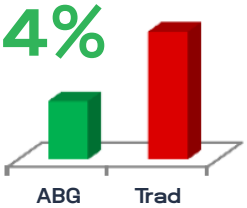
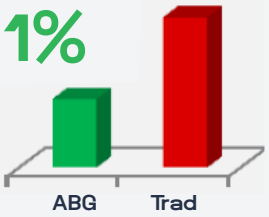
Tech Note: Carbon Footprint Reduction

ABG Porous Paving systems

Gravel Finish

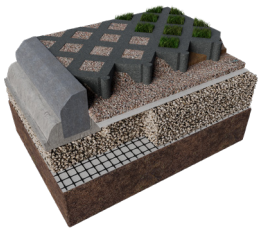
In areas of frequent traffic a gravel finish is the best option. Using ABG Porous Paving solutions the carbon footprint of the solution can be significantly reduced.

Application	ABG System	Traditional Method	Carbon Saving
Light Traffic	**Sudspave** • Interlocking geosynthetic pavers with porous gravel backfill • Quick installation • Recycled materials	**Permeable Block Paving** • Concrete blocks with porous jointing • Labour-intensive laying process	**54%**  **Saves 20kg CO_2e/m^2**
Heavy Traffic	**Truckcell** • Interlocking heavy duty pre-cast pavers with 50% void space • Made from recycled plastic • Backfilled with gravel	**Cast On-Site Cellular Concrete** • Concrete poured on site • Plastic formwork is burned off to leave voids • Backfilled with gravel	**31%**  **Saves 10kg CO_2e/m^2**

Carbon Neutral Grassed Finishes

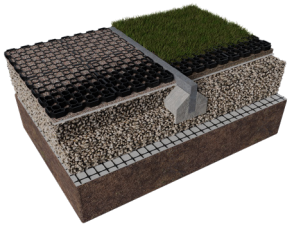
A grassed finish is best suited to environments where the frequency of traffic is low so that the passage of vehicles does not permanently damage the grass - overflow car parks, helipads, events arenas, maintenance and/or emergency vehicle access tracks etc. The time until a system is carbon neutral depends how long the grassed finish remains in place.

Advanced Turf System (ATS)		Sudspave - Green Finish	
Advanced Turf System • Mesh reinforced soil • Mixed with rootzone (a topsoil / sand blend) • Discreet reinforcment	**51 years** **(Time until system is carbon neutral)**	**Sudspave** • Interlocking geosynthetic pavers with rootzone bedding layer and backfill • Quick intallation • Recycled materials	**49 years** **(Time until system is carbon neutral)**



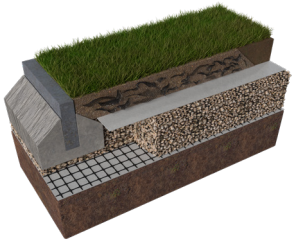
Truckcell

https://www.abg-geosynthetics.com/products/truckcell



Sudspave

https://www.abg-geosynthetics.com/products/sudspave



Advanced Turf (ATS)

https://abg-geosynthetics.com/products/advanced-turf

Truckcell: can be filled with grass or gravel

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General Assumptions

The analysis method follows that described in the WRAP report (Corney, 2010). The carbon associated with four key stages is assessed a) removal and disposal of waste soil, b) the embodied carbon of imported materials, c) the transportation of imported materials to site, and d) construction on site. The carbon footprint of waste material is based on fuel burnt during excavation, loading, and transportation to landfill at an assumed rate of 10m3 per load, 15 minutes excavation and loading time per load, and a 15 mile return journey to the nearest landfill. The fuel efficiency of the vehicles used is assumed as 25 L/hr (excavation and loading) and 2.2 miles/L (bulk soils transportation). The carbon footprint of burning diesel is assessed as 2.60 kgCO2e/L (kilograms of carbon dioxide equivalent per litre of fuel) based on the value given for 'Diesel (average biofuel blend)' in the DEFRA report (Department for Environment Food & Rural Affairs, 2018). The embodied carbon of the various imported gravels used in these assessments is assumed to be quarried crushed rock with an embodied carbon footprint of 0.0052 kgECO2e/kg (kilograms of embodied carbon dioxide equivalent per kilogram of product) as per the ICE report (Hammond and Jones, 2011). The embodied carbon of all ABG geosynthetic products is based on ABG internal assessments (Heritage, 2018) and 'Obtaining reliable embodied carbon values for geosynthetics' (Raja, 2015). The transportation of imported materials is generally based on the installation site being 200 miles from ABG and 10 miles from the nearest quarry. Fuel economy is estimated as 4.4 miles/L for light ABG delivery wagons, and 2.2 miles/L for bulk aggregate transport. The weight of material transported per load varies for each item. The carbon footprint associated with construction is based on estimates where possible and ignored in more complicated situations for simplicity of calculations.

Gravel Finish – Light Traffic

The embodied carbon of the Permeable Block Paving is assessed as 36 kgCO2e/kg (Marshalls.co.uk, 2018) which includes transportation. Added to this is the embodied carbon in the bedding layer and fine gravel in the joints between the pavers. The Sudspave design is a 40mm recycled plastic paver on a 20mm bedding layer. The carbon footprint of the Sudspave solution is based on 1) the embodied carbon of Sudspave pavers, the gravel infill and bedding materials, and a layer of separation geotextile; and 2) the transportation of these materials to site. The embodied carbon of the Sudspave pavers is based on the value used by ABG when assessing the carbon footprint of 100% recycled HDPE. For simplicity, the carbon footprint associated with excavation and road foundation construction (including the carbon associated with waste soil) has not been included in these assessments as it is considered to be the same in both cases – just the carbon footprint of the surfacing is compared.

Gravel Finish – Heavy Traffic

Cast on-site porous cellular concrete blocks are a system which consists of an egg-carton shaped plastic mould being laid on a prepared sub-base/bedding layer. Steel reinforcing bar is then placed in the mould and concrete poured to form a honeycomb shape (visually similar to Truckcell). The exposed plastic mould is then burnt off and the voids exposed are backfilled with porous gravel. The carbon footprint of the cast on-site porous cellular blocks is based on 1) the embodied carbon of the plastic formwork, concrete, reinforcing steel, and gravel backfill and bedding (Hammond and Jones, 2011); 2) the carbon released when burning off the exposed plastic former (Eriksson & Finnveden, 2009), and 3) the transport of all elements to site. The plastic former is assumed to come from a specialist supplier 200 miles from site (as per to ABG materials) whereas the concrete and steel is assumed to be sourced 10 miles from site. Truckcell is an 80mm heavy duty porous plastic paver made from 100% recycled plastic which is backfilled with, and has a 20mm thick bedding layer of, porous gravel. So the carbon footprint of the Truckcell option is based on 1) the embodied carbon of the Truckcell, and gravel backfill and bedding; and 2) the transport of all elements to site. The embodied carbon of the Truckcell is based on the declared value of 0.538 kg ECO2e/kg from the relevant Environmental Product Declaration. For simplicity, the carbon footprint associated with excavation and road foundation construction (including the carbon associated with waste soil) has not been included in these assessments as it is considered to be the same in both cases – just the carbon footprint of the surfacing is compared.

Grassed Finish – Advanced Turf System (ATS)

ABG Advanced Turf System (ATS) is a porous turf reinforcing system comprising mesh elements blended with sandy rootzone growing media. The carbon footprint of the ATS is based on: removal of 300mm of waste material; the embodied carbon of a typical 200mm thick surfacing with 5.4kg of mesh elements per m3, a separation geotextile at the base, a 100mm thick Type 3 sub-base stabilised with a geogrid, and a second separation textile between the sub-base and subgrade; transportation of materials to site, and construction of the system. The embodied carbon of the mesh elements is based on the recommended value for PP geogrid (Raja, 2015). As ATS requires a specialist to mix the mesh and rootzone, the transportation to site is based on a 200 mile journey as with other ABG products.

Grassed Finish – Sudspave

Sudspave is a cellular plastic paving system backfilled with rootzone (a sand/topsoil blend) for grass growth. The carbon footprint of the cellular plastic pavers is generally based on the assessment for Sudspave (see 'Gravel Finish - Light Traffic'). Added to this is a 200mm thick Type 3 sub-base stabilised with a geogrid, and a separation textile between the sub-base and the subgrade. In additions, the gravel backfill and bedding is replaced with rootzone backfill (40mm) and bedding layer (50mm). As the rootzone does not require a specialist mix, the transportation to site is based on a 10 mile journey.

Carbon Neutral Time

The time for a system to become carbon neutral is based on the assumption that grass sequesters carbon at a rate of 1 Mg C ha-1 yr-1 (Qian & Follett, 2002) or 0.37 kgCO2e/m2/yr. It is assumed that the grass is not irrigated, that no fertiliser is added, and that the grass is mown fortnightly for 6 months of the year (Spring/Summer) and monthly for the remainder of the year.

References

Corney, N. et. al. (2010) Sustainable Geosystems in civil engineering applications, WRAP Geosystems Report MRF116-001

Department for Environment Food & Rural Affairs (2018) UK Government GHG Conversion Factors for Company Reporting.

Eriksson, O. & Finnveden, G. (2009) Plastic waste as a fuel - CO2-neutral or not?, Energy & Environmental Science, 2(9), 907. doi: 10.1039/b908135f

Hammond, G. & Jones, C. (2011) Inventory of Carbon & Energy (ICE) Version 2.0, Sustainable Energy Research Team (SERT) Department of Mechanical Engineering, University of Bath, UK

Heritage, R. (2018) Embedded Carbon of ABG Geosynthetics, ABG Technical Note

Marshalls.co.uk (2018) Carbon Footprint Calculator for Hard Landscaping. [online] Available at: https://www.marshalls.co.uk/homeowners/hard-landscaping-carbonfootprint-calculator [Accessed 18 Sep. 2018].

Qian, Y. & Follett, R. (2002) Assessing Soil Carbon Sequestration in Turfgrass Systems Using Long-Term Soil Testing Data, Agronomy Journal, 94(4), 930. doi: 10.2134/agronj2002.0930

Raja, J., Dixon, N., Fowmes, G., Frost, M. and Assinder, P. (2015) Obtaining reliable embodied carbon values for geosynthetics. Geosynthetics International. [http://dx.doi.org/10.1680/gein.15.00020]

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