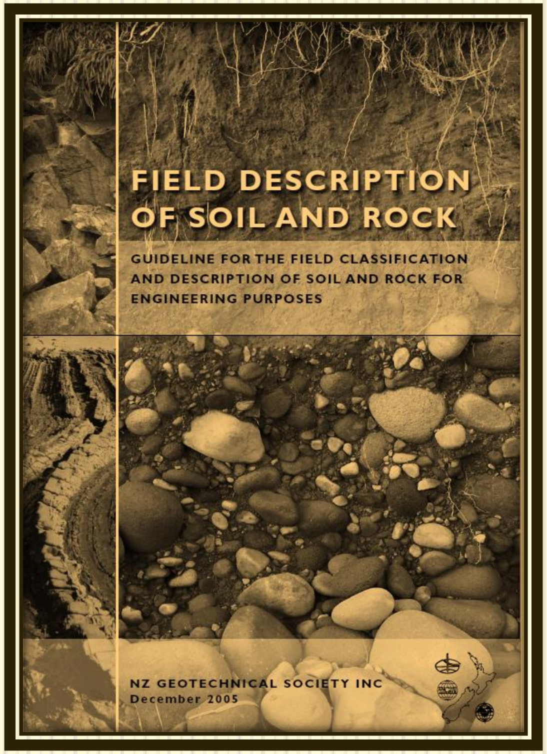
Description Soil



The terms classification and description have the following :

Classification: the identity of the material itself, i.e. what its composition and properties are.

Classification systems used in soil mechanics, such as the Casagrande system, refer primarily to the material itself; they make only passing reference to the state in which the material exists in the ground.

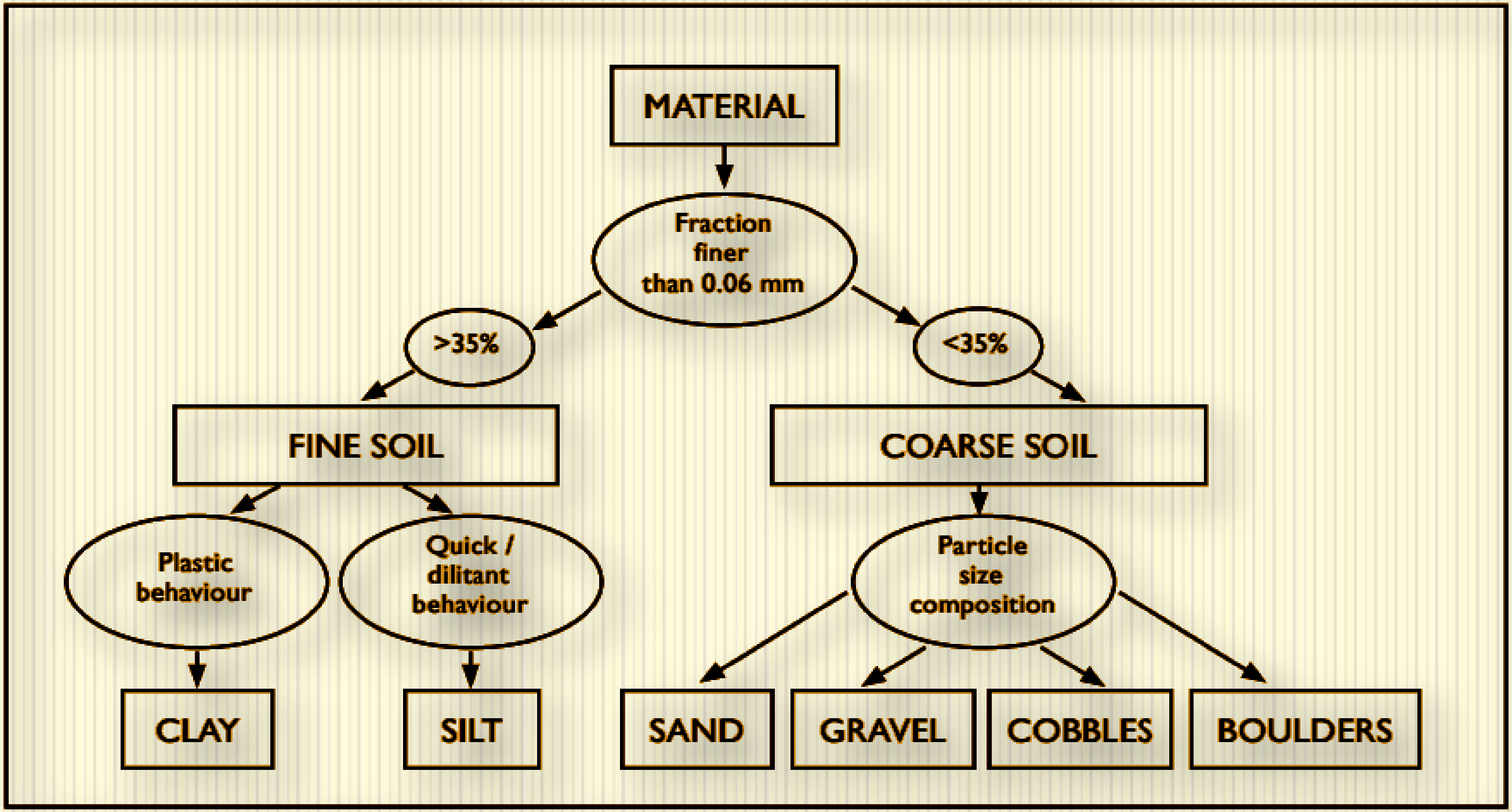
Description: the in-situ properties of the material, i.e. what it is like in its undisturbed state.

Descriptive systems used in logging core, investigation pits etc, enable accurate accounts to be given of the state of the material in-situ. In some situations, for example where borrow sources are being investigated, or when only disturbed samples are available, then classification of the material itself is possible (and relevant), but description of its undisturbed state is not possible (or relevant).

A distinction between these two aspects is therefore made when describing a soil.

Distinction of Coarse Soils from Fine Soils

The first step in classification is to decide, from Figure , whether the soil falls into the coarse or fine category. The 0.06 mm size is considered to be the smallest size that can be seen with the naked eye, and it is also the size of the finest sieve used in particle size analysis



If the material belongs in the fine soil category, it can be classified as silt or clay on the basis of behavioural characteristics – plasticity or quick and dilatant properties. If the material falls into the coarse soil category, it can be further divided into sand, gravel etcetera on the basis of particle size

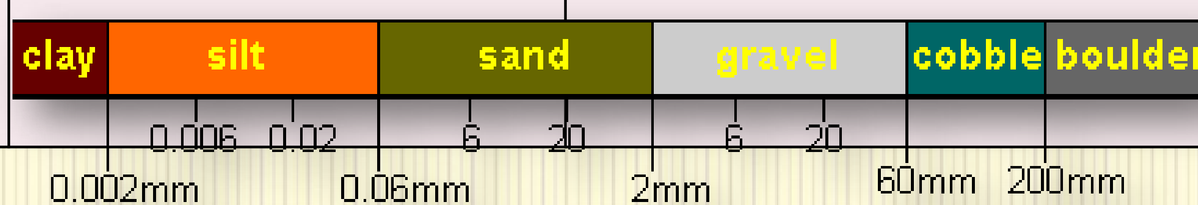
Gravel and sand comprise rock fragments of various sizes and shapes that may be either rock fragments or single minerals. In some cases there may be only a narrow range of particle sizes present, in which case the material is described as ‘uniform’. In other cases a broad range of particle sizes may be present and the material is described as ‘well graded’.

Silt is intermediate between clay and fine sand. Silt is less plastic and more permeable than clay, and displays ‘dilatant’ and ‘quick’ behaviour. Quick behaviour refers to the tendency of silt to liquefy when shaken or vibrated, and dilatancy refers to the tendency to undergo volume increase when deformed. A simple test of patting a saturated soil sample in the hand can be undertaken to assess these properties and distinguish silt from clay.

Clay consists of very small particles and exhibits the properties of ‘cohesion’ and ‘plasticity’, which are not found in sand or gravel. Cohesion refers to the fact that the material sticks together, while plasticity is the property that allows the material to be deformed without volume change or rebound, and without cracking or crumbling.

Organic soil is distinguished as a category different from coarse or fine soils, but should only be identified as such if the organic content is high and the material no longer behaves like a silt or clay. Soils containing small to moderate amounts of organic material still retain the properties of silts or clays and should be described within those categories.

Clay	Silt	Sand
▪ Clay is also known as Cohesive Soil, Frictionless Soil or Expansive Soil ▪ Composed of very fine particles (less than 0.002 mm in size) ▪ Flaky in shape, thus having considerable surface area ▪ Have high inter particle attraction and thus having sufficient cohesion ▪ Susceptible to swelling and shrinkage, and possess low permeability ▪ Commonly brown in colour	▪ Silt particles rang in size from 0.002 mm to 0.06 mm ▪ Have high capillarity and very low dry strength ▪ Since particle size ranges in between that of clay and sand thus possessing properties of both sand and clays i. e. it shows slight cohesion and also friction. ▪ The colour of silty soil is mostly brown	▪ Sand is also known as Frictional Soil or Cohesionless Soil ▪ Particle size ranging from 0.06 mm to 2 mm. ▪ It may be rounded to angular in shape ▪ Grey in colour ▪ No plasticity ▪ Possess high strength in confined state and has considerable frictional resistance ▪ Angular particles have high frictional resistance than rounded ones ▪ It has high permeability and low capillarity
Gravel ▪Particle size ranges from 2 mm to 60 mm ▪Gravel form good foundation material ▪Shows high frictional resistance ▪Angular particles have high frictional resistance than rounded ones ▪The gravels produced by crushing of rocks are angular in shape while those taken from riverbeds are sub-rounded to rounded	**Cobbles or Boulders** ▪ Particles larger than gravels are commonly known as Cobbles or Boulders ▪ Cobbles range in size from 60 mm to 200 mm ▪ The material larger than 200 mm are designated as Boulders	



COARSE SOILS – classification

Introduction

If the soil falls into the coarse group, an estimate is made of the relative proportions of its principal constituents and an appropriate name given (Table)

Fraction	Term	% of Soil Mass	Example
Major	(….) [UPPER CASE]	≥ 50 [major constituent]	GRAVEL
Subordinate	(….)y [lower case]	20–50	Sandy
Minor	with some … with minor …	12–20 5–12	with some sand with minor sand
	with trace of (or slightly)…	< 5	with trace of sand (slightly sandy)

In addition to the name given to the soil, further descriptive information should be given:

a) Proportions of particle sizes;

b) The maximum particle size;

c) Grading;

d) Particle shape;

e) Particle strength/hardness;

f) Other material;

g) Colour; and

h) Geological information.

Table is an attempt to indicate this process, and define the terms some, minor, and trace.
However the table will not always be directly applicable.
For example, a soil could consist of 40 % gravel, 40 % sand and 20 % clay. This is clearly a coarse soil in terms, but does not have a "major" fraction. Its correct description would be either: gravelly SAND, some clay, or sandy GRAVEL, some clay.

In practice, it may appear as a clayey GRAVEL or clayey SAND, depending on the fineness of the gravel and sand, and the plasticity of the clay.
An attempt should be made to indicate whether any fines present in a coarse soil are silty or clayey in nature. This is not easy to do either in the field or the laboratory. Fines, which seem plastic and sticky, and cling to the large particles when the material is dried, are clayey. If they are not plastic and sticky, they are silty in nature

Proportions of Particle Sizes

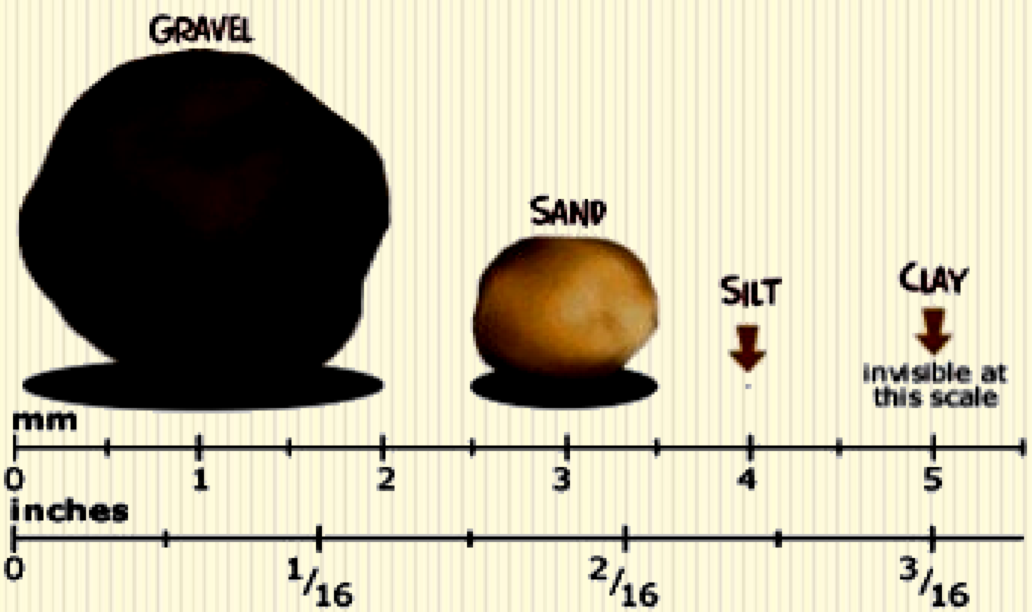
A material consisting mainly of gravel but containing significant sand would be classified as: SANDY GRAVEL.

In this case gravel is referred to as the major fraction and sand as the subordinate fraction. Some soils may also contain other material, for example clay. This is indicated by adding descriptive information to the soil name. The full classification might then become: sandy GRAVEL WITH SOME CLAY.

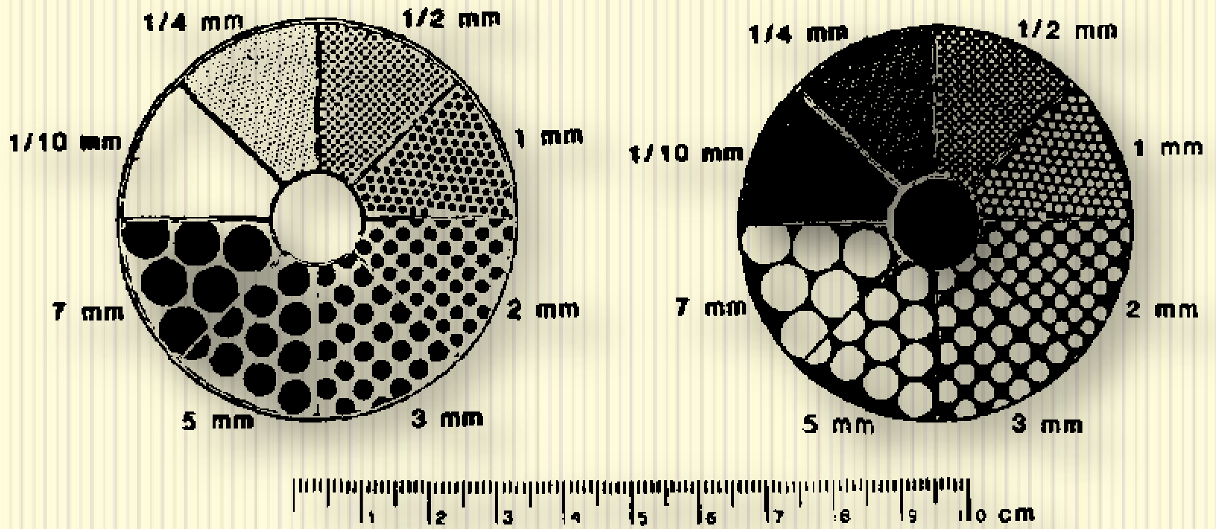
With only a very small amount of clay the classification would be: SANDY GRAVEL WITH A TRACE OF CLAY or SLIGHTLY CLAYEY SANDY GRAVEL.

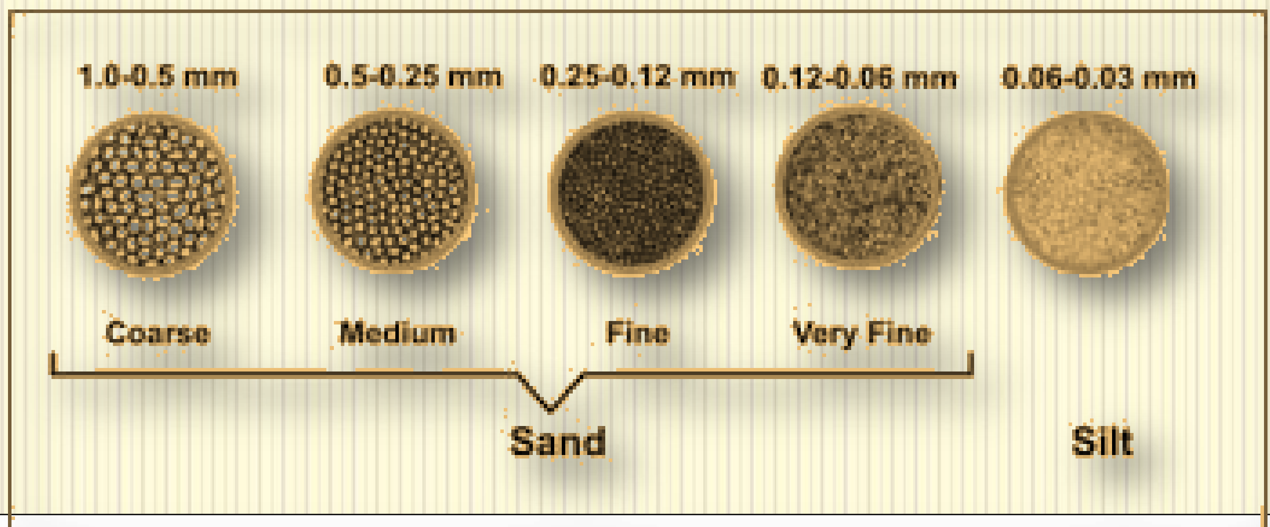
Maximum Particle Size

Maximum particle size should be stated as a dimension in mm.



- If there is abundant sand in the profile, you should describe the sand size, using the magnifying lens and the sand chart. Excessively moisten the soil and rub it around on the palm of your hand. examine the soil and the sand chart with the magnifying lens and determine the proper sand size from the chart.

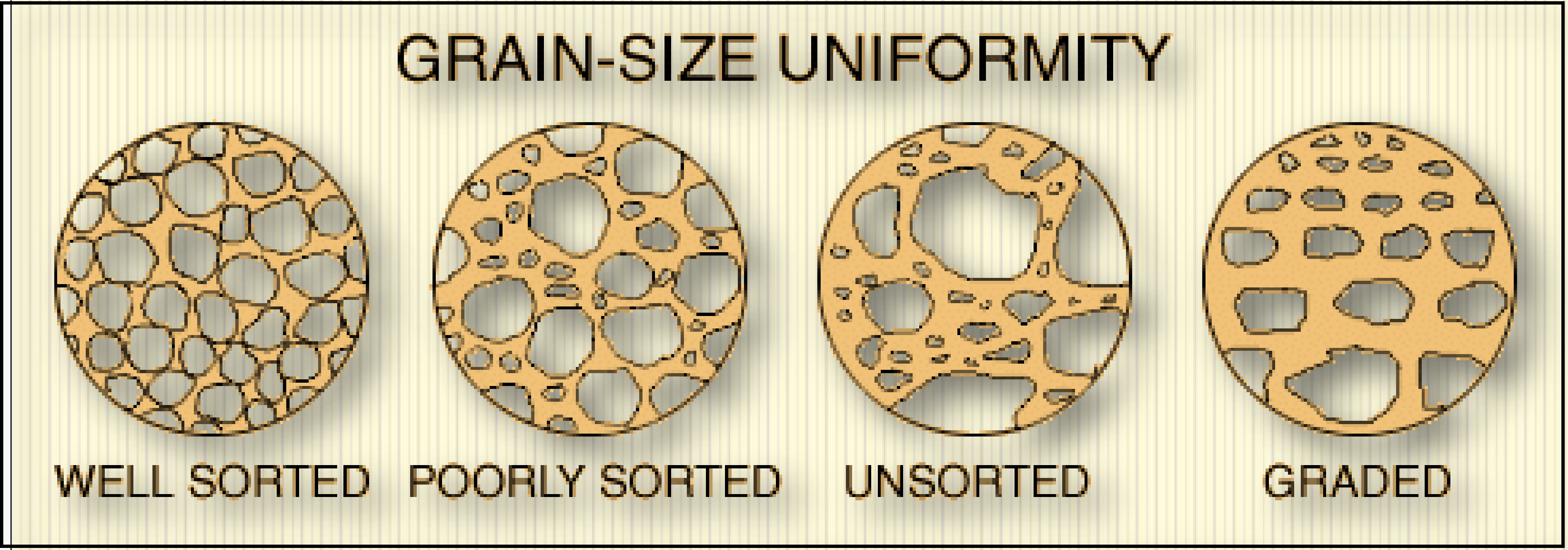




Grading

Gravels and sands should be described as well graded (a good representation of all particle sizes from largest to smallest), or poorly graded (a limited representation of grain sizes).

Poorly graded materials may be further divided into uniformly graded (most particles about the same size), and gap graded (absence of one or more intermediate sizes within what otherwise would be a well graded material).

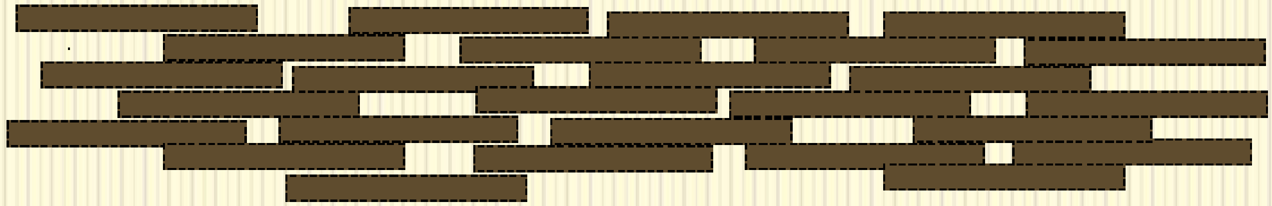


Soil Grain Shapes

- Soil grains have different *shapes that* somewhat difficult to quantify.
- An infinite number of shapes are possible, a few of which below:

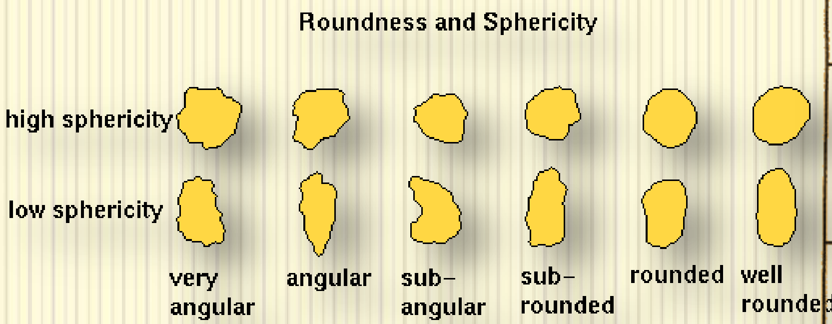
<u>Bulky (sands and gravel)</u>

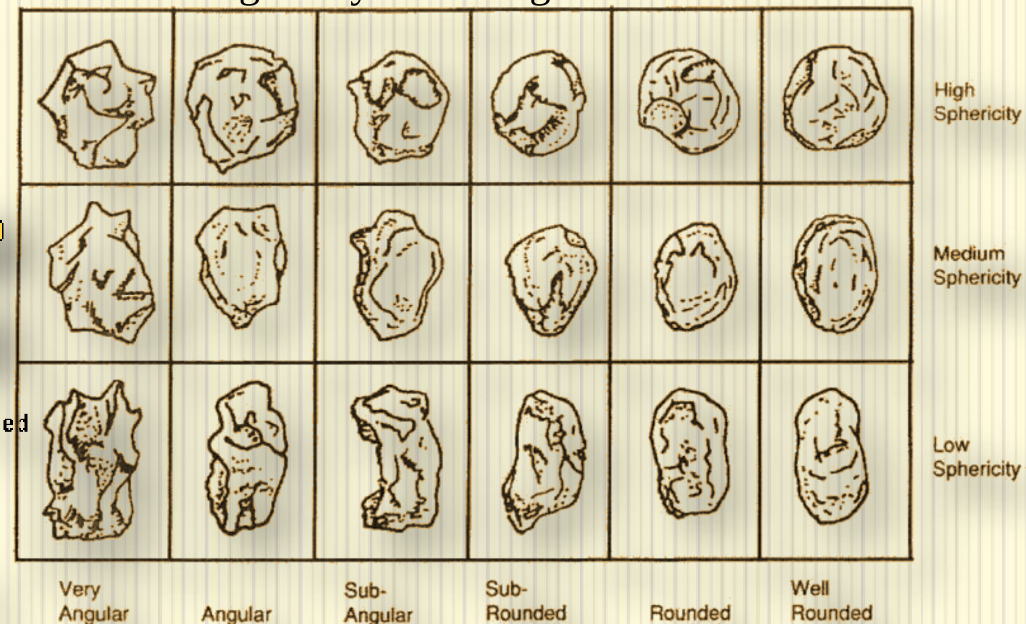
<u>Flaky or Needle shape (clay)</u>

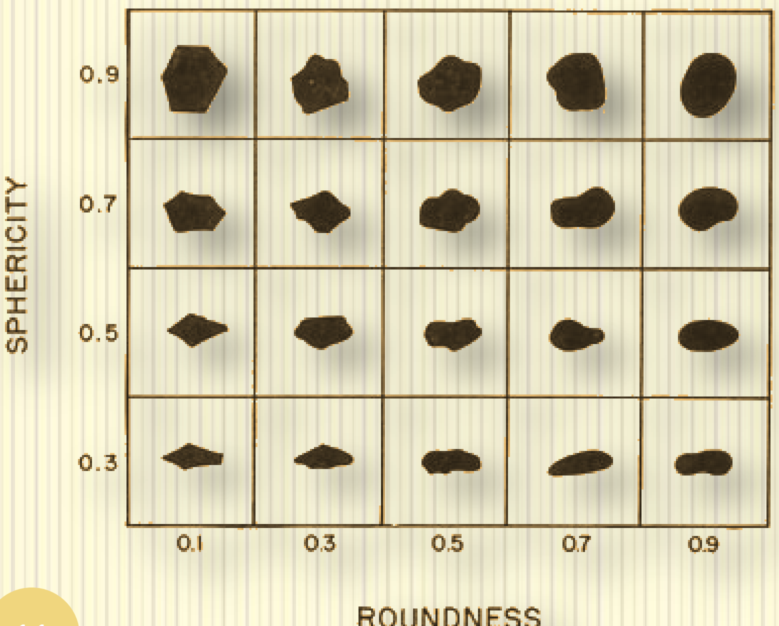


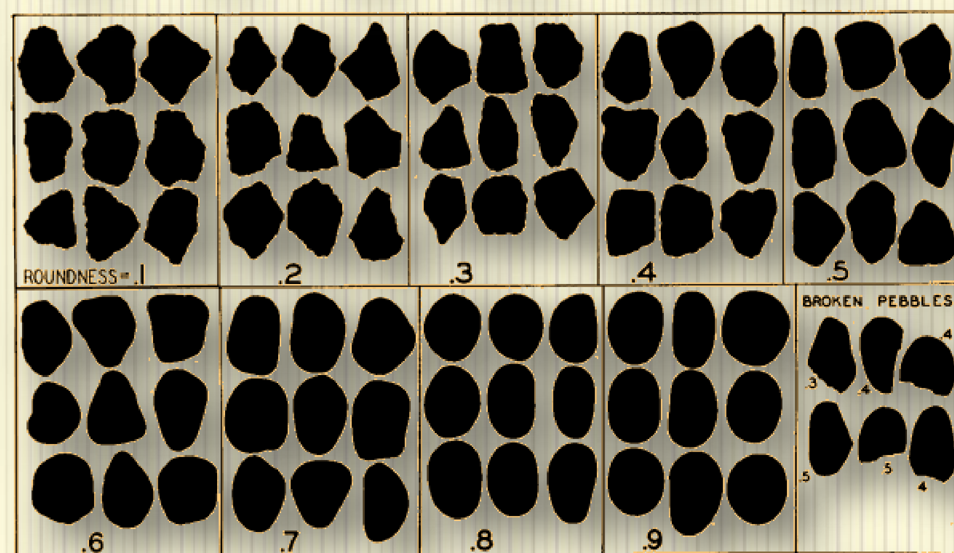
Particle Shape

Particle shape can be expressed in terms of roundness or angularity according to the scale shown in

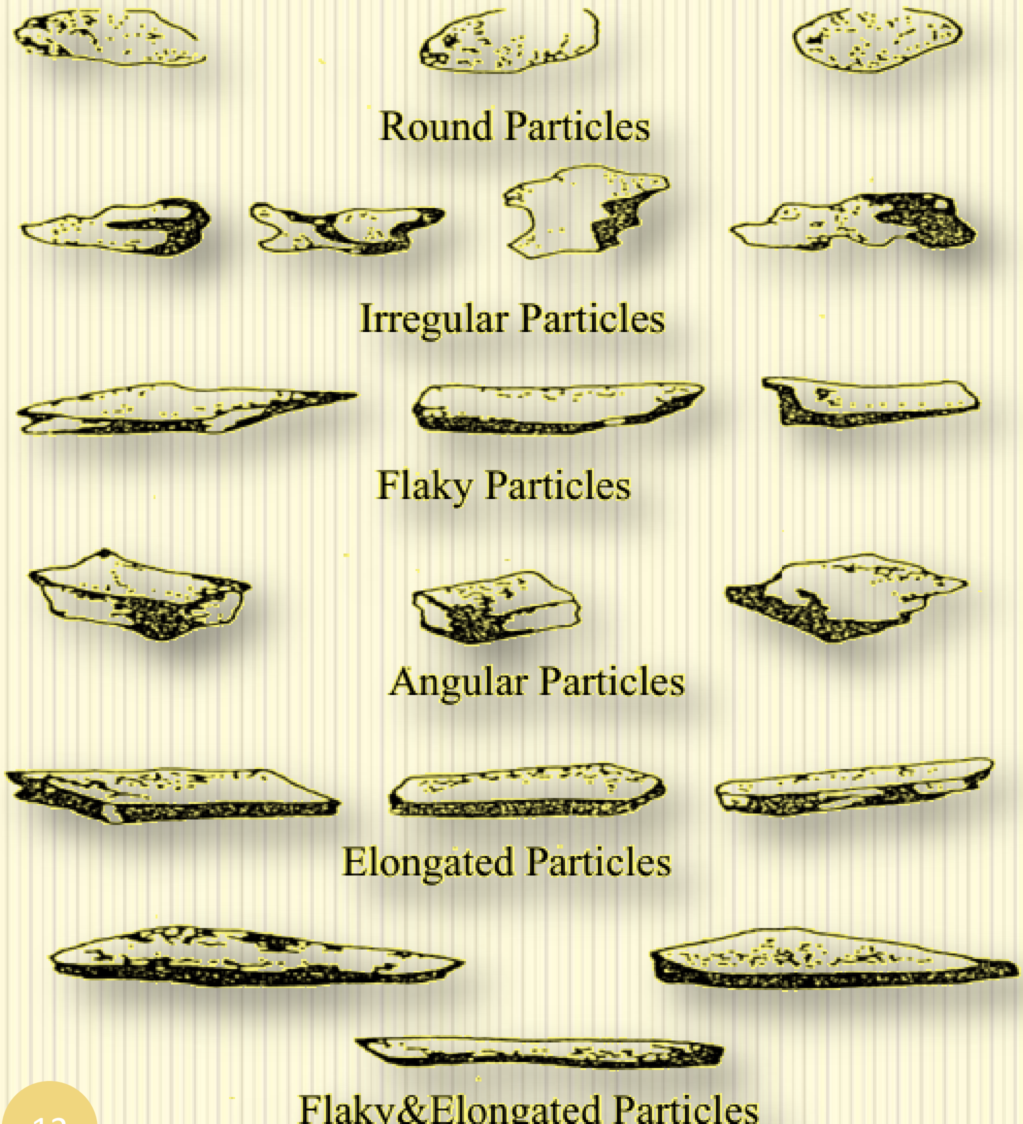


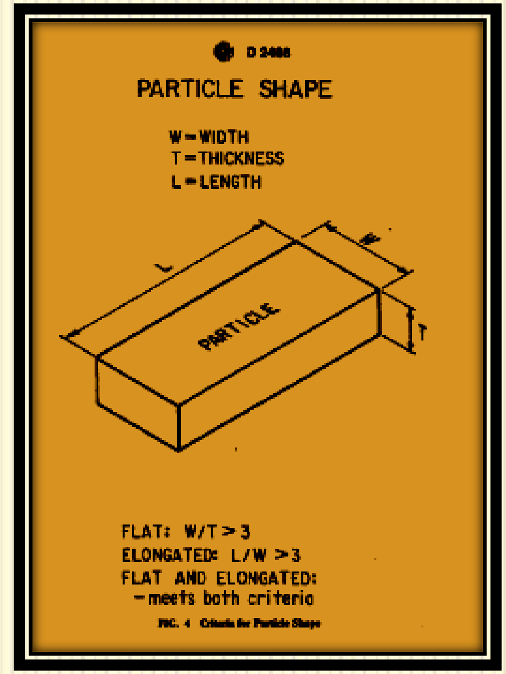




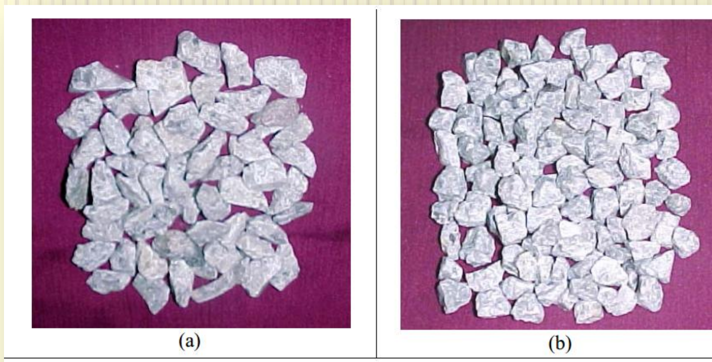


The form of the soil particles may have an important effect on the mechanical properties of the soil mass. Particles can be further described as equidimensional, flat, elongated, flat and elongated or irregular.





BS 812



Aggregate shapes; (a) Bad shape (irregular, flaky, elongated and flaky&elongated) and (b) Good shape (angular and cubical)

Particle Strength/Hardness

Unless otherwise stated, it is assumed that grains of sand or gravel consist of hard, unweathered rock.

If this is not the case, then information should be provided indicating the hardness of the grains, and the extent of weathering if this is a factor. Descriptions such as "easily broken by hand" or "can be easily broken by a hammer blow" are appropriate.

Other Material

Other material such as pieces of coal, shell, or traces of oils should be described.

Colour

Colour should be described using the terms set out in Table. Colour may indicate the degree of weathering or the geological origin, and can be used to trace stratigraphic layers. Colour descriptions should focus on the main overall colour, rather than the fine details of colour variability. The choice of a colour from Column 3 in Table can be supplemented by a term from Column 1 and/or Column 2 as appropriate.

1	2	3
light	pinkish	pink
dark	reddish	red
	yellowish	orange
	brownish	yellow
	greenish	brown
	bluish	green
	greyish	blue
		white
		grey
		black

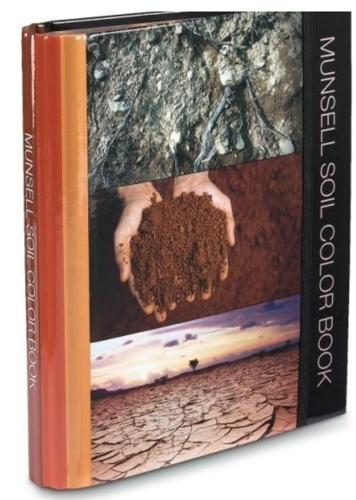
Geological Information

Identify the dominant minerals or parent rock types and the geological unit, if known.

e. COLOR: Use the Munsell Soil Chart to identify soil colors. Hold the piece of soil behind the page with the sun at your back, find the color chip that EXACTLY matches the soil's color. The pages represent hues, the rows designate value, and the columns represent chroma. Munsell colors are always designated in the order of hue (page number), value (number in the left-hand column), and chroma (number across the bottom of the page). Write in the soil color as a hue-value-chroma, for example: 10YR 3/2. Next, look at the opposing page and give the verbal description, for examle: "very dark grayish brown" .

- The colours of the soils are identified according to Munsell system colour chart. The chart is made up of about 250 different coloured papers, or chips, consistently arranged on hue cards according to their Munsell notations. The Munsell system consists of an alphanumeric designation for hue, value and chroma, such as '10YR5/3' and soil colour description such as 'brown'. The most commonly used chart includes only about one fifth of the entire range of hues (measure of the chromatic composition of light that reaches the eye).

Munsell Soil Books include the following charts:
Munsell 10R Soil Chart
Munsell 10YR Soil Chart
Munsell 2.5Y Soil Chart
Munsell 2.5YR Soil Chart
Munsell 5Y Soil Chart
Munsell 5YR Soil Chart
Munsell 7.5YR Soil Chart
10Y - 5GY Olive Greens Soil Chart
Gley 1 & 2 Soil Charts (2 separate charts)
Munsell 5R Individual Soil Chart
Munsell 7.5R Individual Soil Chart
New White page 7.5R, 10YR & 2.5Y



Soil Color

O.M. -- humus, black/brown color

iron oxides/hydroxides -- red/orange/yellow

carbonates -- white

grey color: either: bare mineral grains (mix of black and white minerals)
or: anaerobic (waterlogged) conditions

Color described by: hue → value → chroma

10 YR 4/4

Hue = dominant primary color

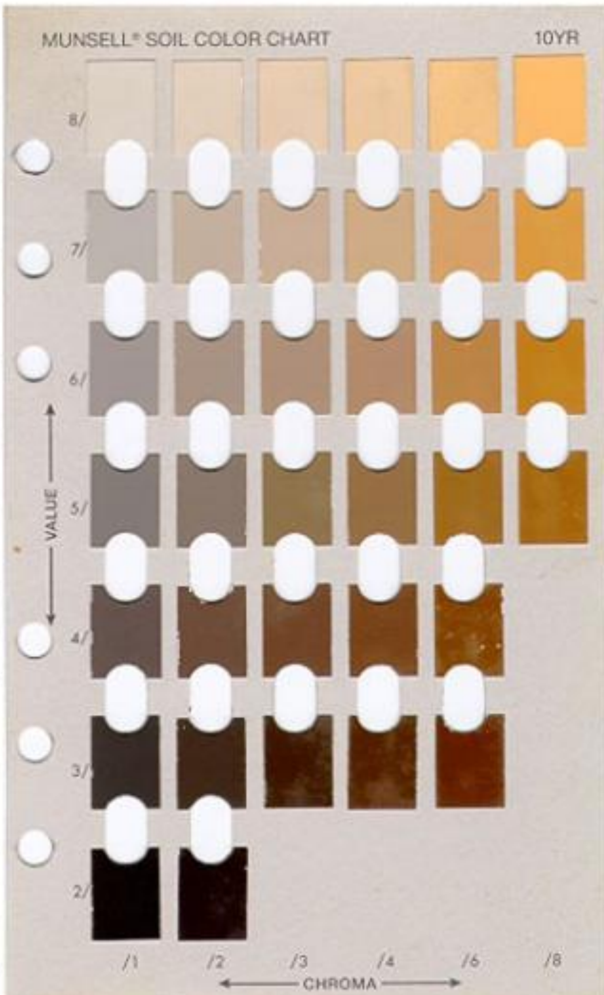
Value = lightness or darkness

Chroma = intensity of color, strength of color

Light Brown

Dark Tan

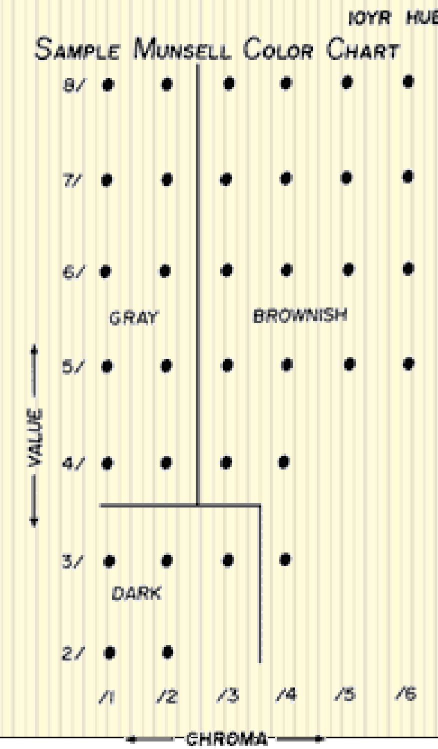
Slate Black



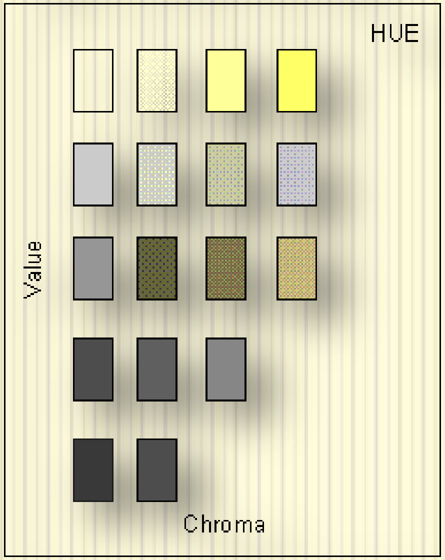
Light New Cedar

Dark Terracotta

Dark Autumn



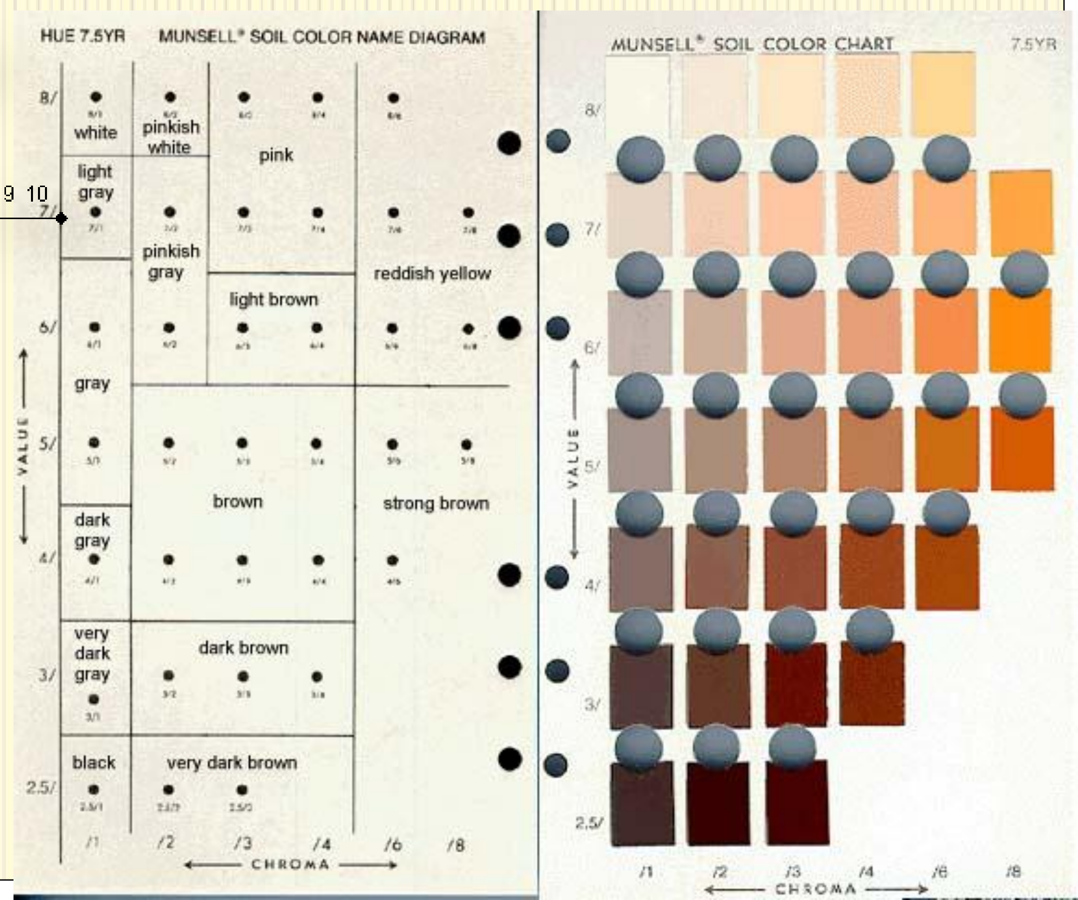
Page in a Munsell Color Book



Hue:
purple blue green yellow red

Value:
pure white
value = 10
pure black
value = 0

Chroma:
0 1 2 3 4 5 6 7 8 9 10



FINE SOILS – classification

Silt or Clay

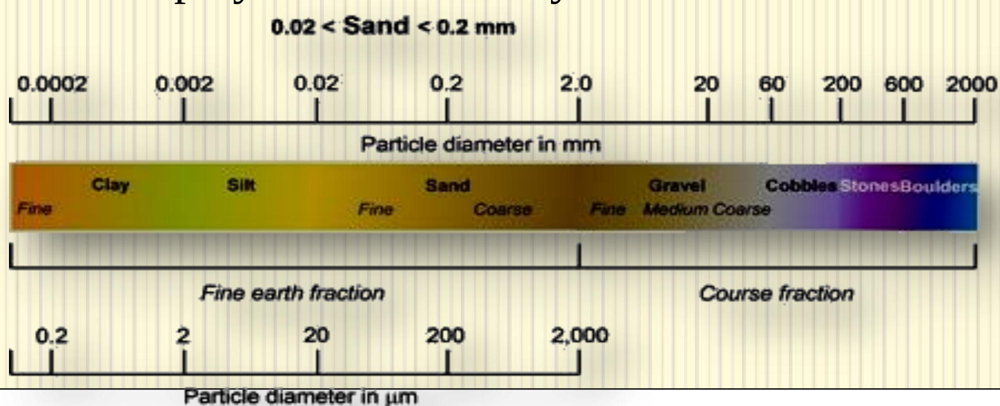
If the soil is fine grained, it is examined to determine whether it is a silt or a clay. As already mentioned, the division into silt or clay is not made on the basis of particle size.

To distinguish between silts and clays, the best test to use is the "quick"/dilatancy test. A pat of soft soil (sufficiently wet to be almost sticky) is placed in the open palm of the hand and shaken, or vibrated horizontally. This is most effectively done by tapping the hand holding the soil, with the other hand. With a silt, "quick" behaviour appears (water will appear on the surface, giving it a shiny appearance), and will then disappear if the sample is squeezed or manipulated. During vibration, the sample tends to collapse and water runs to the surface. When it is manipulated the sample tends to dilate and draw water back into it. With a clay, these characteristics are not present.

In the laboratory, the division into silt or clay can also be made on the basis of Atterberg Limit tests and use of the Plasticity Chart.

For example, a soil which behaves primarily as a clay, but also contains significant sand is classified as SANDY CLAY.

A soil that behaves primarily as a clay, but also displays some tendency towards silt behaviour could be classified as SILTY CLAY.



The use of this terminology may not be strictly in accordance with the USCS, but it is more sensible to use such terminology than to force the soil into a category to which it does not belong.

In addition to the name given to the soil, the following descriptive information should be given:

a) Plasticity;

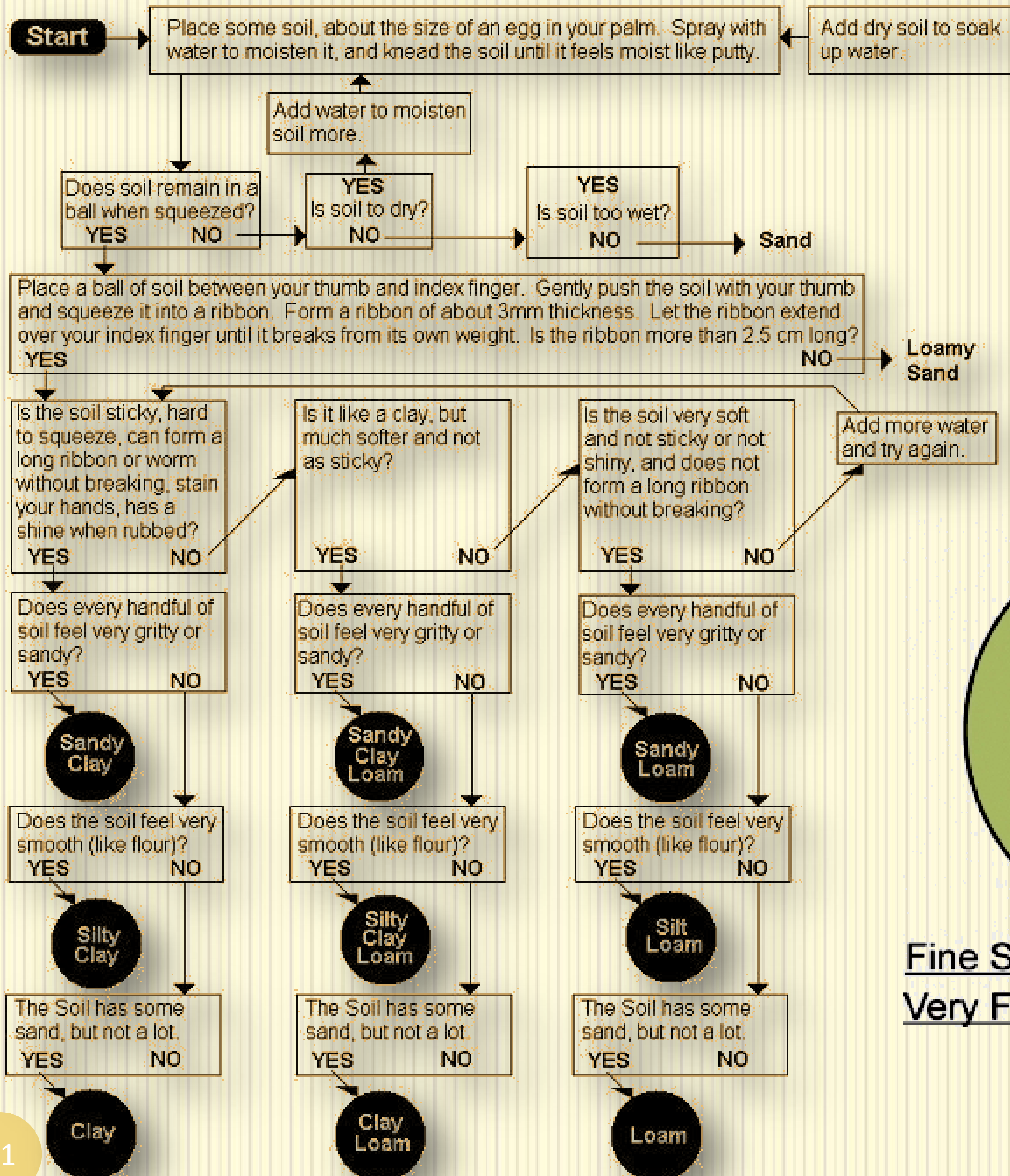
b) Presence of coarse material;

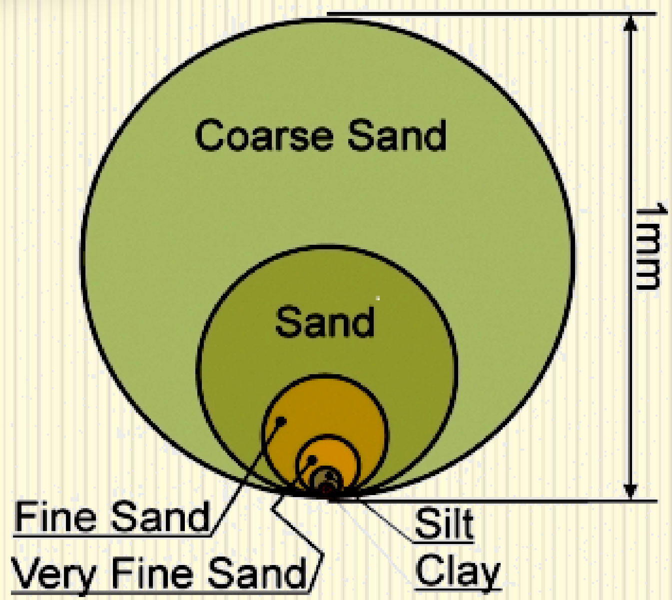
c) Colour;

d) Geology.

In special circumstances, a field or laboratory classification of the particle size may be required, (e.g. when an estimate of the permeability of the soil is needed). In these cases the classification should be added to the field description of the soil and noted so that it is clear on what basis it has been made.

CHARACTERISTICS	SILTS	CLAYS
DILATANCY (reaction to shaking. Movement of water in voids). • None • Slow • Rapid	Rapid reaction. Water appears on the surface to give a livery appearance when shaken. Squeezing the soil causes water to disappear rapidly.	Sluggish or no reaction. Surface of the samples remain lustrous. Little or no water appears when hand is shaken. Sample remains lustrous during squeezing.
DRY STRENGTH (Cohesiveness in dry state). • None • Low • Medium • High • Very High	None to low. Even oven-dry strength is low. Powder easily rubs off surface of the sample. Little or no cohesive strength-will crumble and slake readily.	High to very high. Exceptionally high if oven-dry. Powder will not rub off the surface. Crumbles with difficulty. Slakes slowly.
TOUGHNESS (Plasticity in moist state). • Low • Medium • High	Plastic thread has little strength. Dries quickly. Crumbles easily as it dries below plastic range. Seldom can be rolled to 1/8" thread without cracking.	Plastic thread has high strength. Dries slowly. Usually stiff and tough as it dries below plastic range. Can easily be rolled to 1/8" thread without cracking.
DISPERSION (Settlement in water).	Settles out of suspension in 15 to 60 minutes. (Sands settle in 30 to 60 seconds).	Settles in several hours or days, unless it flocculates (rapidly precipitates out in small clumps).
VISUAL INSPECTION AND FEEL	Only coarsest individual silt grains are visible to the naked eye. Feels slightly gritty when rubbed in fingers. Dries quickly and dusts off easily.	Individual grains cannot be observed by the naked eye. Feels smooth and greasy when rubbed in fingers. Dries slowly and does not dust off, must be scraped off.
BITE TEST (Caution: Eating contaminated soil may be hazardous to your health)	Gritty feeling between the teeth, does not stick to the teeth.	No gritty feeling between the teeth; tends to stick to the teeth.


Start
Place some soil, about the size of an egg in your palm. Spray with water to moisten it, and knead the soil until it feels moist like putty.
Add dry soil to soak up water.
Add water to moisten soil more.
Does soil remain in a ball when squeezed? YES NO
YES Is soil to dry? NO
YES Is soil too wet? NO
Sand
Place a ball of soil between your thumb and index finger. Gently push the soil with your thumb and squeeze it into a ribbon. Form a ribbon of about 3mm thickness. Let the ribbon extend over your index finger until it breaks from its own weight. Is the ribbon more than 2.5 cm long? YES NO
Loamy Sand
Is the soil sticky, hard to squeeze, can form a long ribbon or worm without breaking, stain your hands, has a shine when rubbed? YES NO
Is it like a clay, but much softer and not as sticky? YES NO
Is the soil very soft and not sticky or not shiny, and does not form a long ribbon without breaking? YES NO
Add more water and try again.
Does every handful of soil feel very gritty or sandy? YES NO
Sandy Clay
Sandy Clay Loam
Sandy Loam
Does the soil feel very smooth (like flour)? YES NO
Silty Clay
Silty Clay Loam
Silt Loam
The Soil has some sand, but not a lot. YES NO
Clay
Clay Loam
Loam


Coarse Sand
Sand
1mm
Fine Sand
Very Fine Sand
Silt
Clay

Plasticity

The most important property of a clay or silt is its plasticity. A highly plastic soil is one that can be moulded or deformed over a wide moisture content range, without cracking or showing any tendency to volume change. It also shows no trace of "quick" or dilatant behaviour.

To evaluate plasticity in the field it is necessary to remould the soil over a range of moisture contents.

The dry strength of the material is also a good guide to plasticity. Highly plastic clays will become 'rock hard' when dry, while those of low plasticity can be crumbled in the fingers.

Presence of Coarse Material (Sand or Gravel)

If the fine soil contains significant amounts of coarse material then this should be described. For example, a soil is a sandy CLAY if the proportion of sand lies between 20 and 50 %, and a CLAY, with trace sand, if the proportion of sand is less than 5 %.

Colour

Unless of significance, the colour given should be the overall colour and not that of individual constituents. If appropriate, the distribution of colour may be described using the terms mottled,
banded, mixed, or speckled. Where used, such terms should be written after the main colour e.g. brown, mottled yellow.

ORGANIC SOILS

A small amount of dispersed organic matter can have a marked effect on plasticity and therefore on engineering properties. It may have a distinctive odour, a dark grey/ black or brown colour and a low density. If organic matter is present, the terms in Tables should be used. The relative proportion of organics in a soil should be described as for inorganic soils

Term	Description
Topsoil	Surficial organic soil layer that may contain living matter. However top-soil may occur at greater depth, having been buried by geological processes or man-made fill, and should then be termed a buried topsoil.
Organic clay, silt or sand	Contains finely divided organic matter; may have distinctive smell; may stain; may oxidise rapidly. Describe as for inorganic soils.
Peat	Consists predominantly of plant remains. Can be further described according to its degree of decomposition and strength. *Firm*: Fibres already compressed together *Spongy*: Very compressible and open structure *Plastic*: Can be moulded in hand and smears in fingers *Fibrous*: Plant remains recognisable and retain some strength *Amorphous*: No recognisable plant remains

Fine soils with larger amounts of organic matter usually plot below the A-line as organic silt. They have high liquid limits, sometimes up to several hundred percent. The liquid limit, plastic limit and plasticity index show a very marked drop on rewetting or remoulding following air or oven drying.

If a peat forms a horizon of major engineering significance, a fuller description using the scheme of von Post (Smart, 1986) may be appropriate

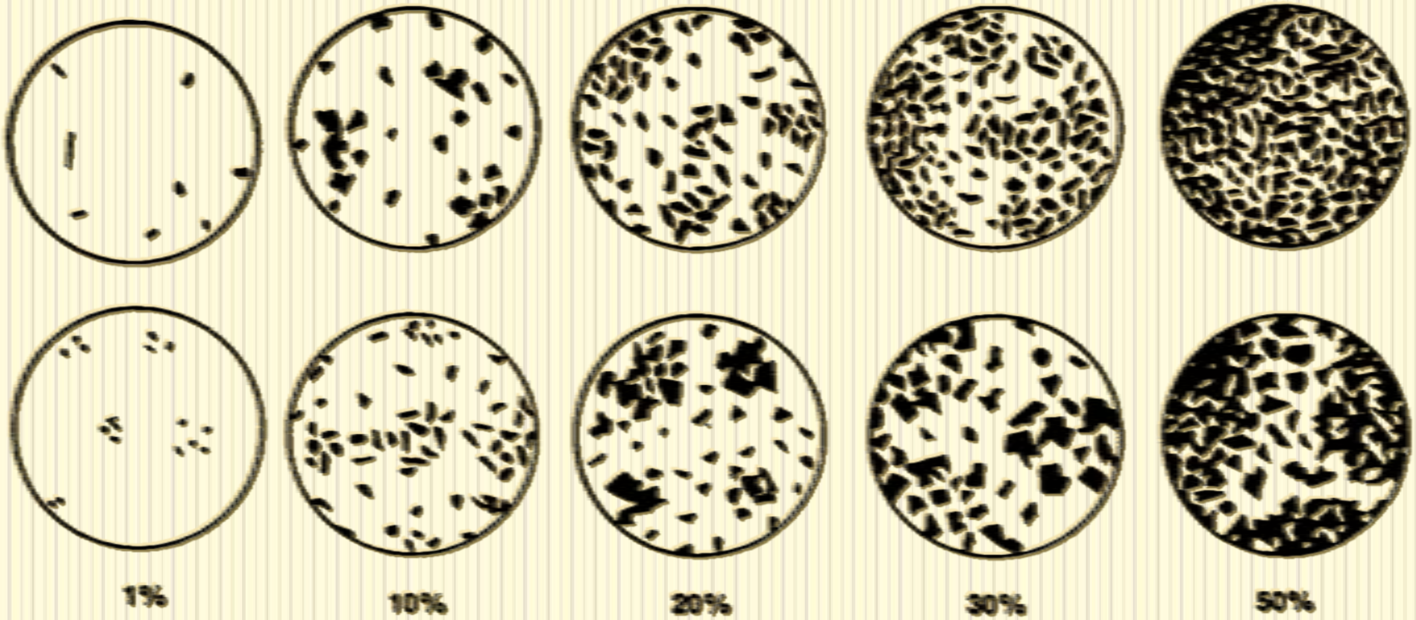
Term	Description
Rootlets	Fine, partly decomposed roots, normally found in the upper part of a soil profile or in a redeposited soil (e.g. colluvium or fill).
Carbonaceous	Discrete particles of hardened (carbonised) plant material.

Table 2.5 Assessment of degree of humification (after von Post (1922))

Degree of humification	Decomposition	Plant structure	Content of amorphous material	Material extruded on squeezing (passing between fingers)	Nature of residue
H1	None	Easily identified	None	Clear, colourless water	
H2	Insignificant	Easily identified	None	Yellowish water	
H3	Very slight	Still identifiable	Slight	Brown, muddy water; no peat	Not pasty
H4	Slight	Not easily identified	Some	Dark brown, muddy water; no peat	Somewhat pasty
H5	Moderate	Recognizable, but vague	Considerable	Muddy water and some peat	Strongly pasty
H6	Moderately strong	Indistinct (more distinct after squeezing)	Considerable	About one-third of peat squeezed out; water dark brown	
H7	Strong	Faintly recognizable	High	About one-half of peat squeezed out; any water very dark brown	Fibres and roots more resistant to decomposition
H8	Very strong	Very indistinct	High	About two-thirds of peat squeezed out; also some pasty water	
H9	Nearly complete	Almost not recognizable		Nearly all the peat squeezed out as a fairly uniform paste	
H10	Complete	Not discernible		All the peat passes between the fingers; no free water visible	

FIGURE 2: COMPARISON CHART (PERCENT BY VOLUME)

(Ref.19)



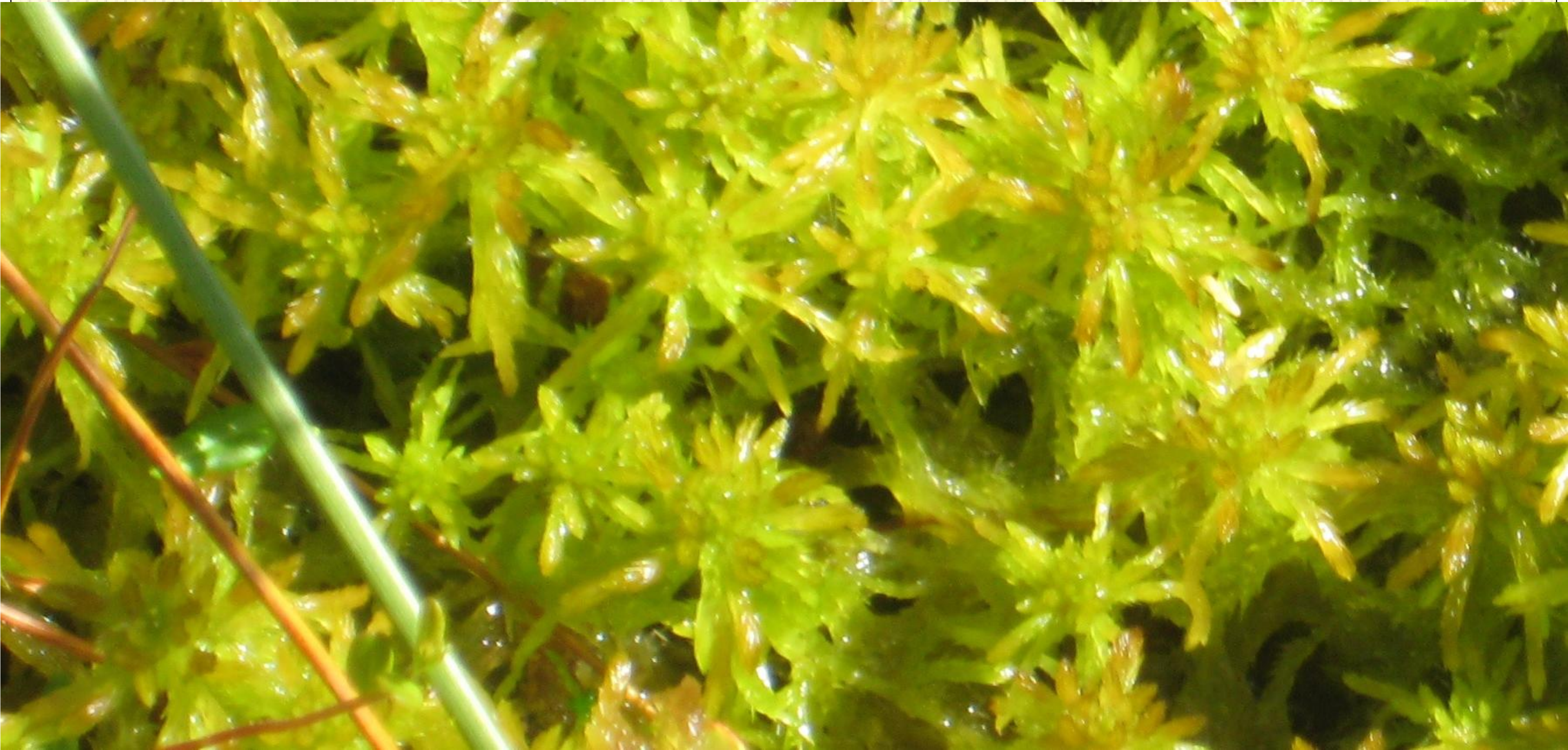
It is not sufficient to simply label a soil as "organic" without showing the organic content. Descriptions of organic material should include the origin and the botanical composition of the material to the extent that these can be reasonably inferred. The principal general kinds of peat, according to origin are:

•*sedimentary peat* consists the remains mostly of floating aquatic plants, such as algae, and the remains and fecal material of aquatic animals, including coprogenous earth;

•*moss peat* includes the remains of mosses, including sphagnum, magellanicum, angustifolium;

•*herbaceous peat* contains the remains of sedges, reeds, cattails, and other herbaceous plants;

•*woody peat* involves the remains of trees, shrubs, and other woody plants



DESCRIPTION OF IN-SITU (UNDISTURBED) CHARACTERISTICS

COARSE SOILS – description

Relative Density

Relative density refers to the "denseness", or degree of compactness of a coarse soil in the ground, and is expressed as the density index. The terms very loose through to very dense are used to describe this property. Table provides a guide for relating descriptive terms to Standard Penetration Test (SPT) N-values and Dynamic Cone Penetrometer (Scala) values.

Descriptive Term	Density Index (R_D)	SPT N-value (blows / 300 mm)	Dynamic Cone (blows / 100 mm)
Very dense	> 85	> 50	> 17
Dense	65 – 85	30 – 50	7 – 17
Medium dense	35 – 65	10 – 30	3 – 7
Loose	15 – 35	4 – 10	1 – 3
Very loose	< 15	< 4	0 – 2

Note:
- No correlation is implied between Standard Penetration Test (SPT) and Dynamic Cone Penetrometer Test values.
- The SPT "N" values are uncorrected.

Soil Strength or "Consistency"

Table provides a guide to the terms used to designate soil strength and related properties in fine soils.

Descriptive Term	Undrained Shear Strength (kPa)	Diagnostic Features
Very soft	< 12	Easily exudes between fingers when squeezed
Soft	12 – 25	Easily indented by fingers
Firm	25 – 50	Indented by strong finger pressure and can be indented by thumb pressure
Stiff	50 – 100	Cannot be indented by thumb pressure
Very stiff	100 – 200	Can be indented by thumb nail
Hard	200 – 500	Difficult to indent by thumb nail

The terms and strengths in Table match those in AS1726:1993 but not those in BS5930:1999.

Undrained shear strength can be determined using either field or laboratory tests. The most common field test in NZ is the hand held shear vane (refer NZGS, 2001).

- Soil consistence provides a means of describing the degree and kind of cohesion and adhesion between the soil particles as related to the resistance of the soil to deform or rupture.
- Since the consistence varies with moisture content, the consistence can be described as dry consistence, moist consistence, and wet consistence.
- Consistence that is evaluated includes rupture resistance and stickiness.
- The rupture resistance is a field measure of the ability of the soil to withstand an applied stress or pressure as applied using the thumb and forefinger.

  - ***Cohesion*** *is the attraction of one water molecule to another resulting from hydrogen bonding.*
  - ***Adhesion*** *is similar to cohesion except with adhesion involves the attraction of a water molecule to a non-water molecule.*

Non-Sticky

Slightly-Sticky

Very Sticky

1. Very soft Exudes between fingers when squeezed in hand
2. Soft Moulded by light finger pressure
3. Firm Can be moulded by strong finger pressure
4. Stiff Cannot be moulded by fingers Can be indented by thumb
5. Very stiff Can be indented by thumb nail
6. Hard Cannot be indented by thumb nail (not included in BS 5930:1981).

SUMBER: www.water-research.net/course/**soilconsistence.ppt**

Wet Consistence	Moist Consistence	Moist Matrix Color	Estimated Mineralogy
Very Sticky Very Plastic	Firm to Very Firm or greater	10YR 2.5Y 5Y	2:1 Smectite
Slightly Sticky to Sticky Slightly Plastic to Plastic	Friable to Firm	2.5YR or Redder (e.g. 10R, 7.5R)	1:1 Kaolinite
Sticky Plastic	Firm	5YR 7.5YR 10YR	Mixed, 1:1 and 2:1

Sensitivity

This is a measure of the loss of strength that occurs when the soil is disturbed or remoulded.

Sensitivity is defined as the ratio of the undisturbed strength to the remoulded strength as outlined in Table

Descriptive Term	Shear Strength Ratio $\frac{\text{undisturbed}}{\text{remoulded}}$
Insensitive, normal	< 2
Moderately sensitive	2 – 4
Sensitive	4 – 8
Extra sensitive	8 – 16
Quick	> 16

Structure (Applicable to Coarse and Fine Soils)

This refers to the presence or absence of bedding, or any other features such as faults, fissures, fractures, striations and slickensided surfaces as defined in Table

Term	Description
Homogeneous	The total lack of visible bedding and the same colour and appearance throughout
Bedding	The presence of layers
Fissured	Breaks along definite planes of fracture with little resistance to fracturing
Polished	Fracture planes are polished or glossy
Slickensided	Fracture planes are striated
Blocky	Cohesive soil that can be broken down into small angular lumps which resist further breakdown
Lensoidal	Discontinuous pockets of a soil within a different soil mass

Moisture Condition

Terms to describe the moisture condition of soil samples are given in Table

Condition	Description	Granular Soils	Cohesive Soils
Dry	Looks and feels dry	Run freely through hands	Hard, powdery or friable
Moist	Feels cool, darkened in colour	Tend to cohere	Weakened by moisture, but no free water on hands when remoulding
Wet			Weakened by moisture, free water forms on hands when handling
Saturated	Feels cool, darkened in colour and free water is present on the sample		

The descriptive sequence outlined in the preceeding sections seeks to place the most important items first and the least important at the end.

Examples are given in Table

Main Paragraph	Example	Item
Subordinate fraction	sandy	Soil name
Major Fraction	fine to coarse GRAVEL	
Minor fraction	with minor silt and clay	
Colour	light greyish brown	Visual characteristics
Structure	bedded	
Qualifying Paragraph		
Strength	loosely packed	Soil mass qualifications
Moisture condition	dry	
Grading	well graded	
Bedding	subhorizontal, thick	
Plasticity		
Sensitivity		
Major fraction	gravel, subangular to subrounded greywacke	Soil fraction qualifications
Weathering of clasts	slightly weathered	
Subordinate fraction	sand, fine to coarse	
Minor fraction	silt and clay, slightly plastic	
Additional structures	few fine sand lenses	Additional information
Additional information	MT JOHN OUTWASH GRAVEL	

Sandy fine to coarse GRAVEL with minor silt and clay; light greyish brown, bedded.
Loosely packed; dry; well graded; bedding, subhorizontal, thick; subangular to subrounded, slightly weathered greywacke gravel; sand, fine to coarse; silt and clay, slightly plastic; few fine sand lenses

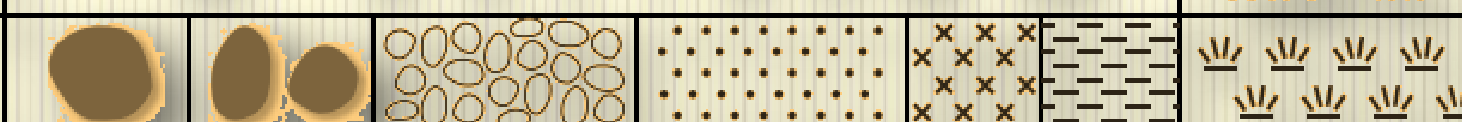
Main Paragraph	Example	Item
Subordinate fraction	clayey	Soil name
Major Fraction	SILT	
Minor fraction	trace peat	
Colour	light grey, mottled black	Visual characteristics
Structure		
Qualifying Paragraph		
Strength	firm	Soil mass qualifications
Moisture condition	moist	
Grading		
Bedding		
Plasticity	low plasticity	
Sensitivity	moderately sensitive	
Major fraction		Soil fraction qualifications
Subordinate fraction		
Minor fraction		
Additional structures		Additional information
Additional information	HINUERA FORMATION	

Clayey SILT, trace of peat; light grey, mottled black. Firm, moist, low plasticity, moderately sensitive, For engineering purposes soil is grouped as shown in Table

COARSE SOILS (granular soils or non-cohesive soils)		FINE SOILS (cohesive soils)		OTHER SOIL
Gravel	Sand	Silt	Clay	Organic Soils

Behaviour

Soil behaviour always depends to some extent on grain size and this forms a starting point for the engineering classification of soils. On this basis soils are categorised as in Table

TYPE	COARSE								FINE		ORGANIC
			Gravel			Sand					
	Boulders	Cobbles	coarse	medium	fine	coarse	medium	fine	Silt	Clay	Organic Soil
Size Range (mm)	200	60	20	6	2	0.6	0.2	0.06	0.002		Refer to Section 2.3.5
Graphic Symbol											

SAMPLE

SOILS AND GEOLOGICAL EXPLORATION LOG
HIGHWAY DIVISION

Project	Raliegh - Old Tooth Rd.	Hole No.	TB 85-1
Highway	Mountain Pass (482) MP 37 — County Kaplan	Prefix	C000-1200
Purpose of Work	Highway Realignment	Bridge No.	—
Equipment	Mobile B 53, #84-199	Tube Elev.	4216'
Geologist	G. Runyan — Driller J. Smith	Recorder	M. Jones
Hole Location	L2 Line, Sta. 488 + 25 Lt. C.L. Rt. 50'	Ground Elev.	4214'

Tests	No.	Drilling Method		Groundwater Level Date	Depth
"N" — Standard Penetration.	4	6" Hollow Stem Auger Depth	9.5'	10-10-85	9.5'
"M" — Oregon Miniature Pile.		HQWL Casing Depth		10-12-85	7.0'
"C" — Core, Barrel Type HQ	3	Drilling Fluid Open Depth	15'	10-20-85	7.0'
"U" — Undisturbed Sample, Size		WATER Total Depth	24.5'		

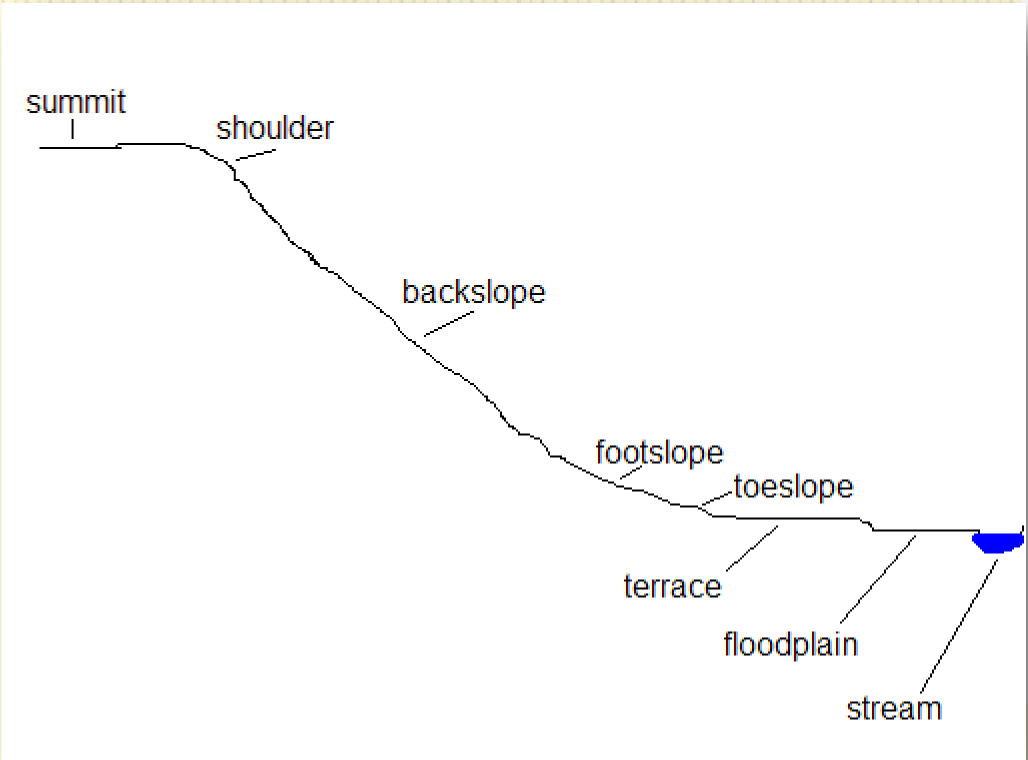
Date Started 10-7-85 — Date Completed 10-8-85 — Sample Data Sheet No.

Depth, ft.	Test Type No.	Driving Resistance	Measured Recovery	% Recovery	Hardness / R Q D	Graphic Log	% Natural Moisture	Material Description (Color, Consistency, Plasticity, Organic Content; Wet-Dry, Jointed-Broken, Angular-Rounded, Drill Remarks etc.)
								Top 3 feet of soil removed for access road. Clayey SILT, ML, Brown, Low plasticity, Moist (Decomposed Basalt).
								Advanced auger to 3.5'. Drill action smooth.
3.5	N-1	10-31-27	1.5	100			18	(N-1) 3.5-5.0' Clayey SILT with trace fine sand, ML, Brown, Low plasticity, Damp, Hard, (Decomposed Basalt).
								Advanced auger to 5.5' Drill action smooth.
5.5	N-2	12-41-22	0.8	50			28	(N-2) 5.5'-7.0' Clayey SILT with trace fine sand and trace of coarse gravel size subangular basalt fragments, ML, Brown, Low plasticity, Moist, Hard, (Decomposed Basalt).
								Advanced auger to 7.5' Ocassional drill chatter.
7.5	N-3	10-19-22	1.5	100		ML	30	(N-3) 7.5'-9.0' Clayey SILT with some fine sand and trace of fine gravel size angular basalt fragments, ML, Grey-brown, Low plasticity, Moist, Hard, (Decomposed Basalt).
						9.5'		Advanced auger to 9.5' Ocassional drill chatter.
9.5	N-4	50/0.1'	0	0		BASALT		(N-4) 9.5'-9.6' No recovery. SPT bouncing. Basalt contact at 9.5'.

Depth, ft.	Test Type No.	Driving Resistance	Measured Recovery	% Recovery	Hardness / R Q D	Graphic Log	% Natural Moisture	Material Description (Color, Consistency, Plasticity, Organic Content; Wet-Dry, Jointed-Broken, Angular-Rounded, Drill Remarks etc.)
22	C-1		2.0'	40	N/A	GW 26'		(C-1) 22'-27' 22'-26': Recovered 12" consisting of coarse gravel and two cobble sized core pieces each 4" long. Interpret material to be same as recovered in N-4.
					R0 / 100	TUFF 27'		26'-27': 12" recovery. TUFF, Yellow-brown, Predominately decomposed, Extremely soft, Massive (Little Butte Series).
27	C-2		5.0'	100	R1 / 100	AGGLOMERATE		(C-2) 27'-32' AGGLOMERATE, Blue-brown, Moderately weathered, Very soft, Massive (Little Butte Series).
32	C-3		5.0'	100	R2 / 100			(C-3) 32'-37' AGGLOMERATE, Blue-brown, Moderately weathered, Soft, Massive, (Little Butte Series).
37	C-4		5.0'	100	R3 / 100	42'		(C-4) 37'-42' AGGLOMERATE, Yellow-brown, slightly weathered, Medium hard, Massive, (Little Butte Series).
								End of hole at 42'. Hole terminated after 15 feet of core recovery. Hole was bailed upon completion. A 3/4-inch stand-pipe piezometer tube was installed to bottom of hole, slotted from 14' to 25' with a two-foot bentonite seal from 11'-13'. Backfilled above and below seal with clean coarse sand. A one-foot bentonite seal placed at collar.

a. DATE: Day, Month, Year

b. PROFILE IDENTIFICATION AND LOCATION:: Give a name or number to the profile and use a GPS to give coordinates of the site location. describe the site. (Include the datum). Give the name of the topographic quadrangle on which the site is found.



c. SLOPE POSITION: Compare site location to diagram:

d. SLOPE ANGLE AND ASPECT: Using a compass and clinometer, determine the aspect , the direction the slope is facing, in degrees and the slope angle in %.

VEGETATIVE COVER: Identify vegetation type (e.g., grassland, hardwood forest) and abundance (sparse, adequate, abundant) .

- **II. PROFILE DESCRIPTION:**

- **a. OVERALL PROFILE DEPTH: Assess the depth to the first restrictive layer, which can be a tree root, a rock or an impenetrable layer. DON'T GIVE UP TOO EASILY!**

- **b. TEMPERATURE: Use the soil thermometer to take the soil temperature in degrees Celsius. record the depth at which the temperature was taken (the tip of the thermometer).**