



ECIV 3302
Engineering Geology

CHAPTER 1

GEOTECHNICAL ENGINEERING – A HISTORICAL PERSPECTIVE

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The materials are mostly adapted from the presentation of Dr. Ahmed Abu Foul

Soil Mechanics

Soil mechanics is the branch of science that deals with the study of physical properties of soil and the behavior of soil masses subjected to various types of forces.

Soil is defined as the un-cemented aggregate of mineral grains and decayed organic matter (solid particles) with liquid and gas in the empty spaces between the solid particles.

Historical Perspective of Soil Mechanics & Geotechnical Engineering

- The record of the first use of soil as a construction material by mankind is lost in antiquity.
- In true engineering sense, there is no 'Geotechnical Engineering' prior to the 18th Century.
- One of the most famous example of problems related to soil bearing capacity and foundations in the construction of structures prior to 18th century is the Leaning Tower of Pisa in Italy.
- The construction of the Tower began in 1173 A.D. and last over 200 years.

Historical Perspective of Soil Mechanics & Geotechnical Engineering



The Leaning Tower of Pisa,
Italy.

Morning, 1 March 2004. SW
view

Height: 54 m;

Max tilt: 5 m out of plumb

Tilt direction: E, N, W, and S.

Weight: 15,700 tons;

Base: $\phi = 20$ m;

Reason: a weak clay layer at
11 m depth

Solution: excavation of soil
from north side for about 70
tons.



Tilting of Garisenda Tower (left) in Bologna, Italy (built in 12th₅ Century)

Study of soil behavior in a more methodical manner in the area of geotechnical engineering started in the early part of the 18th century, and last to 1927.

The development of soil mechanics can be divided into four phases, according to Skempton (1985):

1- Pre-classical period (1700-1776):

The natural slope, the unit weight and rough classification of soils;

2- Classical soil mechanics –Phase I (1776-1856):

Started from French scientist Coulomb's presentation on determining the sliding surface in soil behind a retaining wall; ended by the publication of Rankine's paper on earth lateral pressure.

Rankin's theory is a simplification of Coulomb's theory.

3- Classical soil mechanics –Phase II (1856-1910)

Started from the publication of a paper on the permeability of sand filters by French engineer Darcy in 1856.

4- Modern soil mechanics (1910-1927)

Marked by a series of important studies and publications related to the mechanic behavior of clays, most noticeable:

Atterberg (1911) on consistency of clayey soils, the Atterberg limits;

Bell (1915) on lateral pressure and resistance of clays;

Terzaghi (1925) on theory of consolidation for clays.

Geotechnical Engineering after 1927

The development of Geotechnical Engineering as a branch of Civil Engineering is absolutely impacted by one single professional individual – Karl Terzaghi (1883-1963).

His contribution has spread to almost every topic in soil mechanics and geotechnical engineering covered by the text book:



Born: October 2, 1883 in Prague
Died: October 25, 1963 in Winchester,
Massachusetts.

He won the Norman Medal of ASCE
four times (1930, 1943, 1946, and
1955).

He was given nine honorary doctorate
degrees from universities in eight
different countries.

He started modern soil mechanics with
his theories of consolidation, lateral
earth pressures, bearing capacity, and
stability.