The amount of smaller pores, called capillary or micro-pores, will largely determine the soil's water content, and larger, non-capillary or macro-pores, will determine the air content. If capillary pores predominate, moisture holding capacity of the soil will be high, but water and air movement may be inhibited due to lack of adequate non-capillary pores. If non-capillary pores predominate, excessive drainage and aeration result at the expense of adequate moisture holding capacity. Golf greens should have a capillary porosity between 20 and 35 percent and non-capillary pore space between 12 and 18 percent (**Table 2**). These characteristics are for root zone samples which have been compacted, allowed to percolate water for 24 hours and then exposed to a 40 cm tension. Calculating total pore space involves several tedious steps and these are outlined in **Appendix B.**

Particle size analysis

A particle size analysis is important to turf managers in that it provides a general description of physical textural soil properties to soil scientists, and it is the basis for assigning the textural class name, such as sand, sandy loam, clay, etc., to the soil sample. Once the analysis is made for the percent sand, silt, and clay makeup of a sample, the specific textural class it falls under can be determined by using the U.S. Department of Agriculture's textural triangle. This textural triangle is printed in most introductory soils books. Soils used for golf greens should fall in the loamy sand, sandy loam, or loam textural ranges.

Table 2. Recommended porosity of golf green soils by selective references.

Source	Porosity ($cm^3/100cm^3$ or %)		
	Capillary	Non-Capillary	Total
Anonymous, 1960	15-18	12-18	≥33
Benger, 1970	15-21	12-18	≥33
Bingaman and Kohnke, 1970	---	---	>30
Anonymous, 1973; Radko, 1974; Brewer, 1979	≥15	---	40-55
Peterson, 1974	15	---	50
Gilbert, 1988	20-35	---	35-55
Anonymous, 1989	---	15-25	35-50

Golf green root zones mixtures must have a laboratory analysis to determine the particle size distribution. Particle size analysis is based on sieving and sedimentation methods. To make a particle size analysis, a sample of soil is broken up and particles larger than silt are separated into their various sized groups as outlined in **Table 1** by use of sieves and the weight of each group is determined to give a percentage of total sample weight. Silt and clay percentages are determined by methods that depend on the rate of settling of these two separates from suspension. This principle involves clay and silt settling rates being roughly proportional to their size (diameter of the particle). Therefore, the larger the particles (e.g., sand or gravel), the relatively quicker it will settle in a suspension (e.g., water) solution. Conversely, the smaller the particles (e.g., silt and clay), the slower this settling will occur (this is referred to as Stokes Law). The equation to calculate velocity of a falling particle through a suspension is listed in **Appendix C.**

Another method of separating the particles in suspension is based on the rate of settling by monitoring changes in the specific gravity of the suspension. A hydrometer is a device that is used to measure suspension density at various times, thus reflecting the amount of particles which remain in suspension after a certain settling time. A hydrometer with a Bouyoucos scale in grams per liter (g/L) is used to determine the amount of soil in suspension. The greater the density of a suspension, the greater the buoyant force on the hydrometer and the higher the reading. As particles settle out of the suspension, the density decreases and a lower reading is obtained. Since temperature influences the setting rate, a temperature correction must be made if the suspension temperature differs from the temperature from which the hydrometer is calibrated.

Once the proposed sand and soil samples have had particle size analyses determined, their separations can be compared to those listed in **Table 3**. As **Table 3** indicates, there is no one ideal specification on the correct particle size distribution that would be suited for golf greens. Although these vary considerably, three main points are presented:

1. A maximum amount of 5 percent silt and 3 percent clay (10 percent total) should be allowed or reduced infiltration and percolation may result.