

HIGHLIGHTS OF RECENT CHANGES TO THE USGA'S GREEN CONSTRUCTION RECOMMENDATIONS

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The USGA's recommended method for putting green construction has been revised three times during the past 30 years. Each revision was an effort to integrate the current level of scientific knowledge with the sound practical experience of the Green Section staff. The underlying intent of the USGA has always been to provide a method for greens construction with the highest potential for success under a wide range of environmental conditions.

During 1991 Dr. Norm Hummel, associate professor at Cornell University, spent his year on sabbatical leave working with the USGA to review, update and standardize the procedures used by various labs which test the construction materials for putting greens. After an extensive review of the scientific literature pertaining to the use of high-sand content root zone mixtures for turf a number of revisions to the USGA recommendations were proposed.

An Advisory Committee of soil scientists and Green Section Staff was assembled to review the recommendations. After review, the proposed revisions were submitted to an international group of approximately 30 soil scientists, lab personnel, architects, and industry personnel for comment and further suggestions. The USGA has utilized a broad base of scientific knowledge and practical experience to achieve several goals regarding the current revisions:

- 1) To increase confidence in the recommendations by standardizing lab procedures.
- 2) To reduce the cost of building greens to USGA recommendations by removing unnecessary steps during construction and by providing more flexibility regarding the choice of construction materials.
- 3) To utilize the most current level of scientific knowledge.
- 4) To identify areas in our knowledge of greens construction methods which are poorly understood and will require further research efforts in the future.

The following is a summary of the major changes:

SUBGRADE: The subgrade can be shaped to facilitate drainage and need not conform exactly to the proposed surface contours. However, the contours of the gravel layer must closely conform to the finished grade.

A geotextile fabric may be used between the gravel layer and an unstable subgrade soil, i.e. muck, expanding clay, etc.

DRAINAGE: Drainage trenches shall be 6 inches (15 cm) wide and a minimum of 8 inches (20 cm) deep. Drain lines shall be installed no more than 15 feet (5 m) apart.

A perimeter (smile) drain shall be installed along the low edge of the green/surrounding-soil interface and shall extend to the ends of the first set of laterals.

GRAVEL: Angular particles are preferred for stability -- to facilitate shaping; pea gravel is, of course, acceptable.

Gravel of questionable weathering/mechanical stability must pass the LA Abrasion test and/or the sulfate soundness test -- ASTM tests C-131 and C-88, respectively.

Whether or not an intermediate sand layer is required can only be determined by a soil laboratory and depends upon the particle size distribution of the root zone mix relative to that of the gravel.

Where an intermediate sand layer is required -- no more than 10% of the gravel can be retained on a 1/2-inch sieve, at least 65% must pass through a 3/8-inch and be retained on a 1/4-inch sieve, and no more than 10% can pass through a 2 mm sieve.

INTERMEDIATE SAND LAYER: The acceptable particle size has been expanded, the current recommendations require that 90% of the particles must pass a 4 mm sieve and be retained on a 1 mm sieve.

Particle Size Distribution of USGA Root Zone Mix

Name	Particle Diameter	Recommendation (by weight)	
Fine Gravel	2.0 - 3.4 mm	Not more than 10% of the total particles in this range, including a maximum of 3% fine gravel (preferably none).	
Very Coarse sand	1.0 - 2.0		
Coarse sand	0.5 - 1.0	Minimum of 60% of the particles must fall in this range.	
Medium sand	0.25 - 0.50 mm		
Fine sand	0.15 - 0.25	Not more than 20% of the particles may fall within this range.	
Very fine sand	0.05 - 0.15 mm	Not more than 5%	Total particles in this range shall not exceed 10%
Silt	0.002 - 0.05 mm	Not more than 5%	
Clay	Less than 0.002mm	Not more than 3%	

Allowance has been made for more fine sand (0.25 mm - 0.15 mm) but less very fine sand (0.15 mm - 0.05 mm).

A peat source must be a minimum of 85% organic matter by weight. Other organic composts should be aged for at least one year and must be proven to be non-phytotoxic to the turf by the supplier. The compost should meet the approval of the soil physical testing laboratory. The final organic matter content of the root zone mix must be between 1-5% by weight (ideally 2-4%).

If soil is used in the mix it must have a minimum sand content of 60% and a clay content between 5% and 20%. The final mix must still conform to the revised guidelines for particle size distribution.

Physical Properties of the Root Zone Mix

Physical Property	Recommended Range
Total Porosity	35% - 55%
Air-filled Porosity (at 40 cm tension)	15% - 30%
Capillary Porosity (at 40 cm tension)	15% - 25%
Saturated Conductivity	
Normal Range:	6-12 inches/hr (15-30 cm/hr)
Accelerated range:	12-24 inches/hr (30-60 cm/hr)
Organic Matter Content (by weight)	1% - 5% (ideally 2%-4%)

SOIL FUMIGATION: Sterilization of the root zone mix is recommended prior to establishment of turf only 1) in areas prone to severe nematode problems, 2) in areas prone to grassy weed or nutsedge problems, or 3) when the root zone contains unsterilized soil -- otherwise optional.

A more detailed description of the USGA Recommendations for Putting Green Construction is available from the USGA Green Section, Great Lakes Regional Office, 11431 N. Port Washington Road, Suite 203, Mequon, WI 53092; 414/241-8742.