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An American National Standard

Standard Guide for Construction and Maintenance of Grass Tennis Courts[1]

This standard is issued under the fixed designation F1953; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This guide covers techniques that are appropriate for the construction and maintenance of grass tennis courts. This guide provides guidance for selection of soil systems and turfgrass species in court construction and for selection of management practices that will maintain an acceptable playing surface.

1.2 Decisions in selecting construction and maintenance techniques are influenced by existing soil types, climatic factors, adaptation of grass species, level of play anticipated, intensity of use, budget, equipment, and training and ability of the turf management personnel.

~~1.3The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only.~~

1.3 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.4 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

C33 Specification for Concrete Aggregates ~~D422~~

D422 Test Method for Particle-Size Analysis of Soils ~~D653~~

D653 Terminology Relating to Soil, Rock, and Contained Fluids ~~D1140Test Method for Amount of Material in Soils Finer Than the No. 200 (75-µm) Sieve~~

~~D5268~~

D1140 Test Methods for Amount of Material in Soils Finer than No. 200 (75-m) Sieve

D5268 Specification for Topsoil Used for Landscaping Purposes

E11~~Specification for Wire Cloth and Sieves for Testing Purposes~~ 11 Specification for Woven Wire Test Sieve Cloth and Test Sieves

F405 ~~Specification for Corrugated Polyethylene (PE) Tubing and Fittings~~ Specification for Corrugated Polyethylene (PE) Pipe and Fittings

F2651 Terminology Relating to Soil and Turfgrass Characteristics of Natural Playing Surfaces

3. Terminology

3.1 *Definitions*—Except as noted, soil and turfgrass related definitions are in accordance with Terminology ~~D 653D 653~~F2651.

3.2 *Definitions of Terms Specific to This Standard:*

3.2.1 ~~*cool-season turfgrass*—species best adapted to growth during cool, moist periods of the year, commonly having temperature optimums of 15 to 25°C. Examples: bentgrass, bluegrass, fescue, and ryegrass.~~ reel mower (also 'reel-type' mower), *n*—a machine for cutting grass composed of a cylinder, formed of blades mounted on a horizontal axis. The reel consists of a number of helix-shaped blades which are attached to support spiders which are subsequently mounted on a rotating shaft. During operation the reel blades turn to contact a bedknife which executes a scissors-like cutting action. Properly performed and well-maintained, reel mowers are particularly adapted to a higher mow quality and close cutting action (often to mow heights of less than 2.5 mm (<1⁄10 in.)) compared to other types of mowers.

3.2.2 ~~*coring*—small cores are removed from the turf soil by hollow tines or spoons.~~

3.2.3~~*cultivation, turf*—the working of a turf soil without destruction of the turf **(1)** .~~

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[1] This ~~test method~~ guide is under the jurisdiction of ASTM Committee F08 on Sports Equipment and Facilities and is the direct responsibility of Subcommittee ~~F08.23~~ F08.52 on ~~Tennis Courts and Track~~ Miscellaneous Playing Surfaces.

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

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~~3.2.4*drilling*—vertical holes are created in the turf soil by removal of soil by rotating drill bits or augers.~~

~~3.2.5*gravel*—rounded or sub-rounded rock or mineral particles >2.0 mm and <7.6 mm **(2)**.~~

~~3.2.6*grooving*—vertical rotating blades cut continuous slits through the turf and into the soil, with soil, thatch, and plant material being displaced.~~

~~3.2.7*overseeding*—seeding into an existing turf **(1)**.~~

~~3.2.8*punching, with solid tines*—holes in the soil are created by punching action of solid tines, often mounted on equipment that may also utilize hollow tines.~~

~~3.2.9*renovation*—improvement of turf, usually involving weed control and replanting into existing live or dead vegetation, or both **(1)**.~~

~~3.2.10*soil*—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.~~

~~3.2.11*soil profile*—vertical section of a soil, showing the nature and sequence of the various layers, as developed by deposition or weathering, or both.~~

~~3.2.12*soil textural class*—texture designation based on relative proportions of sand (2.0 to 0.05 mm in diameter), silt (0.05 to 0.002 mm), and clay (<0.002 mm) **(2)** .~~

~~3.2.12.1*Discussion*—Particle size ranges for sand, silt, and clay vary somewhat from ranges in Test Method D 422D 422, Terminology D 653D 653, Test Method D 1140D 1140, and Specification D 5268D 5268.~~

~~3.2.13*soil texture, (gradation) (grain-size distribution)*—the proportions by mass of a soil or fragmented rock distributed in specified particle size ranges.~~

~~3.2.14*spiking*—solid tines or flat, pointed blades penetrate the turf and soil surface.~~

~~3.2.15*thatch*—an intermingled layer of dead and living shoots, stems, and roots that develops between the zone of green vegetation and the soil surface **(1)**.~~

~~3.2.16*topdressing*—a prepared soil mix added to the turf surface and worked in by brooming, matting, raking, or irrigation, or a combination thereof, (1) to smooth a green surface, (2) to firm a turf by working soil in among stolons and thatch forming materials, (3) to enhance thatch decomposition, and (4) to cover stolons or springs during vegetative planting; also, the act of applying topdressing materials to turf **(3)**.~~

~~3.2.17*topsoil*—surface soil, usually containing organic matter. Also see Specification D 5268D 5268.~~

~~3.2.18*turfgrass*—a species or cultivar of grass, usually of spreading habit, that is maintained as a mowed turf **(1)**.~~

~~3.2.19*warm-season turfgrass*—species best adapted to growth during the warmer part of the year; usually dormant during cold weather or injured by it; commonly having temperature optimums of 27 to 35°C. Examples: bermudagrass, carpetgrass, centipedegrass, St. Augustinegrass, and zoysiagrass.~~

~~3.2.20*winter overseeding*—seeding cool-season turfgrasses over warm-season turfgrasses at or near their start of winter dormancy; used in mild climates to provide green, growing turf during the winter period when the warm-season species are brown and dormant.~~ —the practice of overseeding a cool-season turfgrass into a warm-season turfgrass stand at or near their start of winter dormancy for the purpose of providing a green, growing turf during the winter period when the warm-season species are brown and dormant.

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4. Significance and Use

4.1 A grass tennis court should provide a relatively uniform, high quality playing surface as it relates to footing and ball bounce. Undulations, rough surface, bare spots, weeds, and wet spots detract from good play. Playing surface quality is largely affected by construction and maintenance procedures, and this guide addresses those procedures.

4.1.1 During construction, consideration should be given to factors such as soil physical and chemical properties, freedom of large stones and debris in the soil, surface and internal drainage, grass species selection, orientation of the court, and provisions for distributing wear on the playing surface.

4.1.2 Maintenance practices that influence the playability of the surface include mowing height, mowing frequency, rolling, irrigation, fertilization, weed control, disease and insect control, cultivation, thatch control, topdressing, and overseeding.

4.2 Those responsible for the design, construction, or maintenance, or a combination thereof, of tennis courts will benefit from this guide.

4.3 This guide provides flexibility in choices of procedures and can be used to cover a variety of use and budget levels.

5. Construction

5.1 *Soil*—Soil may be the existing topsoil or a sandy ~~top mix~~rootzone prepared by mixing sand with soil.

5.1.1 Existing or native soils used for tennis courts should be well drained. Well drained soils are often medium textured. Avoid poorly drained soils, which remain wet for significant periods during the growing season. Poorly drained soils may possess a layer of soil with slow permeability, a high water table, additional water from seepage, or a combination of these properties. The presence of soil mottling (spots of different colors: for example, yellowish, reddish, grayish, brownish) indicates poor drainage and limited aeration in a soil. Coarse textured, excessively drained soils can be used, but irrigation must be provided because these soils have limited capacity to hold plant available water. County soil survey reports, available for inspection at local offices of the United States Department of Agriculture or at county cooperative extension offices, can be used to obtain information on the properties

of natural soils at a given location. Relationships between general textural terms, textural classes, and permeability are shown in Appendix X1. In some cases, consideration may be given to modifying fine- or medium-textured soils by adding and incorporating sand into the surface to obtain 8 to 12 cm of modified soil (rootzone). The amount of sand required to effectively modify a soil (to increase permeability) will vary depending on the soil and sand properties; however, a minimum of 60 % sand on a volume basis will probably be needed to ensure good internal drainage when the soil is compacted **(41)**.[3] Prior to turf establishment, apply lime and fertilizer as required, based on soil test results. During final surface preparation, all debris and any stones greater than 1 cm in diameter should be raked from the surface 1.5 cm of soil.

5.1.2 Artificial (man-made) profiles are often used on highly-trafficked turfgrass areas. In general, a coarse-textured topsoil or a ~~top mix,~~ rootzone, prepared by mixing soil and sand to obtain a well-drained growing medium, is placed on a drainage blanket of gravel, which provides subsurface drainage. A false water table is formed at the interface of the ~~topsoil~~rootzone and the drainage layer. Water will not move readily from the ~~finer top mix~~ finer-textured rootzone into the gravel layer until the water content is at or near saturation at the interface. If fine- or medium-textured soils are used for the ~~topsoil~~rootzone in such profiles, they will remain too wet; however, in the case of coarse-textured ~~topsoils,~~rootzones, the increased water retention is a benefit. Such profiles are commonly used for golf putting greens **(52)**. If the particle size differential between the topsoil and gravel layer is great, an intermediate layer is placed on the gravel to prevent in-washing of the ~~topsoil.~~rootzone. Some soil laboratories test soils for use on putting greens. Their services could also be used to evaluate soils for tennis courts, especially when ~~artificial~~ modified-soil rootzone profiles will be used. Steps in constructing a tennis court with ~~an artificial~~a modified-soil rootzone profile follow:

5.1.2.1 Excavate to a depth equal to the depth of settled layers within the profile (approximately 40 cm). Compact the subgrade. The subgrade should be parallel to the finished grade, which should have a slope of 0.8 to 1.0 % to provide surface drainage. The slope may be either widthwise or lengthwise, depending on site.

5.1.2.2 Excavate trenches (approximately 20-cm wide and 20-cm deep) in compacted subgrade for drainage pipe (lateral and main lines), with no more than 10 m between laterals. Remove excavated material or spread it evenly over the subgrade between trenches. Drainage pipe should have a diameter of approximately 10 cm. Corrugated, perforated, plastic drainage pipe (tubing) conforming to Specification ~~F 405~~F405 is recommended. Non-perforated pipe can be used outside the drainage area to carry water to a suitable surface drainage area or storm drain.

5.1.2.3 Place drainage pipe on a 5 to 10-cm bed of gravel in trenches. Minimum grade for drainage pipe is 1.0 %. Use laser or other appropriate equipment to maintain accurate grades.

5.1.2.4 Cover the drainage pipe and subgrade with a 7 to 10-cm layer of washed gravel or crushed rock. Do not use soft or easily-weathered materials in this layer. Gravel should consist of hard, durable particles of natural gravel or crushed stone or rock that will not degrade when alternately wetted and dried or frozen and thawed. The particle size of the gravel should meet the following specifications.

~~*(a)*~~ (1) Ninety to 100 % (weight basis) passing 12.5-mm (0.5-in.) sieve.

~~*(b)*~~ (2) Minimum of 50 % passing 9.5 mm (0.375 inch) and retained on 6.3-mm (0.25-in.) sieve.

~~*(c)*~~ (3) Maximum of 10 % passing 2.36-mm (No. 8) sieve.

~~*(d)*~~ (4) Uniformity coefficient: $^{d}90/^{d}10 \leq 3$ ($^{d}90$ and $^{d}10$ refer to the diameter below which 90 % and 10 % of the particles fall, as determined from a particle size accumulation curve.

~~*(e)*~~*(5)* Coarse aggregate size Nos. 7 and 8 (see Specification ~~C 33~~C33) should receive consideration.

~~*(f)*~~ (6) Grading requirements for size Nos. 7 and 8 are as follows:

Sieve Designation	Size	
	7	8
	% passing	
19.0 mm (0.75 in.)	100	. . .
12.5 mm (0.50 in.)	90 to 100	100
9.5 mm (0.375 in.)	40 to 70	85 to 100
4.75 mm (No. 4)	0 to 15	10 to 30
2.36 mm (No. 8)	0 to 5	0 to 10
1.18 mm (No. 16)	. . .	0 to 5

5.1.2.5 Place intermediate layer of 5 to 7-cm thickness on the gravel layer. Material in this layer should have a minimum of 90 % of the particles between 1 and 4 mm. This intermediate layer is placed in the profile to ensure no in-washing of ~~top mix~~ the overlying rootzone material into gravel.

5.1.2.6 Place 25 cm of ~~coarse-textured soil or top mix on~~ rootzone material onto the intermediate layer. ~~By~~ This should be performed by placing layers of 5 to 6 cm and firming by light rolling or heeling (walking over area on heels of shoes) after each layer is ~~placed,~~ placed. Firming the rootzone in this manner during placement will ensure that settling of the ~~area~~ rootzone soil after establishment ~~will be~~ is minimized. The ~~top mix~~ rootzone should have a sand content between 70 to 85 %. Growing media with higher sand contents can support turfgrass growth and provide even greater internal drainage, which could provide for quicker use of the court following rainfall; however, excessively sandy ~~top~~rootzone mixes can ~~be~~produce unstable ~~underfoot~~footing and be abrasive to the turfgrass ~~and can cause difficulty~~ such that it may be difficult in reestablishing turfgrass in worn areas ~~d~~. This

[3] The boldface numbers in parentheses refer to the list of references at the end of this standard.

is because excessively sandy rootsone mixes have low water retention for supporting growth of damaged and recovering turfgrass and movement of the rootzone soil during subsequent play will continue to disrupt or prevent rooting and reestablishment of the damaged/recovering turfgrass. When sand and other soil materials are mixed to create the ~~top mix,~~ rootzone, the ~~added~~ sand amendment should be uniform in size with 85 % of the particles between 0.5 and 2.0 mm or between 0.25 and 1.0 mm. Well-graded sands are not as effective as uniform sands for modifying soils to create better internal drainage. Organic amendments, such as peat, may be added (generally in amounts equal to 10 to 20 % by volume). Organic amendments will increase water and nutrient retention, an important consideration in very sandy ~~top mixes.~~ rootzones. The ~~top~~rootzone mix should be screened to remove material greater than 6.3 mm (0.25 in.); or if not screened, raked thoroughly after placement to remove material greater than 1 cm from the surface 1.5 cm of ~~mix.~~ rootzone profile. Screening is a usual practice in the preparation of ~~top~~rootzone mixes by ~~commercial companies.~~ sports field contractors or soil suppliers, or both. As with native topsoils, use soil test results as a guide for liming and fertilization.

5.2 *Slope*—Final grade should provide for an 0.8 to 1.0 % slope (1-cm fall in 100 to 120 cm) across the width or length of the court. Use laser or other suitable equipment to ensure accurate grade. The surface slope is important for removing excess water during periods of intense rainfall. This slope is essential on all courts regardless of soil type.

5.3 *Orientation*—The long dimension of the court should be close to a north to south direction. Such an orientation minimizes the times when the low early morning or evening sun will be directly in players' eyes.

5.4 *Species Selection*—Species that adapt to the close mowing on golf greens will also do well on tennis courts. Select a creeping bentgrass, *Agrostis stolonifera* L. var. *palustris* (Huds.) Farw., as a cool-season turfgrass or hybrid bermudagrass, *Cynodon dactylon*× *C. transvaalensis* (L.) Pers., as a warm-season grass. Where bermudagrass is overseeded with cool-season grasses in the winter, select species that have done well in winter overseeding of golf greens (for example, perennial ryegrass). Check with other court owners, county or state extension personnel, golf course superintendents, or seed/spring/sod suppliers for cultivars (varieties) best adapted to your area. Grasses other than creeping bentgrass and bermudagrass are used on tennis courts **(63)**. Colonial bentgrass is used with creeping bentgrass in some cases. Annual bluegrass has invaded some courts and has become a major component. Fine fescues and perennial ryegrasses have been used alone and in combination, but should not be as closely mowed as the bentgrasses and annual bluegrass.

5.5 Turfgrasses may be propagated vegetatively or by seed. Creeping bentgrass is usually seeded or sodded. Turf-type bermudagrasses are vegetatively propagated by planting sprigs (stolons, rhizomes, and tillers), by broadcasting sprigs and then topdressing with a soil, or by sodding. If the area is sodded, care must be taken to make sure that the soil on the sod closely matches the texture of the topsoil or top mix. Contrasts in texture of these soil sources can impede water movement and rooting of the grass. To avoid even minor soil differences, use washed sod (soil removed by washing after sod is harvested). Also, any soil used to topdress seed or sprigs should match that already in place.

5.6 *Wear Distribution*—Creating a larger area than needed for one court ~~and~~while also installing an extra set(s) of net post sleeves enables the turf manager to distribute wear by periodically changing the net location. The same technique applies to larger expanses where multiple courts are located (see Appendix X3).

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6. Maintenance

6.1 *Mowing*—Reel-type mowers that collect clippings are preferred.

6.1.1 *Cutting Height*—Grasses differ in their tolerance to close mowing. Suggested cutting heights for tennis courts follow:

Species	Cutting Height	
	mm	(in.)
Annual bluegrass	6 to 12	(¼ to ½)
Bermudagrass	5 to 6	(3⁄16 to ¼)
Creeping and colonial bentgrass	6 to 12	(¼ to ½)
Fine fescues	12 to 19	(½ to ¾)
Kentucky bluegrass	12 to 16	(½ to ⅝)
Perennial ryegrass	10 to 12	(⅜ to ½)
Cool-season grasses overseeded on bermudagrass	5 to 6	(3⁄16 to ¼)

6.1.2 *Cutting Frequency Guideline* —Mow often enough so that no more than one third of the height is removed in a mowing (for example, if mowing height is 6 mm, mow before height exceeds 9 mm). More frequent mowing helps maintain uniformity in playing quality from day to day. During peak growth periods, mow three to six days per week. Remove clippings.

6.1.3 *Cutting Direction*—Use alternate mowing directions to promote upright growth.

6.2 *Fertilization*—Use soil testing every three to four years (every one or two years on very sandy ~~soils)~~rootzones) to obtain guidelines for maintenance fertilization and liming. Turfgrass growth and color are largely affected by nitrogen fertilization. Slow-release or quick-release, or a combination of these types of nitrogen fertilizers, can be used. More frequent, lighter applications should be used with quick-release sources. The total annual requirement of nitrogen will vary with grass species, soil type, type of nitrogen source, irrigation practices, clipping removal practices, length of growing season, and intensity of use (wear). Annual nitrogen requirements can range from 100 to 200 kg/ha (2 to 4 lb/1000 ft^2) for cool season turfgrasses and from 300 to 600 kg/ha (6 to 12 lb/1000 ft^2) for warm-season turfgrass sites. If soil test results are not available, use a complete fertilizer that