THE TEXAS-USGA METHOD SPECIFICATIONS

PART II

Suggested specifications for the Texas-USGA Method are based on the 1960 specifications, with subsequent evolutionary refinements (USGA Green Section, 1960; USGA Green Section, 1973; Beard, 1982). It consists of a 300 mm (12 in.) settled high-sand root zone over a 50 mm (2 in.) intermediate coarse sand zone, over a 100 mm (4 in.) gravel or crushed stone drainage bed that overlays a drain line network (Figure 1). It is important that the final surface grade ensures drainage of excess water across and off the surface, usually in multiple directions. The construction method for sports field and green construction is as follows:

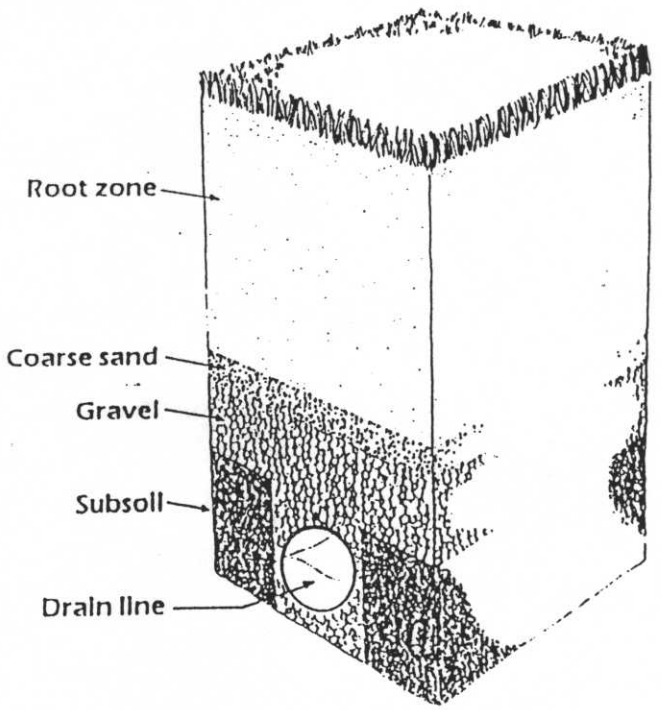

Figure 1. Profile of a Texas-USGA Method high-sand root zone modification with a water-conserving perched hydration zone.

Subgrade

Contour the subgrade base so it conforms to the proposed finished grade, with a tolerance of ± 25 mm (± 1 in.). The subgrade should be 450 mm (18 in.) below the planned finish grade and should be firmed to prevent settling. Care should be taken to ensure that the final subgrade base contours, within the overall slope, drain the gravitational water to the nearest drain line.

Subsurface Drainage System

A herringbone or gridiron design is used, with **100 mm (4 in.) diameter drain lines spaced at 4.6- to 6-meter (15 to 20 ft.) intervals at a minimum grade of 0.5%.** The drain line trenches should be cut into the subgrade at as shallow a depth as possible. A 38 to 50 mm (1.5 to 2.0 in.) depth of 6 to 10 mm (0.24 to 0.38 in.) diameter crushed stone or gravel is placed in the bottom of the trenches and the drain lines laid. Then additional stone or gravel is placed around and over the drain lines to fill the trenches.

Stone Drainage Layer

Angular, hard, noncalcarious, washed, screened gravel or crushed stone of 6 to 10 mm diameter should be selected for covering the subgrade to a minimum settled depth of 100 mm (4 in.). The proper sized crushed stone or gravel must be obtained to prevent migration of the sand into the gravel or stone bed and thereby preserve the integrity of two distinct layers: the upper high-sand mix over gravel or crushed stone. This drainage layer functions in the rapid lateral movement of gravitational water to the drain lines. Also, the porous crushed stone or gravel base prevents the upward capillary rise of salts from the soil base into the root zone. During installation, the crushed stone or gravel typically is dumped from the delivery trucks on the outside perimeter and then distributed over the construction site by a small, tracked crawler tractor, being careful to avoid driving over and crushing the drain lines.

Coarse Sand Zone

A 50 mm (2 in.) deep layer of **washed, screened, hard, angular coarse sand of 1 to 2 mm diameter** is carefully spread over the drainage layer. The specific size of the sand particles must be within **5 to 7 diameters** of the underlying crushed stone or gravel. Thus, if 6 mm stone or gravel is used, the particle size of the coarse sand zone should be not less than 1 mm in diameter. This coarse sand zone has two key functions: (a) To prevent infiltration of the high-sand root zone mix into the spaces between the drainage layer stone particles and (b) To create a perched hydration zone of plant-available water immediately above the drainage layer in the lower portion of the high-sand root zone mix. The distinct interface between the coarse sand zone and the upper 300 mm (12 in.) of settled high-sand root zone mix disrupts the continuity of surface interfaces among the particles and in turn the downward movement of water. When the perched hydration zone above the interface approaches water saturation, the force of gravity overcomes the interface perched effect and the excess water is released downward.

Installation of the coarse sand zone is best accomplished manually, taking care to not mix the sand with or into the stone drainage bed. The coarse sand is dumped from the delivery trucks on the outside perimeter, and is typically moved across the crushed stone or gravel by wheelbarrows over a path of plywood boards. This thin coarse sand layer presents some difficulties in installation. However, this intermediate zone is critical to the overall concept and is a modest long term investment compared to turf failure and rebuilding costs if improperly constructed.

Caution. Substitution of a nonbiodegradable screenlike material for the coarse sand intermediate zone has been proposed. Problems have been observed with these geofabrics which tend to become clogged to the extent that they are impermeable to water and may cease to drain. However, a more open, non-filter mesh or netting may be used between the intermediate coarse sand zone and the drainage layer when using gravel to provide a stabilizing effect during construction. This netting should not be necessary when using angular crushed stone due to the stability of this material.

Ringing the Perimeter

Polyethylene sheeting should be permanently inserted as a vertical barrier between the outer native soil and the root zone mix. This barrier prevents lateral water transfer into the adjacent dry soil, which would cause inner perimeter turf water stress. When the sheeting is extended 100 to 150 mm (4 to 6 in.) above the surface during construction, it also will function in preventing erosion of unwanted soil onto the construction area.

Root Zone Mix Installation

Quality control is the key to successful execution of root zone modification. All root zone mixing should be completed off the construction site, termed off-site mixing. Although it sounds good, in practice the procedure of in-place rotary tilling of the organic and/or soil components into the high-sand component has not been successful. Every truck load of each component in the soil mix, as well as the gravel and coarse sand, should be checked at delivery to ensure that the specifications are met.

Off-site mixing includes soil shredding, screening to remove any objectionable stones, and addition of the specified proportions of each mix component. Because of the narrow range in acceptable limits of the physical properties, it is very important that the laboratory recommendations be explicitly followed in mixing the components of the root zone mix. Upon laboratory confirmation that the root zone mix has met the specifications, it is transported to the construction site and dumped around the perimeter onto the coarse sand zone. A small, crawler tracked tractor with blade then pushes the mix over the area, being careful to avoid crushing the drain lines. Be sure the unit is operated with its weight on the root zone mix. This reduces the chance of disturbing the lower construction profile.

Caution: Use of wheeled tractors causes rutting and they are more likely to crush the drain lines than are tracked vehicles.

Grade stakes placed in a grid pattern at 3 to 4.5 meter (10 to 15 ft.) intervals will aid in constructing the final contours to the specified root zone depth. Success has been achieved by careful adherence to the construction guidelines.

CONSTRUCTION PLAN

Proper green and sports field construction usually involves an extensive subsurface drainage system, specialized root zone modification, and subtle surface drainage contours. It is a critical aspect, since improper construction due to cost cutting results in higher long-term maintenance costs, problems in maintaining a quality playing surface, frequent loss of turf, and costly reconstruction (Beard, 1973 and 1982). The steps in construction are:

(1) Survey and stake
(2) Construct subgrade
(3) Install a subsurface drainage system
(4) Modify root zone:
    (a) construct stone drainage layer
    (b) construct coarse sand zone
    (c) mix and install specified root zone
(5) Install irrigation system
(6) Finish surface contours
(7) Plant:
    (a) soil pH adjustment, if needed
    (b) fertilization based on soil tests
    (c) plant
    (d) post-plant turf care

By following the suggested specifications of the Texas-USGA Method, tens of thousands of greens have been constructed during the past 30 years and, more recently, many sports fields have been constructed and successfully used throughout the world.

Note: The suggested specifications for the upper 300 mm (12 in.) high-sand root zone were presented in the March-April, 1994 issue of Turfax™. Further, the July-August, 1994 issue will address the soil physical analyses procedures.