1. The in situ moisture content of a soil is 18% and the moist unit weight is 104 lb/ft³. The specific gravity of soil solids is 2.76. This soil is to be excavated and transported to a construction site for use in a compacted fill. If the specifications call for the soil to be compacted to a minimum dry unit weight of 103 lb/ft³ at the same moisture content of 18%, how many cubic yards of soil from the excavation site are needed to produce 12,000 yd³ of compacted fill? How many 20 ton truckloads are needed to transport the excavated soil?

2. Let’s pretend you are an earthwork construction control inspector and you are checking the field compaction of a layer of soil. The laboratory compaction curve for the soil is shown in the following figure. Specifications call for the compacted density to be at least 95% of the maximum laboratory value and within ±2% of the optimum water content. When you did the sand cone test, the volume of soil excavated was 1,153 cm³. It weighed 2,209 g wet and 1,879 g dry.

(a) What is the compacted dry density?
(b) What is the field water content?
(c) What is the relative compaction?
(d) Does the test meet the specifications?
(e) What is the degree of saturation of the field sample?
(f) If the sample were saturated at constant density, what would be the water content?

3. Plot variation of dry density (kg/m³) of a soil (Gs=2.67) at different water contents for degree of saturation (S) = 80%, 90%, and 100%.