

DESIGN INTRODUCTION

Terram Bodpave is the original interlocking cellular porous plastic paving grid system for ground surface stabilisation. Typical applications include car and light vehicle parking, pedestrian walkways, golf buggy paths, cycle paths, driveways and residential parking. The porous surface makes Bodpave units ideal for use within a source control permeable paving SuDS (Sustainable Drainage System). Most Bodpave installations will require a new subbase (pavement foundation layer) to be constructed. The thickness and type of granular material used to form the subbase will generally depend on the following factors:

- Strength of the underlying ground (subgrade) measured in CBR*%
- Water permeability of the underlying ground (subgrade) k measured in m/s
- Type of the underlying ground (subgrade) e.g. clay/silt/sand/gravel/rock
- Type of vehicle traffic (HGV/LGV/car/cycles/pedestrian)
- Frequency of traffic (occasional/regular)

* California Bearing Ratio test

A comprehensive ground investigation survey with suitable testing is highly recommended to ensure the subbase for a Bodpave surface is suitably strong and sufficiently durable for the anticipated use. This design guide can be used for estimating ground conditions and producing preliminary pavement designs but it is not a substitute for site specific ground investigation works and a detailed pavement design by a suitably qualified civil engineer.



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SUBBASE DESIGN

The following guides are based on Terram products including Bodgrid and T series geotextile. Alternative and equivalent products are available from other manufacturers.

Table 1 – Minimum Subbase Thickness (Tx) with Bodgrid

SUBGRADE	Cars/light vehicles (#)		Coaches/Heavy Goods/Emergency vehicles (#)		Overlap (mm)
	Thickness (mm)	Bodgrid	Thickness (mm)	Bodgrid	
CBR*%					
1	300	GC30	400	GC30	600
2	150	GC30	250	GC30	500
3	125	GC30	175	GC30	450
4	125	GC30	150	GC30	400
5+	100	GC30	125	GC30	300

Table 2 – Minimum Subbase Thickness (Tx) without Bodgrid

SUBGRADE	Cars/light vehicles (#)		Coaches/Heavy Goods/Emergency vehicles (#)		Overlap (mm)
	Thickness (mm)	Bodgrid	Thickness (mm)	Bodgrid	
CBR*%					
1	450	T2000	600	T2000	600
2	225	T1500	375	T1500	500
3	200	T1000	300	T1000	450
4	200	T1000	225	T1000	400
5+	150	T1000	200	T1000	300

Regular tight turning of vehicles and “dry” steering may cause damage to the Bodpae units and/or displace gravel infill; vehicle manoeuvring should be carefully considered at specification/design stage. Gravel filled units may require some maintenance when subjected to regular channelised and turning traffic loadings. If construction traffic axle load exceeds 60kN (6 tonnes), minimum subbase thickness over Terram Bodgrid should be 200mm.



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Table 3 – Field Guidance for Estimating Subgrade Strength

Consistency CBR*%	Indicator		Mechanical (test) SPT	Strength	
	Tactile (feel)	Visual (observation)		CBR %	Cu Kn/SQM
Very Soft	Hand sample squeezes through fingers	Person standing will sink >75mm	<2	<1	<25
Soft	Moulded by moderate finger pressure	Person walking sinks 50-70mm	2-4	~1	~25
Medium	Moulded by moderate finger pressure	Person walking sinks 25mm	4-8	1-2	25-40
Firm	Moulded by strong finger pressure	Utility truck ruts 10-25mm	8-15	2-4	4-75
Stiff	Cannot be moulded but can be indented by thumb	Loaded construction vehicle ruts by 25mm	15-30	4-6	75-150

Table 4 – Typical Soil Types and Properties

Soil Type	Plasticity Index %	CBR% Depth of water table below formation level		Typical range for coefficient of permeability CBR %	Infiltration
		>600mm	<600mm		
Heavy Clay	70	2	1	10 ⁻¹⁰ to 10 ⁻⁸	No
	60	2	1.5		
	50	2.5	2		
	40	3	2		
Silt clay	30	5	3	10 ⁻⁹ to 10 ⁻⁸	No
Sandy clay	20	6	4	10 ⁻⁹ to 10 ⁻⁶	Partial
	10	7	5		
Silt	Non-plastic	2	1	10 ⁻⁸ to 10 ⁻⁶	Partial
Poorly graded sand	Non-plastic	20	10	10 ⁻⁷ to 10 ⁻⁶	Partial
Well graded sand	Non-plastic	40	15	10 ⁻⁶ to 10 ⁻⁴	Partial
Well graded sandy gravel	Non-plastic	60	20	10 ⁻⁵ to 10 ⁻³	Partial

This field guide is provided as an aid to assessing the mechanical stabilisation requirements in commonly encountered site conditions. Neither Groundtrax nor Terram, who provided this information, accept no responsibility for any loss or damage resulting from the use of this guide who provided this information.



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Design Notes

1. Minimum subbase thickness (tx) can be selected from table 1 or 2 with ground strength and permeability estimated from tables 3 and 4 in the absence of any site specific ground investigation report.
2. If the Terram Bodgrid (or equivalent) layer is omitted, the total subbase layer thickness (Tx) must be increased by 50%. A Terram standard geotextile (or equivalent) separation layer should be specified with lower subgrade strength (CBR value) requiring a more robust grade in accordance with BS8661:2019 (see table 2).
3. Bodpave units are an ideal surface for source control porous paving SuDS (Sustainable Drainage Systems) with a permeable subbase; DoT Type 3 (Type 1x) porous/open graded granular material described in Specification for Highways Works clause 805. If a higher water storage (attenuation) capacity (void ratio) is required a hard crushed angular "clean stone" such as a course graded aggregate (CGA) type 4/20 (4mm minimum and 20mm maximum particle size) can be used. The type of SuDS design (attenuation, total or partial infiltration) will depend upon the underlying ground conditions and not all sites are suitable for infiltration. Weak and low-permeability cohesive subgrades are generally unsuitable for infiltration (permeability coefficient $k < 10^{-6}$ m/s). Clays with a low plasticity index (<20%) will reduce in strength when saturated; a full attenuation system with an impermeable membrane directly on top of the subgrade is recommended (See table 4). Specific advice on suitable drainage and construction over very weak ground (CBR <1%) is available from the manufacturer.
4. Alternatively traditional 'DoT Type 1@ well graded granular material may be used for the subbase provided that an adequate drainage system is installed. Typical drainage details; 100mm diameter perforated pipe drain laid at minimum gradient 1:100, bedded on gravel in trench backfilled with SHW Clause 505 'TypeA' drainage aggregate (or CGA type 4/20), covered or wrapped with a standard non-woven geotextile such as Terram T1000 or equivalent and leading to suitable outfall or soakaway. Drains placed down the centre or along the edge of access routes up to 5m wide. Wider areas may require additional drains at 5m-10m centres.
5. The subbase must be covered with a layer of a standard non-woven geotextile such as Terram T1000, Inbitex or equivalent to prevent settlement due to mixing of the bedding & subbase layers to provide filtration & pollution control.
6. Bedding layer material should be either free-draining clean angular hard aggregate gravel chippings or course grit sand. Bodpave units should be filled with free draining angular hard aggregate gravel chippings. **Rounded pea shingle is not suitable.** See table 6 for more details.
7. The final payment and drainage design should be undertaken by a suitably qualified civil engineer and based on specific site conditions.
8. Maximum advised gradient for traffic applications is 12% (1:8) 7o, Bodpave units have specific fixing points for steel u-pins if required for steep slope applications.



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