A power screen for mixing of the soil and sand materials
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Preparation of a Sand: Soil Mix – Procedure and Pitfalls

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The construction of Category 1, 2 and 3 athletic fields, as outlined in the Sports Turf Association's *Athletic Field Construction Manual*, calls for a certain percentage of silt plus clay in the root zone. The site where the field is to be constructed may have an excellent top soil which the architect is reluctant to discard preferring to mix the existing top soil with sand to achieve the requirements of the category of field that is to be built.

Several points are necessary to consider in making the use of the in situ soil a success.

The first point is the sand and soil cannot be adequately mixed on site. Attempting to mix by layering the sand on the surface and rototilling it throughout the 30 cm depth of root zone will not be successful because the depth is beyond that workable by a rototiller and the sand will continue to be concentrated near the surface. The appropriate procedure is to strip the top soil off the site and stock pile it prior to mixing with the sand. The selected sand and appropriate volume of sand are then blended together by passing over a power screen. Stripping the top soil and the necessary sub soil allows the final grade to be established and the drainage system correctly installed.

The second point is the mixing must be based on particle size analysis of the sand and soil by an accredited laboratory. Standard dry sieve analysis must be done on the sand source and the particle size distribution should fall within the specifications as outlined in the *Manual*. The soil sample, however, must be analyzed by the standard procedure for soil texture which provides estimates of the percentage sand, silt and clay in the soil. During this

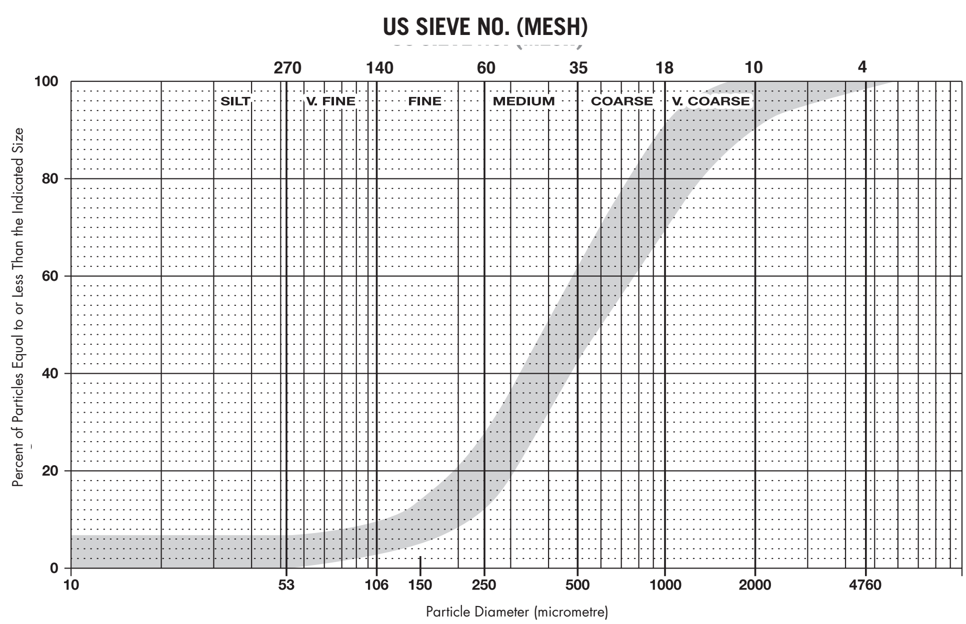


Table 1. The particle size distribution envelope for the root zone mix of a Category 1 athletic field. *Athletic Field Construction Manual*, Sports Turf Association, 2012.

procedure the aggregation or soil structure is destroyed so that all the individual soil particles are estimated. The use of the dry sieve analysis on the soil sample would result in high estimates of fine and very fine sand as the soil aggregates would appear in these size fractions. This is particularly true for soils which are well aggregated due to a high organic matter and/or clay content.

The laboratory should also be requested to do sieve analysis on the sand fraction in the soil using the same mesh sizes as used in the dry sieve analysis of the sand. The size distribution of the sand fraction in the soil should conform to that for the sand portion of the mix. Soils which are a fine sandy loam or a course sandy loam texture can result in poorly performing mixes if the sand in the soil makes up a large proportion of the total sand component of the final mix.

The third point is the volume of sand and of soil must be based on calculations using the data obtained from the laboratory analysis. The calculations use an iterative procedure which means repeating the calculations until the desired result is obtained.

The following example illustrates the iterative procedure.

Assume the soil sample has 77.4% sand and 27.6% silt plus clay and that the sand has 2.5% silt plus clay. In order to meet the requirements for a Category 2 field and to maximize available water assume the final mix should contain 20% silt plus clay and 80% sand.

For the first iteration assume a 1000 g trial mix is made containing 250 g of sand and 750 g of soil. The mix would have the following distribution of particles from the two sources.

- In the sand there would be 250 x .025 = 6.25 g silt + clay and 243.75 g of sand.
- In the soil there would be 750 x .276 = 207 g silt + clay and 543 g of sand.
- This would provide a mix with 213.25 g of silt + clay and 786.75 g of sand or 21.3 % silt + clay and 78.6% sand.

For the second iteration assume a 1000 g trial mix is to be made having 275 g of sand and 725 g of soil.

- In the sand there would be 275 x .025 = 6.87 g silt + clay and 268.13 g of sand.
- In the soil there would be 725 x .276 = 200.1 g silt + clay and 524.9 g of sand.
- This would provide a mix with 206.8 g of silt + clay and 793.0 g of sand or 20.6 % silt + clay and 79.3 % sand.

Realistically further iteration would be unnecessary.

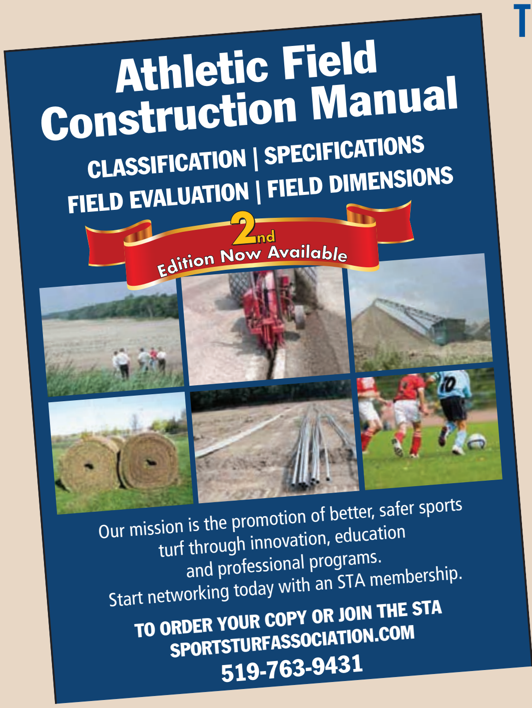
In practice, the measuring of the two components to place in the mix is done by volume, not by weight. Therefore it is necessary to convert the above weights to volume which is done by multiplying the weight by the dry density of the material. The dry density of the stockpiled sand can be assumed to be 1.75 g/cm^3 and that of the non-compacted soil in a stock pile to be 1.1 g/cm^3. The volume of sand to use in a unit of mix would be 275/1.75 = 157 cm^3 and the volume of soil would be 725/1.1 = 659 cm^3. The volume ratio for the sand/soil mix would be 157:659 or approximately 1 part of sand to 4 parts of soil. The assumption of the densities of the two materials as they would appear in a stock pile is why further iteration calculations would be unnecessary.

It is interesting to note that most of the sand in the mix comes from the soil. This is why the particle size distribution of the sand fraction of the soil is a critical laboratory requirement.

The preferred procedure for mixing is with a front end loader and a power screen. Four buckets of soil followed by one bucket of sand would be passed over the screen. The power screen also has the advantage of removing stones and other debris which may be present in the soil from the site.

The architect should verify the particle size distribution of the mix by making a small trial mix of four pails of soil and one pail of sand. A sample from this trial mix is sent to the laboratory for regular particle size distribution of sand, silt and clay. The laboratory should be requested to do sieve analysis on the sand portion. This analysis is critical to determine if the sand in the soil approximates the particle size distribution required of the sand sample.

Some inexpensive laboratory analysis, a few simple calculations, power screen mixing of the determined ratio of sand and soil, and a root zone mix which conforms to the specifications of the STA's *Athletic Field Construction Manual* is ready to be spread on the field.•



The Sports Turf Association Publishes Second Edition of the

Athletic Field Construction Manual

GUELPH, ON. The Sports Turf Association announces the publication of the second edition of its popular *Athletic Field Construction Manual*, a staple reference for those in the sports turf industry.

The manual, written by Dr. R.W. Sheard in conjunction with an editorial committee of professionals, brings uniformity to the construction of grass athletic fields.

"The reputation of the first edition published in 2008 has led to its approaching out-of-print status", said Dr. Sheard. "Rather than simply reprinting, we took advantage of the opportunity to make subtle revisions to this edition".

The opening pages have been restructured to improve readability. Classifications based on the root zone material for categories three and four have been more adequately defined, as have the tolerances for grade control and depth of the stone layer and root zone material. Additional changes are of only a clarifying nature.

The second edition of the *Athletic Field Construction Manual* is now available for purchase in both print and electronic PDF format.

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