SECTION XII

SUBJECTS OF A GENERAL CHARACTER

SUB-SECTION XII a

CLASSIFICATION OF SOILS

XII a 1

UNIFIED CLASSIFICATION OF SOILS

RADZIMIR PIETKOWSKI

Without any dispute we must consent that the studies on soils and soil mechanics represent such a big task that it can be forwarded an and developed only by international cooperation

It is a matter of primordial importance to this aim to have an unified classification and denomination (nomenclature) of soils. Otherwise comparing and profitting of similar tests and experience is very difficult if not at all impossible.

Because all methods of classification presented up to now did not fit well enough to the practice and common names of different soils, - in frames of studies of Polish Committee of Standards was undertaken this task anew.

Two bases were taken: granulometrie composition and consistency.

As to the granulometric composition the first trials showed that the content of particles ≺ 0,002 mm does not present a characteristic feature for general classification. On the contrary the percentage of particles < 0,006 mm apparently well grouped together the soils of similar features.

Here were advantageously used some hundreds of granulometric analyses taken from contributions presented to the Harvard Conference on Soil Mechanics, as well as from other foreign and this country's sources. Results of the analyses were plotted on the Féret-triangle and joined afterwards in particular contours, as shown on the drawing, fig. 1.

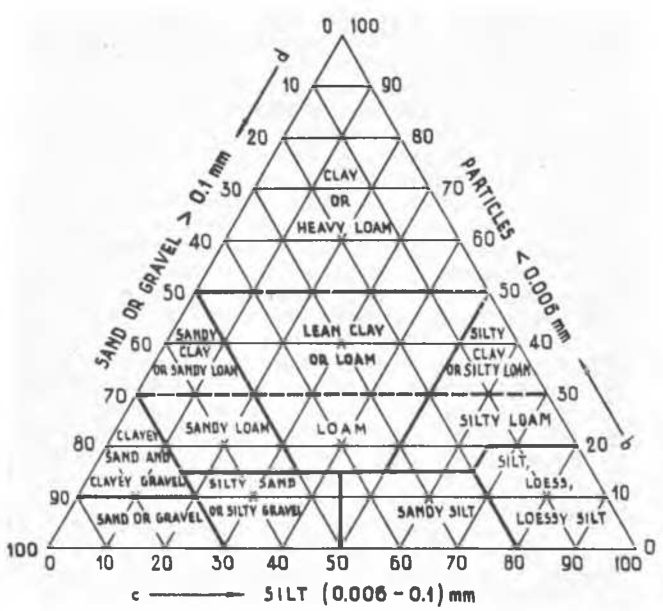

FIG. 1

This triangle required supplementary data concerning the content of particles < 0,002 mm in clays to separate them from loams and additional division among particles ≻ 0,1 mm, - the following table serves to this aim.

Nr	NAME OF SOIL	DIMENSIONS OF PARTICLES	WEIGHT PERCENTAGE TO THE DRY MASS OF SOIL
1	CLAY	< 0.002 0.002 - 0.006	a ≥ 30 b ≥ (50-a)
2	HEAVY LOAM	< 0.002 0.002 - 0.006	a < 30 b ≥ (50-a)
3	LEAN CLAY	< 0.002 < 0.006 0.006 - 0.1 ≻ 0.1	a ≥ 30 30 ≤ b < 50 0 ≤ c < 20 0 ≤ d < 50
4	SANDY CLAY	< 0.002 < 0.006 0.006 - 0.1 > 0.1	a ≥ 30 30 ≤ b < 50 0 ≤ c < 20 30 ≤ d < 70
5	SILTY CLAY	< 0.002 < 0.006 0.006 - 0.1 > 0.1	a ≥ 30 30 ≤ b < 50 30 ≤ c < 70 0 ≤ d < 20
6	LOAM	< 0.002 < 0.006 0.006 - 0.1 > 0.1	a < 30 15 ≤ b < 30 0 ≤ c < 30 0 ≤ d < 30
7	SANDY LOAM	< 0.002 < 0.006 0.006 - 0.1 > 0.1	a < 30 15 ≤ b < 30 0 ≤ c < 35 30 ≤ d < 70
8	SILTY LOAM	< 0.002 < 0.006 0.006 - 0.1 > 0.1	a < 30 15 ≤ b < 30 30 ≤ c < 80 0 < d < 35
9	SILT	< 0.006 0.006 - 0.1 > 0.1	0 ≤ b < 20 65 ≤ c ≤ 100 0 ≤ d < 20
10	LOESS AND LOESSY SILT. PERCENTAGE OF PARTICLES AS IN SILT. LOESS AND LOESSY SILT OF AEOLIC ORIGIN. LOESS CONTAINS CALCIUM, WHILE IN LOESSY SILT IT IS WASHED OUT.		
11	SANDY SILT	< 0.006 0.006 - 0.1 > 0.1	0 ≤ b < 15 42.5 ≤ c < 80 20 < d < 50
12	SILTY SAND	< 0.006 0.006 - 0.1 > 0.1 > 2.0	0 ≤ b < 15 15 ≤ c < 50 42.5 ≤ d < 70 e ≤ 10
13	LOAMY SAND	< 0.006 0.006 - 0.1 > 0.1 > 2.0	10 ≤ b < 30 0 ≤ c < 20 70 ≤ d < 90 e ≤ 10
14	HETEROGENEOUS SAND	< 0.006 0.006 - 0.1 > 0.1 > 2.0 NO FRACTION 0.1-0.5, 0.5-1.0 AND 1.0-2.0 EXCEEDING 60%. GENERAL WEIGHT.	0 ≤ b < 10 0 ≤ c < 30 70 ≤ d < 100 e ≤ 10
15	FINE SAND	COMPOSITION AS POS. 14 BUT ADDITIONALLY 0.1-0.5	f ≥ 60
16	MEDIUM SAND	COMPOSITION AS POS. 14 BUT ADDITIONALLY 0.5-1.0	f ≥ 60
17	COARSE SAND	COMPOSITION AS POS. 14 BUT ADDITIONALLY 1.0-2.0	f ≥ 60
18	GRAVEL	< 0.006 0.006 - 0.1 > 0.1 2 - 50	0 ≤ b < 10 0 ≤ c < 30 70 ≤ d ≤ 100 e ≥ 50
19	SAND-GRAVEL	< 0.006 0.006 - 0.1 > 0.1 2 - 50	0 ≤ b < 10 0 ≤ c < 30 70 ≤ d ≤ 100 10 < e < 50
20	SILTY GRAVEL	< 0.006 0.006 - 0.1 > 0.1 2 - 50	0 ≤ b < 15 15 ≤ c < 50 42.5 ≤ d < 70 e ≥ 40
21	LOAMY GRAVEL	< 0.006 0.006 - 0.1 > 0.1 2 - 50	10 ≤ b < 30 0 ≤ c < 20 70 ≤ d < 90 e ≥ 50
22	SILTY SAND-GRAVEL	< 0.006 0.006 - 0.1 > 0.1 2 - 50	0 ≤ b < 15 15 ≤ c < 50 42.5 ≤ d < 70 10 < e < 40
	LOAMY SAND-GRAVEL	< 0.006 0.006 - 0.1 > 0.1 2 - 50	10 ≤ b < 30 0 ≤ c < 20 70 ≤ d < 90 10 < e < 50

THIS TABLE DOES NOT CONTAIN THE FOLLOWING KINDS OF SOILS:

a) PEATS, b) ORGANIC MUDS AND DIATOMITES

c) MARLS, CONTAINING 1/3 TO 2/3 OF LIMESTONE

d) ROCKS.

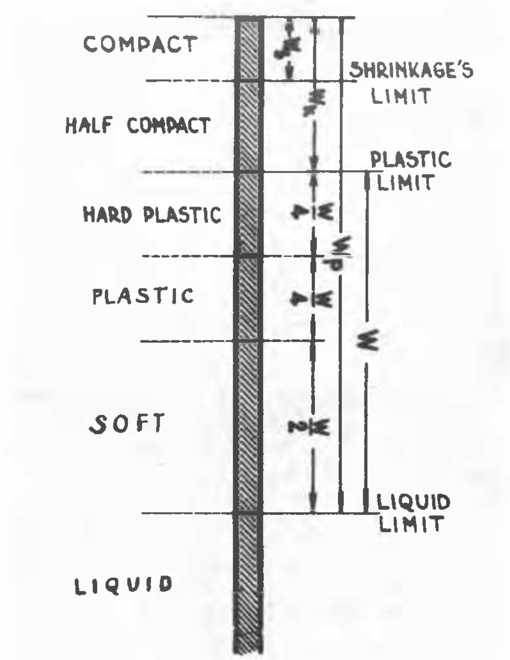

FIG. 2

The classification may seem to be somewhat to minute: the practice shall show that it is virtually so, many contours can be possibly hereafter joined together; it is obvious new that to day a too wide classification would be reproachable.

It must be added that all designations of soils were adjusted to their commonly used names.

The second base of classification is the water - or voids - content of soils.

For the cohesive soils the Atterberg's consistency limits serve for a classification, as shown on fig. 2

For the cohesionless soils the compaction-index $D = \frac{\varepsilon - \varepsilon_{min}}{\varepsilon_{max} - \varepsilon_{min}}$ gives the second sign of value of a soil. In this figure the voids-indexes ε_{max}, ε_{min}, and ε represent correspondingly the most loose, the most compact and the natural consistency of the same soil.

If $0 < D \leq 0{,}33$ - soil is called loose
" $0{,}33 < D \leq 0{,}66$ - " " " half compact
" $0{,}66 < D \leq 1{,}00$ - " " " compact

It seems that in the present time it would be of high value to adopt an unified international classification and denomination of soils This motion is here presented to the National Committees. In hope to serve to this aim this contribution is joined here.-

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XII a 2 DEVELOPMENT OF A UNIFORM SYSTEM OF SOIL IDENTIFICATION AND CLASSIFICATION

MELBOURNE AND METROPOLITAN BOARD OF WORKS

Australia.

In view of the diversity of soil identification and classification systems, 1), it is suggested that this conference might consider initiating a uniform system.

The essential functions of a uniform system would be:

a) To provide a standard of nomenclature for soil identification.
b) To assist in condensing experience with soil behaviour.

A suitable system should be:

a) Acceptable to all soil workers, e.g. engineers, agricultural scientists, and geologists.
b) Simple and convenient in use.
c) Capable of detailed expansion for special purposes without affecting the basic systems.

Any single system which met these basic requirements would probably be too complex for convenient use. An alternative would be a two-stage system providing:

a) Simple system of field identification.
b) Detailed functional classification for each major branch of soils work. These could each be developed by the appropriate professional association and its details exchanged with the other soil workers. Workers in any one field, e.g. civil engineering, would operate with that particular functional classification, but would have the other systems for reference when exchanging data.

For the field identification, two systems are available: (a) The modified descriptive system adopted by the Division of Soils, C.S. I.R. Australia, or (b) the field section of the AC classification. 1).

The modified descriptive system uses standardized terminology, 2), but is essentially a field identification system. The ultimate test of the description of any soil is the majority verdict of experienced soil surveyors. To keep such opinions up to date and uniform, periodic conferences are held for interested parties, general descriptions are prepared, and comparisons are made between the classified types and their simple physical properties 2). All such descriptive terms and standards are subordinate to field usage and are periodically amended where necessary. This method has the advantage that it has been and still is, the most widely used identification system, it is very simple and convenient in use, and it is based on field observations and was developed solely for field use.

The AC classification field section is more complex and less flexible than the simpler system. In addition, its use is much more restricted and as such it would be harder to reach international agreement on its use.

For the engineering functional classification the alternative systems could be (a) PRA