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An American National Standard

Standard Terminology Relating to Soil and Turfgrass Characteristics of Natural Playing Surfaces[1]

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1. Scope

1.1 This terminology defines characteristics of soils and turfgrass for use in the development of standards and specifications for natural playing surfaces. This standard includes terms that pertain to natural playing surfaces used for sports and may include those surfaces supporting the growth of turfgrass or unvegetated (bare soil) playing surfaces that are constructed with natural materials.

1.2 The terms defined in this terminology standard are appropriate for use by sports field development professionals, owners and institutions, installers and contractors and other practitioners in matters concerning natural surfaces evaluations, test methods, specifications, maintenance and construction.

2. Terminology

aeration, *n*—condition and sum of all processes affecting soil pore-space gaseous composition, particularly with respect to the amount and availability of oxygen for use by soil biota or soil chemical oxidation reactions, or both.

aeration, *v*—practice to mechanically restore a soil to a condition where gas and water permeability rates are improved and bulk density is lowered (decompaction) by the use of devices (spikes, cores, tines, air-jets, water-jets) which penetrate into the soil profile. See also **aerification, soil** and **cultivation, turf**.

aerification, soil, *n*—mechanical process to relieve soil compaction. This term is often used synonymously with aeration, v (that is, mechanical aeration). See also **aeration, v**.

bulk density, *n*—mass of dry soil per unit bulk volume. The value is expressed as Mg per cubic metre (Mg m^{-3}) or gram per cubic centimetre (g cm^{-3}).

clay, *n*—can be defined in terms of a particular size fraction of a soil, a soil textural class, a soil particle size class, a soil textural group, soil mineralogy, or, in engineering terms, as materials that exhibit plastic soil properties when at appropriate water contents.

DISCUSSION—Ideally, the term "clay" should be appropriately defined when used to describe soils or materials for rootzones. For example, a 90 % sand/10 % clay mixture could imply either 90 % sand/10 % clayey soil (or other soils with textures containing enough clay (<0.002 mm) to exhibit plasticity) or 90 % sand (2 to 0.05 mm)/10 % clay (<0.002 mm).

clay, as a particular size fraction of a soil, n—soil separate consisting of particles <0.002 mm (fine earth fraction) in equivalent diameter.

clay, as a textural class, n—soil material that contains 40 % or more clay, <45 % sand, and <40 % silt.

clay, as a soil particle size class, n—soil material that contains 35 % or more clay (clayey soils).

clay, as a soil textural group, n—soil material that falls within the textural classes of "sandy clay," "silty clay," and "clay (clayey soils)."

clay, in terms of mineralogy, n—soil particulates that are commonly occurring but not restricted to the <0.002 mm fraction (clay minerals). Commonly occurring in soil mineralogy classes as smectitic, kaolinitic, illitic (micaceous), gibbsitic, ferritic, or mixed.

DISCUSSION—Soil mineralogy classes are defined predominantly by the type of soil mineral dominating (40 % or more) the fine earth fraction.

clay, in engineering terms, n—soils containing enough soil material in the less than 0.4 mm fractions such that when moist they exhibit consistence characteristics of "moderately plastic" or "very plastic" forming a roll 4 cm or longer and 4 mm or thinner that supports its own weight.

coefficient of uniformity, CU_{Irr}, irrigation , *n*—measure of the efficiency of irrigation application (expressed as a percent) which was originally described by J.E. Christiansen.

DISCUSSION—The original Christiansen's CU was a computation which could be determined without statistical analysis. In more precise statistical terms, it can now be defined as the value obtained from

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subtracting the statistical coefficient of variability (CV) value from 1 (or 100 when expressed as a percentage): $CU_{Irr} = 1 - CV$.

coefficient of uniformity, C_u (D), particle size, *n*—in describing granular materials, it is a measure of the particle size range of the granules.

DISCUSSION—Uniformity coefficients must be described as to the particle size range for which it is describing the uniformity. For example, a C_u value which describes the particle size range between the particle size for the D_{60} to D_{10} (D_{60}/D_{10}) will produce a different number than the C_u which describes the particle size range between D_{85} and D_{15} (D_{85}/D_{15}). Traditionally, the C_u value used in engineering and soil mechanics has been the D_{60}/D_{10} relationship which is also sometimes termed as the 'Hazen Coefficient.'

coefficient of variability (CV), *n*—ratio of the sample standard deviation to the sample mean (s / $\bar{x}$).

DISCUSSION—The coefficient of variation measures the spread of a set of data as a proportion to its mean. It is often expressed as a percentage.

cool season turfgrasses, *n*—grass species widely adapted to cool climates.

DISCUSSION—Some species persist and are used in warm temperate climates either for the specific turf qualities or to provide an actively growing turf system during a period when warm season turfgrasses exhibit winter dormancy.

cultivation, turf, *n*—practice of disrupting the soil by mechanical means without turning or excessively disrupting the sod.

DISCUSSION—This may include such practices as spiking or solid-tine aeration, coring or hollow-tine aeration, grooving or slicing, or drilling. It might also include methods to inject water or air into the soil to create channels, holes, or fissures or break up the soil structure, or a combination thereof.

coring, n—process in which a hollow spike (pipe) tine is inserted more or less vertically into the soil using a mechanical aerator machine.

DISCUSSION—Hollow tines are normally cylindrical and have a sidewall cutout which allows for the soil core to eject the previous soil core in a continuous process as the core is pushed into the soil. The end result is that the turf surface is littered with soil cores having a plug of turf attached to the one end. These cores can be removed or left to dry and then broken up using some type of drag. A subsequent mowing may also break up the cores but caution should be used to limit the hazard from flying debris.

drilling, n—practice which combines principles of both spiking and coring. Instead of pushing a solid or hollow tine into the soil a specially modified drill bit is drilled into the soil to create a hole and also to remove the soil from the rootzone in the process.

DISCUSSION—Drilling is sometimes used to eliminate the propensity to create a somewhat compacted layer at the bottom of the tine penetration depth or to reach greater soil profile depths than is typically possible with standard-tine aeration machines.

grooving, n—see **slicing**.

punching, n—see **spiking**.

slicing, n—process which uses mechanically driven blades to slice vertically into the soil which will create a series of grooves or channels.

DISCUSSION—Historically, slicing practices cut through the sod layer to limited shallow depths in the soil and created little soil disturbance other than the actual creating of the groove and were not very effective at compaction relief or improving soil aeration. More modern slicing techniques using updated equipment (so called "vertical," "shattertine," or "quaking" aerators) slice through the soil with offset knives which create a wobbling or quaking effect which has shown to have better results for compaction relief due to this soil-shattering action.

spiking, n—process in which a solid spike (solid tine) is inserted more or less vertically into the soil. Solid tines can include round bar stock, knives, or bayonets.

D number, *n*—on a logarithmic cumulative percent (%) passing particle size distribution curve, the D number (D_X or DX) is the particle size that correlates with point on the curve in which X % of the particles pass or are finer.

DISCUSSION—For example, a D_{60} (D60) value is the point on the curve in which 60 % of the particles are finer than that diameter. A D_{20} (D20) value can be viewed as a particle size diameter where 20 % of the sand would be less than and 80 % would be greater than that size.

dethatching, *n*—mechanical process used to remove and reduce the amount of thatch in a turfgrass installation. This could include a mechanical "verticutter," power rake, spike drag, or even shallow-depth core cultivation. See also **verticutting**.

gravel, *n*—commonly used to denote spherical, cube-like, or equiaxial aggregate materials with an equivalent diameter > 2.0 mm and < 7.6 mm. More correctly used, this classification refers to "rock fragments" classed as pebbles in the Glossary of Soil Science Terms (1997).

interseeding, *n*—an overseeding practice whereby the purpose or intention of the practice is not simply to increase plant density or for winter overseeding of warm season turfgrass, but rather to change the species or cultivar composition of the resultant turfgrass stand. See also **overseeding**.

matric potential (soil water potential, or pressure, head), *n*—amount of work that must be done per unit of a specified quantity of pure water in order to transport reversibly and isothermally an infinitesimal quantity of water from a specified source to a specified destination.

DISCUSSION—If the specified quantity is volume, the potential is referred to as pressure (Pa). If the specified quantity is weight, the potential is referred to as head (m). If the specified quantity is mass, the energy potential is the term used ($J\ kg^{-1}$).

organic matter, *n—in context with soils and turfgrass systems*, the carbon-based residue of plant or animal residues, or both.

DISCUSSION—In a well-decomposed stable form within the soil it often referred to as 'humus' or as 'soil organic matter.' Organic matter is often discussed in terms of its level of decomposition. Less decomposed organic forms when incorporated into the soil do not technically become part of the soil organic matter until they are broken down into a stable form of humus. It is simply organic "debris" (part of the organic fraction but not technically "soil organic matter") until such decomposition occurs. Composts are also commonly marketed and sold as organic matter (often for the intent to use as a soil amendment) but it may not broken down to a degree so as to technically be classified as soil organic matter (or humus) or many times the compost-material may be preblended with soil mineral matter such that it is really just an organic-rich soil material. See also **soil organic matter**.

overseeding, *n*—practice of seeding a turfgrass into a turf area that has an established turfgrass.

DISCUSSION—Overseeding is normally practiced to increase plant density of a pre-established turfgrass stand or to seed a cool season

turfgrass into a warm season turfgrass for the purpose of providing green color or an actively growing turfgrass, or both, during a winter dormancy period. See also **interseeding**.

particle density, *n*—density of the soil particles, the dry mass of the particles being divided by the solid (not bulk) volume of the particles, in contrast with bulk density. Units are Mg m^{-3} or g cm^{-3}.

permeability, soil, *n*—property of a porous soil medium that expresses the ease with which gases, liquids, or other substances can flow through it.

playing surface, *n*—surface of contact with a player, ball, or any other object or animal utilizing the surface.

DISCUSSION—A natural playing surface may be turfgrass or other vegetation, soil, sand, other natural organic and inorganic materials, or combinations of these types of surfaces.

playing surface system, *n*—composite that includes the contact surface, energy-absorbing materials, if any, and the substrates.

porosity, *n*—volume of pores in a soil sample (non-solid volume) divided by the bulk volume of the sample.

renovation, field, *n*—process to improve or restore the performance of an existing athletic field.

DISCUSSION—Renovation practices may be extensive such as removal and replacement of the rootzone profile, or more basic such as aerification and sand topdressing. Typical field renovation practices may fall between these two extremes and may include, for example: installation of a subsurface drainage system, extensive deep aeration, followed by heavy sand topdressing. Another type of renovation may include the removal of the sod, application of an amending sand, and then tilling into the existing rootzone, and then reseeding or resodding. Installation of a new or upgrading of an outdated irrigation system may be part of a renovation project.

rootzone, *n*—soil media which is available or prepared for the development and growth of roots and rhizomes.

saltation, *n*—a particular type of momentum-dependent transport involving: *(1)* The rolling, bouncing, or jumping action of soil particles 0.1 to 0.5 mm in diameter by wind, usually at a height <15 cm above the soil surface, for relatively short distances; *(2)* the rolling, bouncing, or jumping action of mineral grains, gravel, stones, or soil aggregates affected by the energy of flowing water; *(3)* the bouncing or jumping movement of material down slope in response to gravity.

sand, *n*—can be defined in terms of a particular size fraction of soil, a soil textural class, a soil particle size class, and a soil textural group.

DISCUSSION—Although no mineralogy term is associated with the definition of sand, common usage often utilizes the terms "quartz" or "silica" as synonyms for sand. While quartz is the most common silica mineral in soils and in the sand fractions in particular, quartz being a mineral highly resistant to weathering, the synonymy with the term sand is incorrect. A proper mineralogy class for quartz is "siliceous," defined as 90 % or more of the 0.2 to 2.0 mm fraction composed of silica minerals (quartz, chalcedony, or opal) and other extremely durable minerals that are resistant to weathering.

sand, as a particular size fraction of soil, n—soil separate consisting of particles >0.05 mm and <2.0 mm in equivalent diameter.

sand, as a textural class, n—soil material that contains 85 % or more sand, and not more than 10 % clay.

sand, as a soil particle size class, n—soil material that contains 70 % or more sand, and not more than 15 % clay (sandy soils).

sand, as a soil textural group, n—soil material that falls within the textural classes of "sand" and "loamy sand" (sandy soils).

saturated hydraulic conductivity, *n*—under saturated conditions, it is the proportionality factor in Darcy's law as applied to the viscous flow of water in soil.

DISCUSSION—The saturated hydraulic conductivity is the flux of water per unit gradient of hydraulic potential. When a head (height) of water is placed (ponded) over a saturated soil column, the quantity of water collected at the bottom of the column is defined as the "flux." The soil flux changes for a given soil material depending upon the height of the soil column and upon the height of water ponded upon the top of the soil column. The saturated hydraulic conductivity is a calculated value that "adjusts" the flux value to the soil to determine its water transmission (permeability) properties by mathematically adjusting the hydraulic potential such that if theoretically possible, the water ponding depth would be immediately at the soil surface. That is, all soil conductivity values are adjusted such that the reference point for permeability is the soil surface and not for the depth of water ponded on the surface.

skinned area, *n*—area on sports fields that, by design, is devoid of turfgrasses or other vegetation; may be entire field or a portion of the field (for example, skinned infield in baseball or softball; skinned base paths in otherwise turfed infield).

soil, *n*—sediments or other unconsolidated accumulations of solid particles produced by the physical and chemical disintegration of rocks, and which may or may not contain organic matter.

soil compaction, *n*—increasing the soil bulk density, and concomitantly decreasing the soil porosity, by the application of mechanical forces to the soil.

soil organic matter, *n*—the well decomposed, more or less stable portion of plant or animal residues, or both, in a mineral soil.

DISCUSSION—Often also referred to as 'humus.' See also **organic matter**.

soil profile, *n*—vertical section of a soil, showing the nature and sequence of the various layers, as developed by deposition or weathering, or both, or as developed by construction procedures.

soil texture (gradation, grain-size distribution), *n*—proportions by mass of a soil or fragmented rock distributed in specified particle size ranges.

soil textural class, *n*—texture designation based on relative proportions of the various soil separates: sand (2.0 to 0.05 mm in diameter), silt (0.05 to 0.002 mm), and clay (< 0.002 mm).

thatch, *n*—loose intermingled organic layer of dead and living shoots, stems, and roots that develops between the zone of green vegetation and the soil surface.

topdressing, soil, *n*—practice of applying a soil material (such as sand, organic materials, or blends) to the existing soil surface in an even layer.

DISCUSSION—This practice is often employed in conjunction with mechanical aeration to apply materials which will both partially form a surface layer and also be distributed into aeration holes for the purposes of modifying the soil properties. Often this is an ongoing maintenance process which relieves compaction, modifies the soil (normally sand applied to a heavier-textured soil), and controls the buildup of thatch and near-surface soil organic matter buildup.

topsoil, *n*—soil material that forms the top horizon of naturally formed soils (designated as an "A Horizon" in soil classification) which supports the growth of plants and normally has a greater degree of weathering and greater accumulations of organic matter than underlying soil horizons or soil parent material.

DISCUSSION—The term topsoil properly used should designate the top ("A") horizon of naturally formed soils. Soil materials other than topsoil are sometimes adulterated to provide chemical, physical, nutritional, or biological properties of topsoil materials (a "manufactured" topsoil). While these soil materials may provide a good growing medium they should not properly be termed "topsoil." Only soils which have naturally formed into a soil profile "A" horizon should be termed as topsoil. Some naturally formed soils have not undergone enough weathering and other soil-forming processes to be classified as topsoil even though such soils may form the soil surface and support plant growth.

sandy soils (> 85 % sand), n—types of soils which may have no (or a very thin) "A" horizon and thus technically not a "topsoil" material.

turf, *n*—covering of mowed vegetation, usually a turfgrass, growing in association with an upper soil stratum of intermingled roots and stems.

turfgrass, *n*—species or cultivar of grass, usually of spreading habit, which is maintained as a mowed turf.

verticutting, *n*—practice of using a mechanical device which operates vertically and cuts into the turf surface/thatch and often the upper soil layer.

DISCUSSION—Verticutting is often employed to remove excess thatch or the accumulation of excess actively growing turfgrass (thinning). Verticutting may also be employed to stimulate lateral turfgrass growth/development in order to increase turf density. This is sometimes also referred to as vertical mowing or power raking. See also **dethatching**.

warm-season turfgrasses, *n*—grass species widely adapted to warm temperate climates. Some species persist and are used in cool humid to cool sub-humid climates; referred to as a transition zone.

water retention, *n*—soil-water content (by mass or volume) at a given soil-water matric potential.

winter dormancy, *n*—dormancy of warm season turfgrasses during the winter when these warm season turf species are grown in areas subject to seasonal cool temperatures.

DISCUSSION—Normally, the warm season turfgrasses exhibit brown leaf tissue during dormancy and do not actively grow. Different warm season turfgrass species exhibit differing adaptations to cold temperatures and do not all go into or come out of winter dormancy at the same temperature ranges.

3. Keywords

3.1 athletic field; impact; sports; sports field; sports surfaces