Rufford
sports surface technology

Sands for Sports Turf

Sand is a cornerstone ingredient in most construction and maintenance materials for both natural and artificial playing surfaces. Whether mixed with an organic amendment to make top dressings and rootzones, or used on its own as a carpet infill or beach sport surface, sand plays a vitally important role in a playing surface's performance, appearance and longevity.

But sand comes in many different forms, all of varying quality with a range of properties and characteristics, and the challenge is to select the right one for your project. This article explains what sand is and introduces some of the basic considerations.

What is sand and where does it come from?

Sand is an inorganic mineral made up of individual particles or grains formed by the weathering and erosion of rock. These small pieces of rock will vary in chemical composition depending upon the source and condition of the parent rock from which they were derived.

Sand grains are categorised as those having a diameter of between 0.063mm and 2.0mm. Particles less than 0.063mm but greater than 0.002 we call silt, whilst particles less than 0.002mm are categorised as clay. Any particle greater than 2.0mm is classed as gravel.

It is important to remember that any particle having a size between 0.063mm and 2.0mm would be classed as sand, including sands with a very high calcium content (calcareous sands.) The majority of sands available in the UK consist mainly of silica (Silicon Dioxide SiO_2) which is inert, stable, extremely hard wearing and has a high melting point. Sand hardness is measured using the Mohs scale of mineral hardness which ranges from 1 being the softest (talc) up to 10 being the hardest (diamonds).

Typically sands containing a high silica content have a hardness of around 7, however the actual amount of silica can vary from around 80% up to 99.99% depending on source. Industrial silica sands are characterised by their high silica content, which is usually in the form of quartz. In general whiter sands have fewer impurities. Typical impurities would include: surface clay, feldspar, alumina, iron oxide, pyrite or chromite, but could also include, coal, lignite, sea shells or chloride salts

Sand extraction and processing

Sands are extracted from mines, open cast mines (quarries) or dredged from the sea or river beds. The source of extraction will usually determine any impurities present, for example sea dredged sands tend to have higher chloride salt and calcium (lime) contents. Numerous types of sand processing techniques are used, from the most basic which would involve the as dug sand passing through a screen to remove stones or gravel through to a more sophisticated washing plant which may also include: magnetic separation, sand attrition or even hot acid leaching.

Whilst the most basic form of processing may be acceptable for some building applications, it is not suitable for sportsturf for which a sand washing plant is essential. The most basic washing plant will rinse the material and remove some clay (sometimes these wash plants require the sand to be double washed to improve the cleanliness of the finished sand). For an advanced technical mineral processing, more sophisticated wash plants are used requiring large scale capital investment.

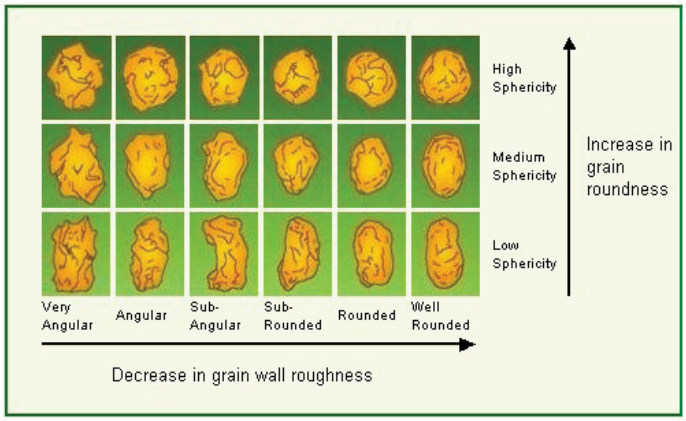
Such plants will not only wash the sand effectively but will also separate the incoming sand into two or more different grades. This process is called hydro classification and usually consists of density

separators, cyclones, dewatering screens and upward current tanks together with numerous pumps and extensive lengths of pipeline. It is a continuous process which utilises gravity to sort sand sizes whilst dispersed in water. Coarser heavier grains fall to the base of the tank for discharge whilst finer lighter grains remain suspended in water at the top and are removed as the water overflows. This process will manufacture consistently graded sand irrespective of fluctuations with incoming material. It also produces a tightly graded product with uniform sand grain sizes.

Particle Size Distribution

Sand deposits usually contain a wide range of grain sizes mixed with clays and gravels. These raw sand deposits require extensive processing to remove unwanted oversize grains and clays and to sort grain sizes to make them suitable for their intended application. Particle size distribution or sieve grading is carried out by laboratory analysis therefore representative samples are taken from the stockpile. This large sample is then reduced in size and dried. A small amount, typically around 100g, is then mechanically shaken through a stack of sieves. Various sieve mesh sizes are used depending on grain size distribution of the material being tested. If the material contained clay or organic material it would be washed and dried prior to sieve analysis testing otherwise the grains would stick together giving a false result.

Grain shape



Grain shape refers to two attributes: surface texture or angularity and grain roundness or sphericity. Grain shape is determined by nature and is dependent on the weathering and erosion subjected to each grain at the time they were formed. Glacial sand deposits tend to have a more rounded grain shape whereas carboniferous sandstone deposits are typically more angular.

Sands having a more angular grain shape are preferred when used in golf bunkers as this gives greater stability and less ball plugging, whereas rounded sands are preferred for use in synthetic turf infill.

Physical properties

Saturated Hydraulic Conductivity (otherwise known as Ksat or perc. rate) is probably the most critical test for a sports sand or rootzone material. This test will give an indication as to the amount of water that would percolate through the material whilst at field capacity for a given depth when placed above a gravel drainage layer.

Porosity measures the void space between the grains when compacted. Total porosity, as the term suggests, measures the total available pore space.

Capillary porosity, or water filled porosity, is the percentage of total porosity which contains water at or near the surface for a given depth (tension).

Non-capillary porosity, or air-filled porosity, is the percentage of total porosity which contains air at or near the surface for a given depth (tension).

Bulk Density is the measurement of weight to known volume. This figure is useful when calculating the amount of sand or rootzone required. For example if you required sand to fill a space 10m x 5m to 300mm depth (12") this would require 15 cubic metres of material. If this is multiplied by the bulk density figure then the quantity in weight is obtained.

Acidity of a sand or rootzone is measured using pH. Sands containing appreciable amounts of solid carbonates (calcium) should be avoided as this will increase the pH level. Ideally sands used for sportsturf should be slightly acidic.

Summary

Whilst a coarse sand may be expected to drain more freely than a finer sand this is not always the case. Grain size, shape, particle size distribution, silt/clay content, fine sand content and even silica content will all play their part in the performance of sand used for sportsturf. If you rely on particle size distribution alone to determine sand suitability for use then you could be in for a few surprises.

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