



## Turf & Soil Diagnostics

### Excerpts from ASTM F2396-11 Standard Guide for Construction of High Performance Sand Based Rootzones for Athletic Fields

Recommended Physical Properties of the Rootzone Mix (40 cm tension)	
Test	Allowable Ranges
Infiltration Rate	$\geq 10$ in/hr ( $\geq 25$ cm/hr)
Total Porosity	35 - 45%
Capillary Porosity	15 - 25%
Air-filled Porosity	15 - 25%
Bulk Density	1.5 - 1.7 kg/m <sup>3</sup>
The physical performance criteria should be given priority over the sand size distribution specifications.	

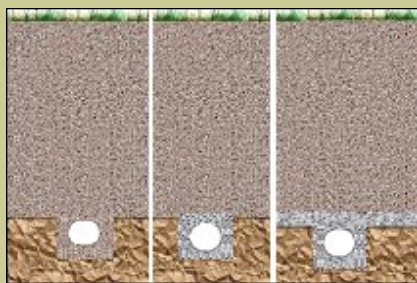
Recommended Particle Size Distribution of Rootzone Sand			
Fraction Size Name	Particle Diameter Range (mm)	Acceptable Range % Retained	
Gravel	> 4.75	0%	-
Gravel	3.40 - 4.75	< 5%	≤ 30% Combined
Fine Gravel	2.00 - 3.40	< 20%	
Very Coarse	1.00 - 2.00	< 20%	
Coarse	0.50 - 1.00	25 to 50%	≥ 60%
Medium	0.25 - 0.50	> 25%	Combined
Fine	0.15 - 0.25	< 10%	≤ 15% Combined
Very Fine	0.05 - 0.15	< 5%	
Silt	0.002 - 0.05	< 5%	
Clay	< 0.002	< 3%	
Uniformity Coefficient (Cu)		2.5 - 4.5	
Quartz sands with < 5% calcium carbonate content are recommended.			

#### Subsurface Drainage Material Options

- Rootzone sand (with or without rootzone amendment) may be used to backfill around drain lines. Drainage pipe must have slitted openings meeting a  $D_{85\text{sand/slot width}} > 1.5$ .
- Gravel may be used for backfill of drainage trenches.
- Gravel may be used to backfill drainage trenches and to form a drainage layer beneath the sand rootzone. The same gravel should be used for backfill & drainage layer.

Gravel used for options 2 or 3 must meet Gravel Filter Drainage Specs. Surface drainage guidelines are also included in the standard.

Option 1      Option 2      Option 3



#### Sod-Soil Rootzone Sand Compatibility Recommendations \*

Criteria	Preferred	Acceptable	Marginal	Unacceptable
$D_{50R}/D_{50S}$	< 2.5	2.5 to 5.0	5 to 10	> 10
Silt & Clay %	< 5	5 to 10	10 to 15	> 15
Silt to Clay Ratio	< 2	2 to 5	5 to 7	> 7
Gravel (> 2mm) %	0	0 to 2	2 to 5	> 5
R = rootzone; S = sod-soil      * copyright 2001, Michael DePew - used by permission				

#### Gravel Filter Drainage Recommendations

Performance Factor	Criteria	Acceptable Values
Filter Factors	$D_{15\text{gravel}}/D_{85\text{rootzone}}$	< 5
	$D_{50\text{gravel}}/D_{50\text{rootzone}}$	< 25
Permeability Factor	$D_{15\text{gravel}}/D_{15\text{rootzone}}$	$\geq 5$
Uniformity Factors	$D_{90\text{gravel}}/D_{15\text{gravel}}$	$\leq 2.5$
	> 12 mm fraction	0%
	< 2 mm fraction	$\leq 10\%$
	< 1 mm fraction	$\leq 5\%$

This card contains rootzone and drainage physical properties recommendations that have been excerpted from ASTM standard F2396-11. For the complete guide please consult the latest annual revision of ASTM Volume 15.07 or [www.astm.org](http://www.astm.org).

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