

Advice Sheet 33: **BS8601:2013 British Standard Subsoil**

What is Subsoil?

The subsoil is an essential component of most soil profiles. Only soil that is shallow over rock lacks a subsoil layer. Subsoil provides storage of moisture, transmits rainfall to deeper layers or watercourses and enables deep rooting by trees, shrubs, grasses & other plants. It controls water logging of surface layers, helps vegetation and crops to withstand summer droughts and provides anchorage for trees. Subsoil plays an important role in reducing the amount and speed of surface water runoff, reduces the risk of erosion and flooding, and consequently is an integral part of sustainable drainage systems.

Subsoil can be both naturally occurring and manufactured. Naturally occurring subsoil is the product of dynamic, chemical, physical and (to a lesser extent) biological processes acting on weathered mineral matter. Subsoil can be manufactured by combining mineral ingredients to provide a medium that develop properties similar to naturally occurring subsoil.

What is the BS8601:2013?

This British Standard specifies requirements for subsoils that are moved or traded for creating soil profiles intended to support plant growth. It is not intended for the grading of subsoil *in situ*. This standard recognises 2 different grades of subsoil; **Multipurpose** subsoil and **Specific Purpose** subsoil. As can be implied from the name, multipurpose subsoil suits the majority of situations where subsoil is required. Specific purpose subsoil comprises of subsoils with characteristics appropriate for specialist applications, e.g. supporting the growth of certain plant communities. Specific purpose subsoils can either be:

- Acidic
- Calcareous

This is the first British Standard for subsoils and its very existence confirms the importance of subsoil within the soil profile.

Sampling

The standard states that natural subsoil should be sampled to its full depth before stripping. Sampling patterns should be based on a rectilinear grid or W-pattern. Before sampling, a specialist resource survey should be carried out which will determine the different soil areas where a separate subsoil analysis will be required. A minimum of 10 incremental samples should be taken across each sampling area and mixed together to create a 2kg composite sample.

For manufactured subsoils, point samples should be taken from the stockpile at regular intervals from the surface and the core. One composite sample shall represent no more than 5000m³ of subsoil supplied or produced.

These composite samples should then be thoroughly mixed and sub-divided by quartering or riffing to produce a reduced sample of not less than 1kg which can then be sent to NRM for analysis.

Analysis

The minimum testing requirement includes pH, texture, organic matter, neutralising value, coarse fragments and visible contaminants, along with the soil conductivity and the phytotoxic contaminants (zinc, copper and nickel). To calculate the exchangeable sodium percentage (ESP) knowledge of the concentration of the cations is required so values for potassium, sodium, calcium and magnesium are listed on the report but do not have any influence on compliance with the standard. Methods of tests employed at NRM satisfy the BS8601:2013 standard.

Report

The NRM BS8601 Subsoil report will classify the soil into either its grade, or report the subsoil as a failure or non-compliant. On the left of the report is the list of the tests performed, and on the right the test is marked with a Y (yes) or a N (no), which state if that test result falls within the permissible range **for that grade** of subsoil. The supplier needs a full list of 'Y' against a particular grade of subsoil before a declaration of compliance can be made. The subsoil characteristics are listed in Table 1 (please see following page).

What is the ESP or exchangeable Sodium Percentage?

Salinity is measured by the electrical conductivity of the soil solution which is a measure of the soluble salts in the soil. The most common soluble constituents are products of fertilisers (ammonium, potassium, calcium, magnesium, sulphate and nitrate) or sodium and chloride from sea water flooding. There are 3 possible problems with very high salinity;

- An osmotic effect on root activity
- A toxicity effect
- A soil structural stability effect depending on the proportion of sodium in the soluble ions.

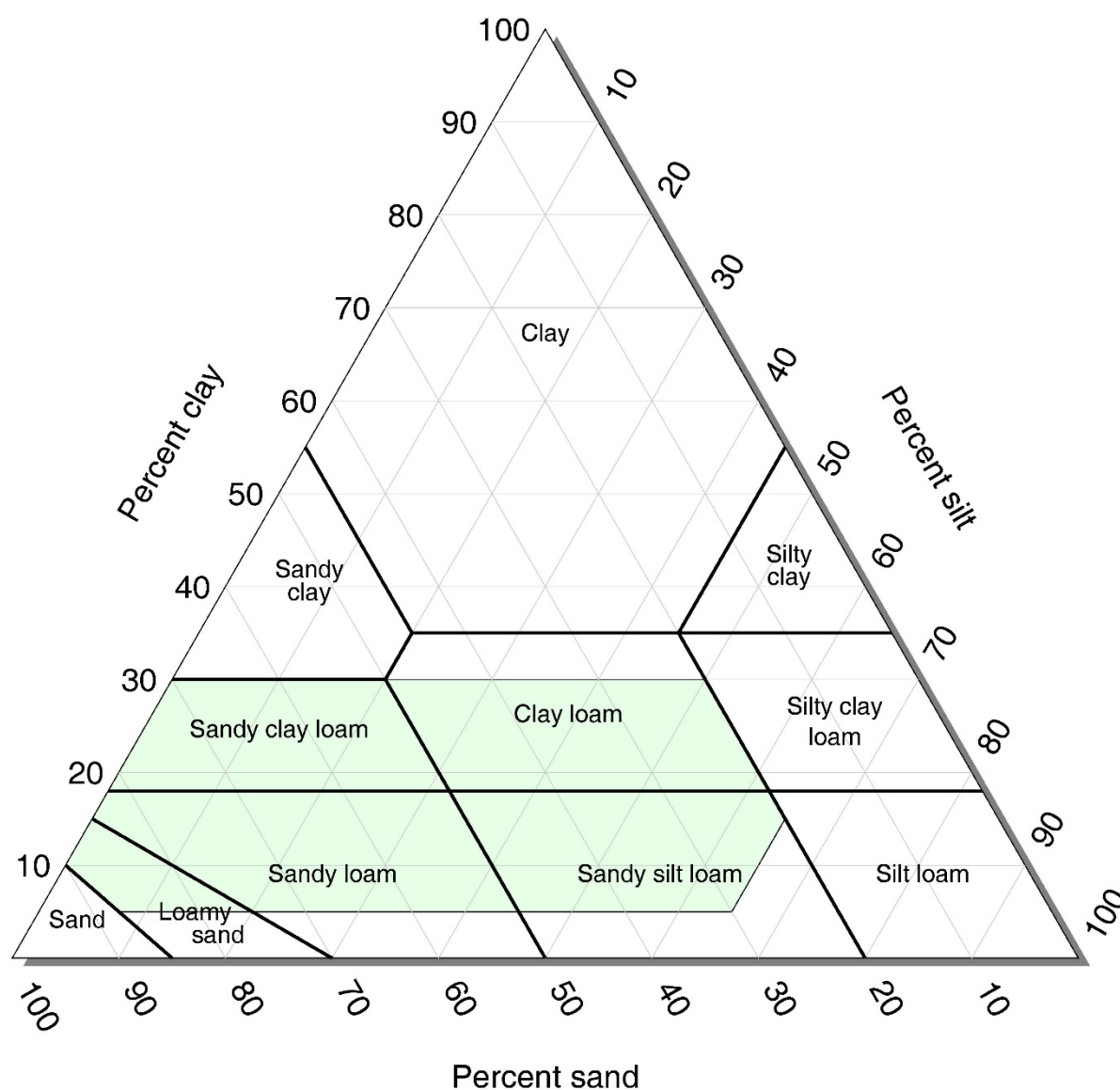
Different plant species display a range of tolerances to the soluble salts present: this can be measured by soil electrical conductivity. However a low soil electrical conductivity is not necessarily a guide to the absence of sodium related structural problems.

The exchangeable sodium percentage (ESP) is a measure of the exchangeable sodium ions relative to the total exchangeable ions. If the soil conductivity is greater than 2800uS/cm, the ESP needs to be measured. An ESP of up to 15% is acceptable where the clay content is less than 35%. Only soils with an ESP less than 15% conform to this standard. Gypsum can be applied to ameliorate structural instability due to excessive sodium, preventing clay dispersion by exchanging the exchangeable sodium with calcium.

Table 1 – Subsoil Characteristics

Parameter	Multipurpose Subsoil	Specific Purpose Subsoil	
		Acidic	Calcareous
Soil Texture (%m/m)	See textural classification triangle for permitted soil textural classes (Figure 1)		
Soil Organic Matter Content (%m/m)	Maximum 2%		
Maximum Coarse Fragment Content (%m/m)			
>2mm	40		
>20mm	20		
>75mm	0		
pH H₂O (Measured in water)	5.5 to 8.5	3.5 to 5.5	7.5 to 8.5
Carbonate (% m/m)	N/A	N/A	>1
Exchangeable Sodium Percentage (%) (Need not measure if Soil Electrical Conductivity is <2800 $\mu\text{S cm}^{-1}$)	< 15		
Electrical Conductivity ($\mu\text{S cm}^{-1}$)	Value to be measured and recorded		
Phytotoxic Contaminants (by Soil pH) (mg/kg DS)	Multipurpose and Specific Purpose Subsoils		
	Soil pH < 6.0	Soil pH 6.0 - 7.0	Soil pH > 7.0
Zinc (Zn)	< 200	< 200	< 300
Copper (Cu)	< 100	< 135	< 200
Nickel (Ni)	< 60	< 75	< 110
Visible Contaminants (%m/m)			
> 2mm	< 0.5		
... of which plastics	< 0.25		
... sharps	Zero in 1kg of air-dried soil		

Figure 1 – Textural Classification Triangle



We refer the reader to the informative British Standard BS8601:2013 for more details on Subsoil and its use, handling and storage.

The standard can be purchased from the British Standards Institute, 309 Chiswick High Road, London W4 4AL.

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