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**Specification for performance  
parameters and test methods for green  
roof substrates**

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# Foreword

## Publishing information

This British Standard is published by BSI Standards Limited, under licence from The British Standards Institution, and came into effect on 31 August 2019. It was prepared by Technical Committee AW/20, *Topsoil, Other Growing Media & Turf*. A list of organizations represented on this committee can be obtained on request to its secretary.

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## Presentational conventions

The provisions of this standard are presented in roman (i.e. upright) type. Its methods are expressed as a set of instructions, a description, or in sentences in which the principal auxiliary verb is “shall”.

*Commentary, explanation and general informative material is presented in smaller italic type, and does not constitute a normative element.*

The word “should” is used to express recommendations of this standard. The word “may” is used in the text to express permissibility, e.g. as an alternative to the primary recommendation of the clause. The word “can” is used to express possibility, e.g. a consequence of an action or an event.

Notes and commentaries are provided throughout the text of this standard. Notes give references and additional information that are important but do not form part of the recommendations. Commentaries give background information.

Where words have alternative spellings, the preferred spelling of the Shorter Oxford English Dictionary is used (e.g. “organization” rather than “organisation”).

## Contractual and legal considerations

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**Compliance with a British Standard cannot confer immunity from legal obligations.**

## 0 Introduction

A green roof is typically understood to be an intentionally vegetated roof or platform disconnected from the underlying ground. Green roofs range from simple shallow/lightweight systems comprising only vegetation supported by substrates, to accessible roof gardens characterized by deeper substrates and diverse planting. A distinction between “extensive” systems with less than 150 mm substrate and “intensive” systems with more than 150 mm substrate is often made. However, many alternative system configurations are observed in practice. Substrate is a key component of any green roof and directly contributes to its success. The suitability of a green roof substrate can be assessed by measuring key performance parameters.

*NOTE 1 For more information on how extensive and intensive substrates are typically characterized, see Annex A.*

Green roofs are living systems, reliant on a complex set of factors, including climatic conditions and nutrient and water availability. There are, therefore, many considerations when designing and installing a green roof to achieve the desired green roof habitat, ecosystem service provisions and aesthetic quality. Weight restrictions, installed substrate, planting regimes, as well as the aspect and environment in which a building is located, can limit what is achievable on a green roof.

*NOTE 2 For more information on green roofs, not confined to substrates, see the GRU Green Roof Code [1].*

Green roofs have the potential to deliver multiple benefits. These include positive impacts on urban amenity, health and well-being, biodiversity (habitat creation), building energy savings, roof membrane protection, improvements in air quality, urban heat island mitigation and urban flood risk reduction.

Many green roof systems incorporate an underlying drainage layer or drainage board below the substrate to ensure that the system is effectively drained. In some instances this layer can also provide sub-surface irrigation to the substrate. Methods to assess the suitability of substrates for this type of system are not dealt with in this standard.

*NOTE 3 Drainage boards are typically plastic, non-porous, and are also called reservoir boards.*

Green roofs contribute to urban green infrastructure, which increases the interactions between people and natural habitats. The effects of this are wide-ranging, from encouraging people to undertake physical activity to improving mental well-being through reducing anxiety and improving concentration [2]. In addition, a number of physical stressors, such as air pollution, which are being increasingly shown to have negative impacts on mental health, are also mitigated by green infrastructure, including green roofs [3].

Green roofs have the potential to act as high quality habitats in their own right, or contribute to the wider ecological landscape, particularly for mobile species such as birds and pollinating invertebrates such as bees [4]. Key limiting factors are:

- 1) their relative inaccessibility for colonizing species, especially on very high or very urban roofs [5]; and
- 2) limitations posed by their design, such as soil moisture content [6] and the diversity of the plant community present [7].

Greater diversity on green roofs can be achieved by planting appropriate plant mixes at the time of construction (e.g. wildflower meadows) or by designing green roofs to maximize natural colonization; this method usually takes longer to achieve results than direct planting. Success in establishing viable plant communities, however, relies on producing environmental conditions conducive to plant growth, of which initial substrate selection is key.

From a stormwater management perspective, green roofs (even shallow, extensive, systems) offer considerable potential to intercept and retain small rainfall events. However, they have finite capacity, and additional downstream measures are required to ensure protection from extreme events within a fully scoped Sustainable Drainage System (SuDS). Substrate characteristics can significantly affect the ability of a green roof to retain stormwater.

*NOTE 4 Further information is provided in the CIRIA SuDS Manual (Woods-Ballard et al., 2015) [8].*

## 1 Scope

This British Standard specifies requirements for the testing of substrates (the growing medium) for constructed green roofs intended to provide long term support for specified plant communities. This includes extensive and intensive green roof substrates.

This British Standard provides methodologies for testing green roof substrates covering the complete application range, and recommended specifications for physical and chemical characteristics considered to be optimal for extensive substrates.

This British Standard only addresses methods and parameters to ensure that the substrate used does not become a limiting factor for successful green roof installation. It does not address the wider range of other design considerations, such as the supporting structure construction, planting options or post-build maintenance.

It is recognized that there are green roof systems that do not incorporate a substrate layer and these are not covered in this British Standard.

## 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes provisions of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

BS EN 932-1:1997, *Tests for general properties of aggregates — Part 1: Methods for sampling*

## 3 Terms and definitions

For the purposes of this British Standard, the terms and definitions given in BS 3882:2015 and the following apply.

### 3.1 green roof

intentionally vegetated roof or platform disconnected from the underlying ground

*NOTE 1 Green roofs can occur naturally but this British Standard covers constructed green roofs.*

*NOTE 2 Green roofs are also known as living roofs.*

#### 3.1.1 extensive green roof

roof that generally provides a visual or biodiverse interest and is considered to be less suitable as an amenity or leisure space

[SOURCE: GRO Code, 2.2.1]

*NOTE 1 Planting often includes (1) perennial succulent species, most often *Sedum* spp., which flower from April to September, (2) annual wildflower mixes, with some perennials, which are likely to flower in spring and autumn, and become dormant or die during winter and late summer before re-seeding and (3) a mixture of the two. All*