any changes required to the proposal as a result of new drawings, surface areas or design parameters measured. Occasionally we are asked to comment on material specifications or local details for example imported store, geotextiles and drainage outfalls.

Drawings are marked 'feasibility only – not for construction' and the decision to proceed should be made by the Scheme Engineer or project team.

- **Formal Design**

On schemes where the project team feels that they do not wish to be involved in approving and issuing drawings 'for construction' we are asked to provide a formal design. Our deliverable documents include a design signed off by a chartered engineer recording all the information provided. The project team should check that all the information used is current. The Scheme Engineer still has a duty to check the design provided.

This service excludes supervision of the works but we will often make one or two technical visits or inspections to comment on the works executed and advise on particular problems. Responsibility for supervision of the works remains with the Resident Engineer, usually a representative of the Project Engineer. If this supervisory service is required, Geoman should be given a brief and asked to formally quote for it by the project team. Invoices will be made direct to the project team or client for this supervisory service.

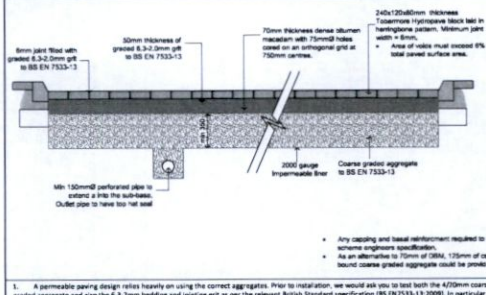
- **Construction Sign-off or Warranty**

Occasionally some projects have the specialized aspects of the works billed as contractor design or a form of warranty may be required. Geoman Ltd can offer an indemnified design as above and in addition will make visits as we see fit in order to check that the works are being undertaken correctly. Often this service will consist of one or two visits per week, occasionally we are requested to supervise full time. Good liaison is required with the Main Contractor and if defects are not corrected we reserve the right to report any concerns direct to the project team.

The Main Contractor still has a duty to install the system correctly and make any changes advised but once this is done we will produce a signed document to state that the works have been completed to our satisfaction and are fit for purpose.

Any site supervisory staff still has a duty to record and notify Geoman of any activities that give rise to concern in our absence. If this supervisory service is required, Geoman should be given a brief and asked to

Hydropave Permeable Paving Design | Attenuation Design | Loading Category C



Notes:
1) All dimensions in mm's unless otherwise specified.
2) All paving should be installed in accordance with BS 7533:Part 3 2005 by a competent experienced paving contractor.
3) All aggregates should be installed in accordance with the material specifications table.
4) This drawing must be used in conjunction with Geoman Ltd. design document 13-5456

Adjustment to thickness of CDA or alternatively SF2 capping thickness required based on subgrade CBR.

Subgrade CBR (%)	Additional thickness of CDA (mm)	Depth of Capping required (mm)
1	+300	600
2	+175	350
3	+125	250
4	+100	200
5-10%	+50	150
>10%	Use design thickness	Use design thickness

MATERIAL SPECIFICATION

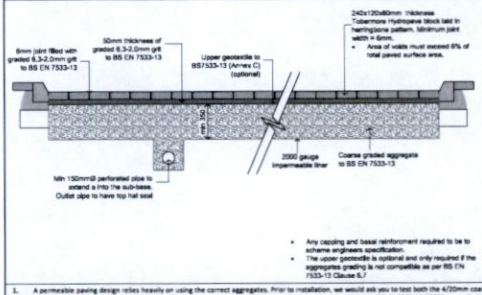
Material	Specification
80mm Hydropave block	BS1338:2003
50mm laying course of graded 6.3-2.0mm grit	BS EN 7533-13:2009
Dense Bitumen Macadam	BS EN 7533-13:2009
Coarse graded aggregate	BS EN 7533-13:2009
2000 guage Impermeable membrane	For attenuation systems only

1. A permeable paving design relies heavily on using the correct aggregates. Prior to installation, we would ask you to test both the 4/20mm coarse graded aggregate and also the 6.3-2mm bedding and jointing grit as per the relevant British Standard specification (BS EN7533-13:2009). In particular, the material should be categorised as LA30, FI20 and MDE20 according to Table A.3, within this standard. The grit should be insoluble in dilute hydrochloric acid and should be naturally occurring material. In our experience, incorrect use of aggregates is one of the most common reasons for failure of a permeable paving design.
2. All joints must be filled to the top with 6.3-2mm grit. Joints which are not fully filled can lead to possible movement of the blocks after use. We recommend that after a few weeks use that any joints, which have settled and are not full, are topped up with grit. Joints should be kept filled at all times. You need approximately 1 ton of grit for every 100m2 of 80mm paving.
3. Care should be taken that the permeable joints do not become contaminated as work on the scheme is completed. Special care needs to be taken when soft landscaping is carried out so that soil does not enter the joints.

Geoman Ltd. | Designed: GM | Drawn: BD | Approved: | Date: - / 21.10.13. / | Project Title: Heartlands Whitburn Edinburgh | Client: Tobermore | Drawing Title: Attenuation System: Category C | Scale: NTS | Project No: 13-5456 | Drawing No: SK13-5456-01 | Revision: 0

FEASIBILITY ONLY NOT FOR CONSTRUCTION

Hydropave Permeable Paving Design | Attenuation Design | Loading Category B



Notes:
1) All dimensions in mm's unless otherwise specified.
2) All paving should be installed in accordance with BS 7533:Part 3 2005 by a competent experienced paving contractor.
3) All aggregates should be installed in accordance with the material specifications table.
4) This drawing must be used in conjunction with Geoman Ltd. design document 13-5456

Adjustment to thickness of CDA or alternatively SF2 capping thickness required based on subgrade CBR.

Subgrade CBR (%)	Additional thickness of CDA (mm)	Depth of Capping required (mm)
1	+300	600
2	+175	350
3	+125	250
4	+100	200
5-10%	+50	150
>10%	Use design thickness	Use design thickness

MATERIAL SPECIFICATION

Material	Specification
80mm Hydropave block	BS1338:2003
Upper geotextile (select based on grading of aggregate)	BS EN 7533-13:2009
50mm laying course of graded 6.3-2.0mm grit	BS EN 7533-13:2009
Coarse graded aggregate	BS EN 7533-13:2009
7000 guage Impermeable membrane	For attenuation systems only

1. A permeable paving design relies heavily on using the correct aggregates. Prior to installation, we would ask you to test both the 4/20mm coarse graded aggregate and also the 6.3-2mm bedding and jointing grit as per the relevant British Standard specification (BS EN7533-13:2009). In particular, the material should be categorised as LA30, FI20 and MDE20 according to Table A.3, within this standard. The grit should be insoluble in dilute hydrochloric acid and should be naturally occurring material. In our experience, incorrect use of aggregates is one of the most common reasons for failure of a permeable paving design.
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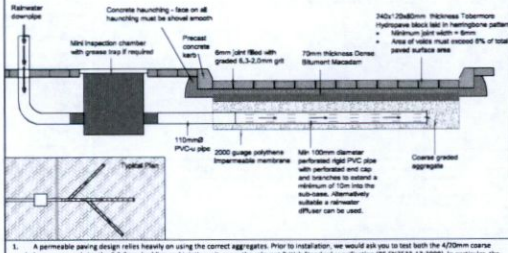
3. Care should be taken that the permeable joints do not become contaminated as work on the scheme is completed. Special care needs to be taken when soft landscaping is carried out so that soil does not enter the joints.

Geoman Ltd. | Designed: GM | Drawn: BD | Approved: | Date: - / 21.10.13. / | Project Title: Heartlands Whitburn Edinburgh | Client: Tobermore | Drawing Title: Attenuation System: Category B | Scale: NTS | Project No: 13-5456 | Drawing No: SK13-5456-02 | Revision: 0

FEASIBILITY ONLY NOT FOR CONSTRUCTION

Hydropave Permeable Paving Design | Attenuation Design | Loading Category C

Downpipe Drainage into Attenuation System



Notes:
1) All dimensions in mm's unless otherwise specified.
2) All paving should be installed in accordance with BS 7533:Part 3 2005 by a competent paving contractor.
3) All aggregates should be installed in accordance with the material specifications table.
4) This drawing must be used in conjunction with Geoman Ltd. preliminary design document 13-5456

Adjustment to thickness of CDA or alternatively SF2 capping thickness required based on subgrade CBR.

Subgrade CBR (%)	Additional thickness of CDA (mm)	Depth of Capping required (mm)
1	+300	600
2	+175	350
3	+125	250
4	+100	200
5-10%	+50	150
>10%	Use design thickness	Use design thickness

MATERIAL SPECIFICATION

Material	Specification
80mm Hydropave block	BS1338:2003
50mm laying course of graded 6.3-2.0mm grit	BS EN 7533-13:2009
Dense Bitumen Macadam	BS EN 7533-13:2009
Coarse graded aggregate	BS EN 7533-13:2009
2000 guage polythene Impermeable membrane	*FOR ATTENUATED SYSTEMS ONLY

1. A permeable paving design relies heavily on using the correct aggregates. Prior to installation, we would ask you to test both the 4/20mm coarse graded aggregate and also the 6.3-2mm bedding and jointing grit as per the relevant British Standard specification (BS EN7533-13:2009). In particular, the material should be categorised as LA30, FI20 and MDE20 according to Table A.3, within this standard. The grit should be insoluble in dilute hydrochloric acid and should be naturally occurring material. In our experience, incorrect use of aggregates is one of the most common reasons for failure of a permeable paving design.
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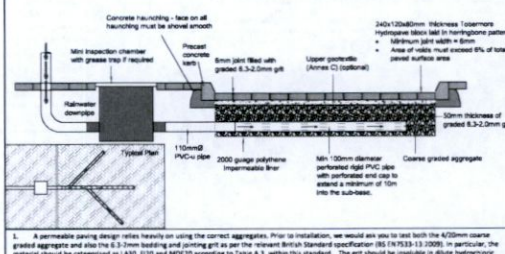
3. Care should be taken that the permeable joints do not become contaminated as work on the scheme is completed. Special care needs to be taken when soft landscaping is carried out so that soil does not enter the joints.

Geoman Ltd. | Designed: GM | Drawn: BD | Approved: | Date: - / 21.10.13. / | Project Title: Heartlands Whitburn Edinburgh | Client: Tobermore | Drawing Title: Indicative downpipe from roof section | Scale: NTS | Project No: 13-5456 | Drawing No: SK13-5456-04 | Revision: 0

FEASIBILITY ONLY NOT FOR CONSTRUCTION

Hydropave Permeable Paving Design | Attenuation Design | Loading Category B

Downpipe Drainage into Attenuation System



Notes:
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3) All aggregates should be installed in accordance with the material specifications table.
4) This drawing must be used in conjunction with Geoman Ltd. preliminary design document 13-5456

Adjustment to thickness of CDA or alternatively SF2 capping thickness required based on subgrade CBR.

Subgrade CBR (%)	Additional thickness of CDA (mm)	Depth of Capping required (mm)
1	+300	600
2	+175	350
3	+125	250
4	+100	200
5-10%	+50	150
>10%	Use design thickness	Use design thickness

MATERIAL SPECIFICATION

Material	Specification
80mm Hydropave block	BS1338:2003
50mm laying course of graded 6.3-2.0mm grit	BS EN 7533-13:2009
Dense Bitumen Macadam	BS EN 7533-13:2009
Coarse graded aggregate	BS EN 7533-13:2009
2000 guage polythene Impermeable membrane	*FOR ATTENUATED SYSTEMS ONLY

1. A permeable paving design relies heavily on using the correct aggregates. Prior to installation, we would ask you to test both the 4/20mm coarse graded aggregate and also the 6.3-2mm bedding and jointing grit as per the relevant British Standard specification (BS EN7533-13:2009). In particular, the material should be categorised as LA30, FI20 and MDE20 according to Table A.3, within this standard. The grit should be insoluble in dilute hydrochloric acid and should be naturally occurring material. In our experience, incorrect use of aggregates is one of the most common reasons for failure of a permeable paving design.
2. All joints must be filled to the top with 6.3-2mm grit. Joints which are not fully filled can lead to possible movement of the blocks after use. We recommend that after a few weeks use that any joints, which have settled and are not full, are topped up with grit. Joints should be kept filled at all times. You need approximately 1 ton of grit for every 100m2 of 80mm paving.
3. Care should be taken that the permeable joints do not become contaminated as work on the scheme is completed. Special care needs to be taken when soft landscaping is carried out so that soil does not enter the joints.

Geoman Ltd. | Designed: GM | Drawn: BD | Approved: | Date: - / 21.10.13. / | Project Title: Heartlands Whitburn Edinburgh | Client: Tobermore Ltd | Drawing Title: Typical downpipe from roof section | Scale: NTS | Project No: 13-5456 | Drawing No: SK13-5456-03 | Revision: 0

- FEASIBILITY ONLY - NOT FOR CONSTRUCTION

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Sir Chris Hoy Velodrome

///// Glasgow

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Sports & Leisure

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http://bit.ly/2ep7rle

Project details

Architect:
3DReid

Main contractor:
Sir Robert Alpine, Edinburgh

Sub-contractor:
Land Engineering, Glasgow

Product details:
Sienna Duo | Sandstone & Graphite
Hydropave Sienna Duo | Silver & Graphite
Hydropave 240 | Bracken & Charcoal

www.tobermore.co.uk | 0844 800 5736 | Additional images of this scheme can be found on **MEDIALIGHTBOX**

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University of Hertfordshire

///// Hertfordshire

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Education

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Or visit:
http://bit.ly/2e47wGs

Project details

Architect:
The Landmark Practice

Main contractor:
Bouygues UK Limited Living

Groundworker:
Darby Groundworks

Product details:
Eco Hydropave Pedesta | Charcoal, Heather & Natural
Eco Hydropave 240 | Charcoal, Heather & Natural

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Queen Elizabeth University Hospital

///// Glasgow

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Medical & Healthcare

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Or visit:
http://bit.ly/2e5aahC

Project details

Architect:
Gillespies
| BMJ, Glasgow

Main contractor:
Brookfield Multiplex
| Land Engineering

Groundworker:
Land Engineering

Product details:
Hydropave Fusion | Silver,
Hydropave Sienna Duo | Silver

www.**tobermore**.co.uk | 0844 800 5736 |

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#FeaturedProject | No: 91

West Mill

////Colinton Village, Edinburgh

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Housing

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http://bit.ly/2ekl7NM

West Mill was named **'Apartment Development of the Year'** at the **2015 Scottish Home Awards** and **'Best Show Home'** at the **2015 Glasgow Property Herald Awards.**

Project details

Developer:
Westpoint Homes

Architect:
Fouin & Bell

Product details:
Hydropave Tegula 200 | Bracken
Historic Flags | Bracken

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