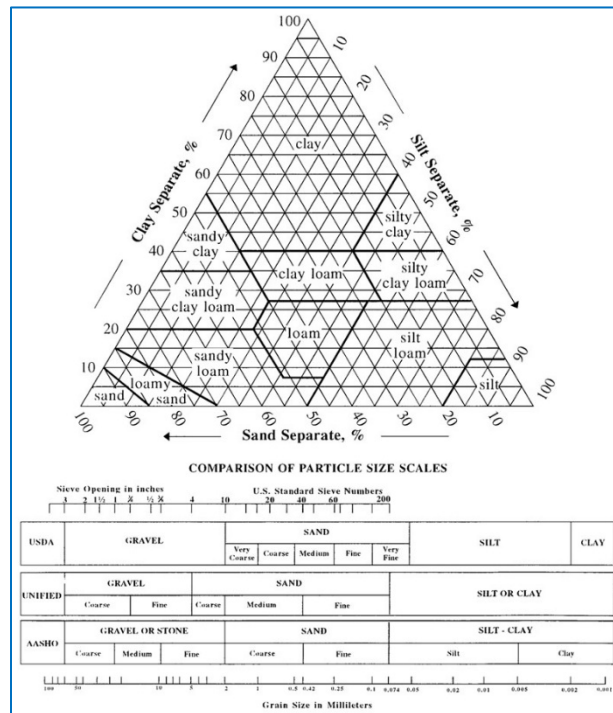Soil texture triangle showing the USDA classification system based on grain size and sand/silt/clay content (Public domain, Wikipedia)



## USCS and the USDA Soil Classification System

Garcia-James and Frankenstein, 2015.

### INTRODUCTION

Soil characteristics and properties are important to human daily living. A variety of disciplines (geology, agriculture, engineering, etc.) require a systematic categorization of soil, detailing its physical properties. Due to different interests, numerous soil classification systems have been developed worldwide. Many soil scientists share a goal of developing a universally understood and accepted system. Also, it would be advantageous to unite available soils databases and create one global soil database. Many soil databases exist worldwide; most of them use different soil classification systems.

Soil classification systems can be divided into two main groups, one for engineering purposes and another for soil science. For engineering purposes, the following are the most used classification systems (Das 2009):

1. **United States Department of Agriculture (USDA) textural soil classification**

    a. Based on particle size distribution

    b. Commonly used because of its simplicity


2. **American Association of State Highway and Transportation Officials (AASHTO) soil classification**

    a. Based on particle size distribution and soil plasticity

b. Used mostly by state and county highway departments

## 3. Unified Soil Classification System (USCS)

a. Based on particle size distribution, liquid limit, soil plasticity, and organic matter concentrations

b. Widely used by geotechnical engineers

For soil-science purposes, a variety of classification systems have been created for diverse uses. Most of them follow one of the following approaches:

**1. Natural system** (Muir 1969)

a. Based on soil morphology, behavior, or genesis

b. Examples of classification systems that follow this approach are the French Soil Reference System, USDA soil taxonomy, and the World Reference Base for Soil Resources

**2. Technical system**

a. Organized and classified into groups for specific applied purposes (Cline 1949)

b. Relies on the most current practices and an understanding of the intended use of soil or present land-use regulations (Buol et al. 2011)

3. **Numerical system** (Buol et al. 2011)

a. Based on statistical analysis (by similitudes)

4. **Vernacular system** (Tabor 2001) a. Based on names that describe characteristics, such as physical appearance (e.g., color, texture, landscape position), performance (e.g., production capability, flooding), and accompanying vegetation

*Garcia-Gaines, R. and S. Frankenstein, 2015. USCS and the USDA Soil Classification system. US Army Corps of Engineers, ERDC/CRREL Tr-15-4, March 2015.* *https://apps.dtic.mil/dtic/tr/fulltext/u2/a614144.pdf*

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**See Concawe Toolbox Section 10.3 for more detail on soil types.**