Engineering Characterization of Soils

Soil Properties that Control its Engineering Behavior

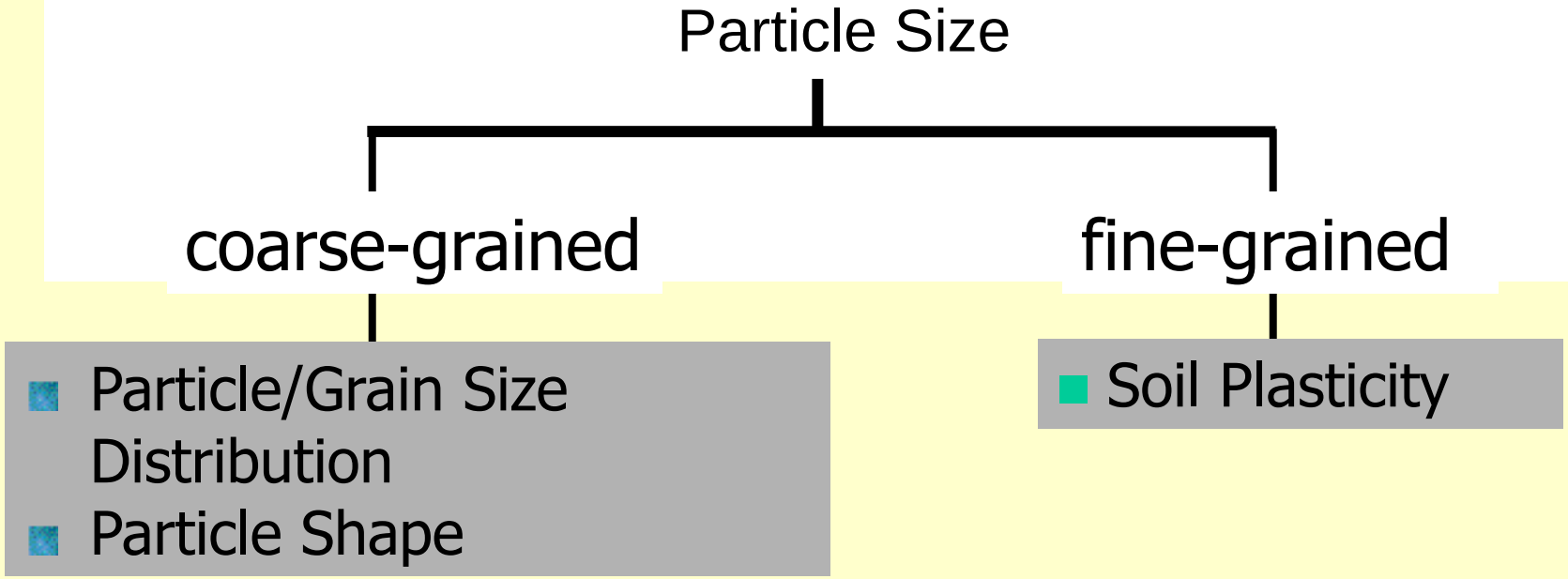
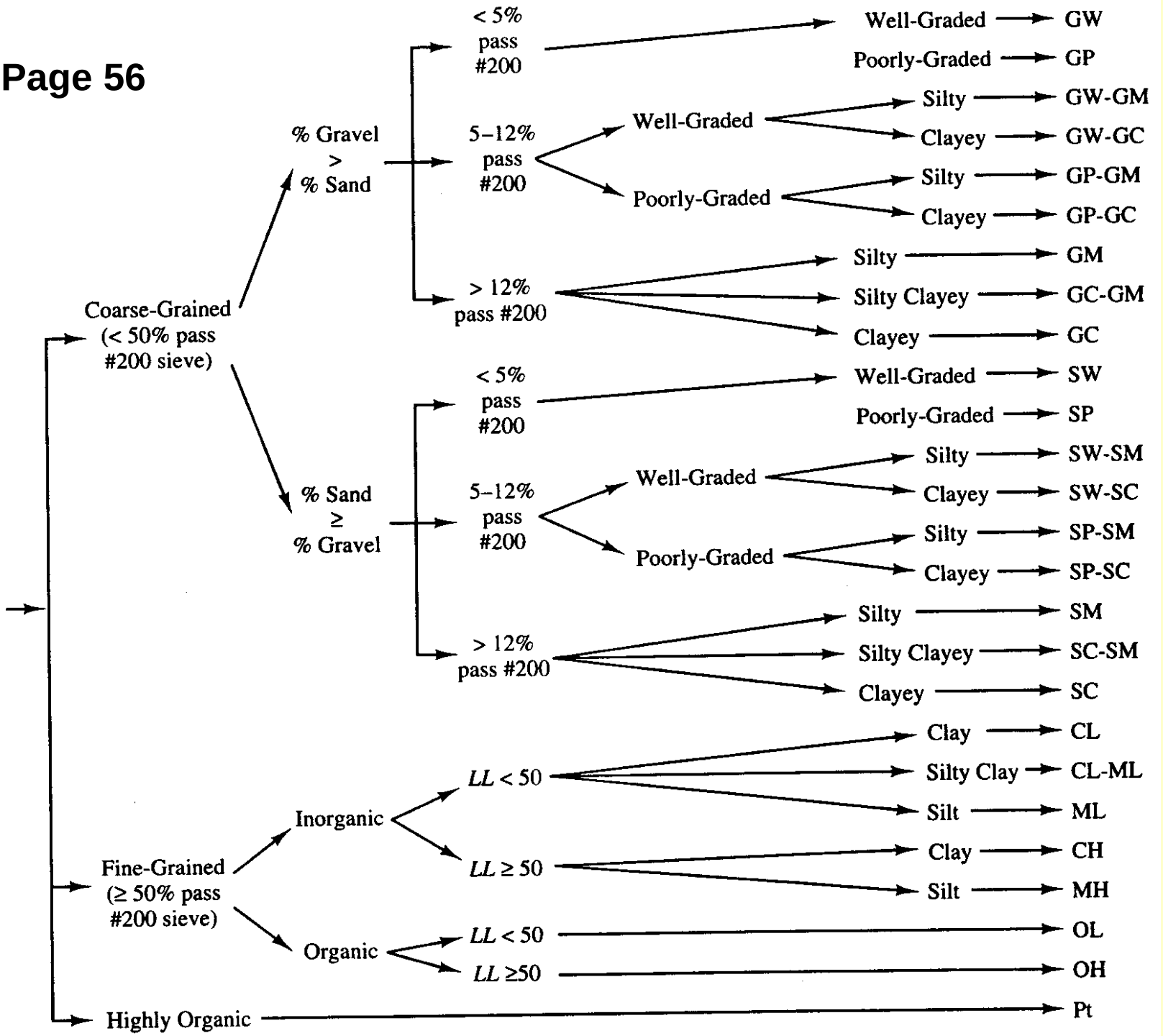


Table 1.3 Particle size distribution of soils.

Types of material		Sizes (mm)
Boulders		Over 200
Cobbles		60–200
	Coarse	20–60
Gravel	Medium	6–20
	Fine	2–6
	Coarse	0.6–2
Sand	Medium	0.2–0.6
	Fine	0.06–0.2
	Coarse	0.02–0.06
Silt	Medium	0.006–0.02
	Fine	0.002–0.006
Clay		Less than 0.002

Table 1.7 Symbols used in the Casagrande soil classification.

Main soil type		Prefix
Coarse grained soils	Gravel	G
	Sand	S
Fine grained soils	Silt	M
	Clay	C
	Organic silts and clays	O
Fibrous soils	Peat	Pt
Subdivisions		**Suffix**
For coarse grained soils	Well graded, with little or no fines	W
	Well graded with suitable clay binder	C
	Uniformly graded with little or no fines	U
	Poorly graded with little or no fines	P
	Poorly graded with appreciable fines or well graded with excess fines	F
For fine grained soils	Low compressibility (plasticity)	L
	Medium compressibility (plasticity)	I
	High compressibility (plasticity)	H


Coarse-Grained (< 50% pass #200 sieve)
% Gravel > % Sand
< 5% pass #200
Well-Graded
GW
Poorly-Graded
GP
5–12% pass #200
Well-Graded
Silty
GW-GM
Clayey
GW-GC
Poorly-Graded
Silty
GP-GM
Clayey
GP-GC
> 12% pass #200
Silty
GM
Silty Clayey
GC-GM
Clayey
GC
% Sand ≥ % Gravel
< 5% pass #200
Well-Graded
SW
Poorly-Graded
SP
5–12% pass #200
Well-Graded
Silty
SW-SM
Clayey
SW-SC
Poorly-Graded
Silty
SP-SM
Clayey
SP-SC
> 12% pass #200
Silty
SM
Silty Clayey
SC-SM
Clayey
SC
Fine-Grained (≥ 50% pass #200 sieve)
Inorganic
LL < 50
Clay
CL
Silty Clay
CL-ML
Silt
ML
LL ≥ 50
Clay
CH
Silt
MH
Organic
LL < 50
OL
LL ≥50
OH
Highly Organic
Pt

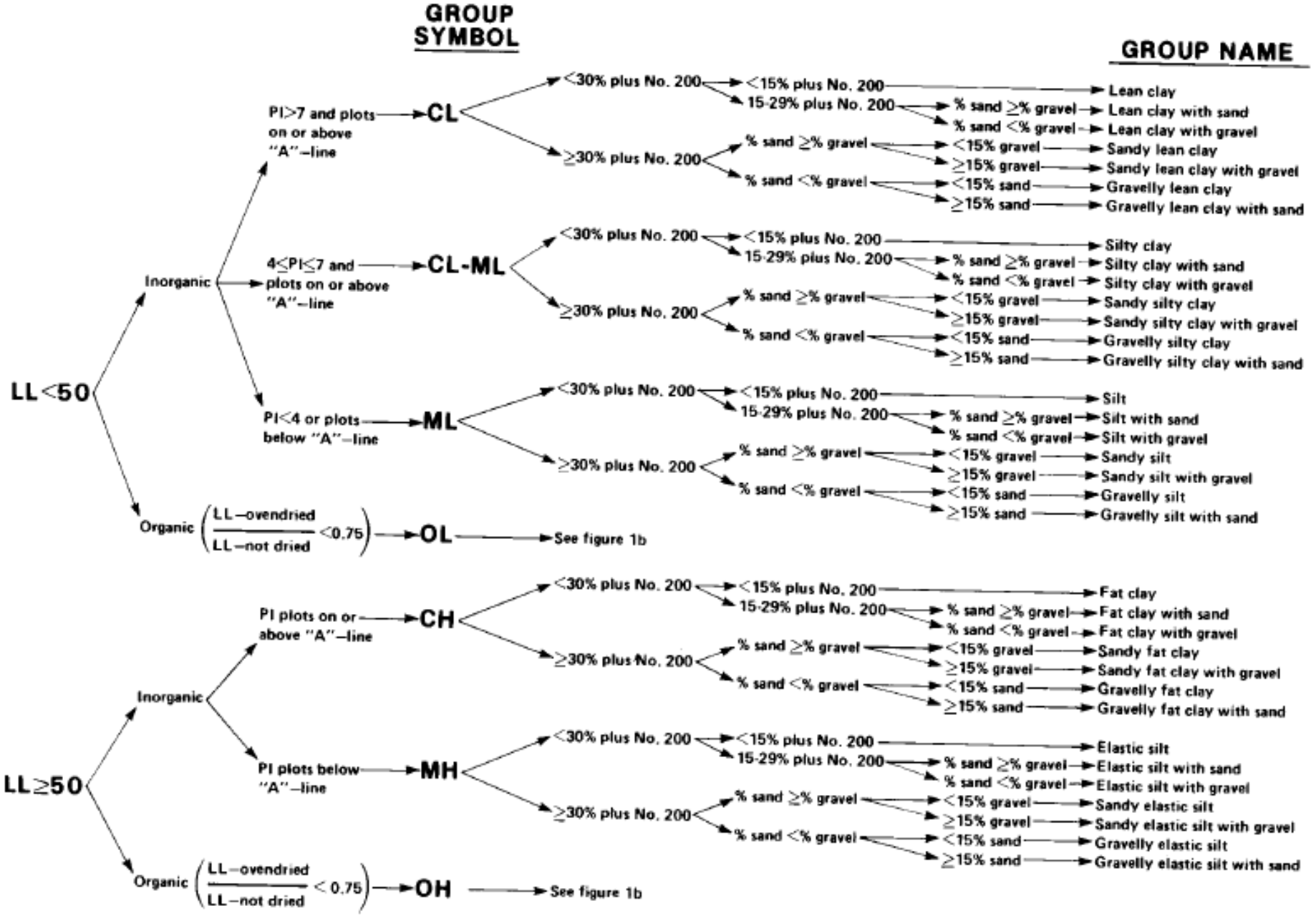


FIG. 1 Flow Chart for Classifying Fine-Grained Soil (50 % or More Passes No. 200 Sieve)

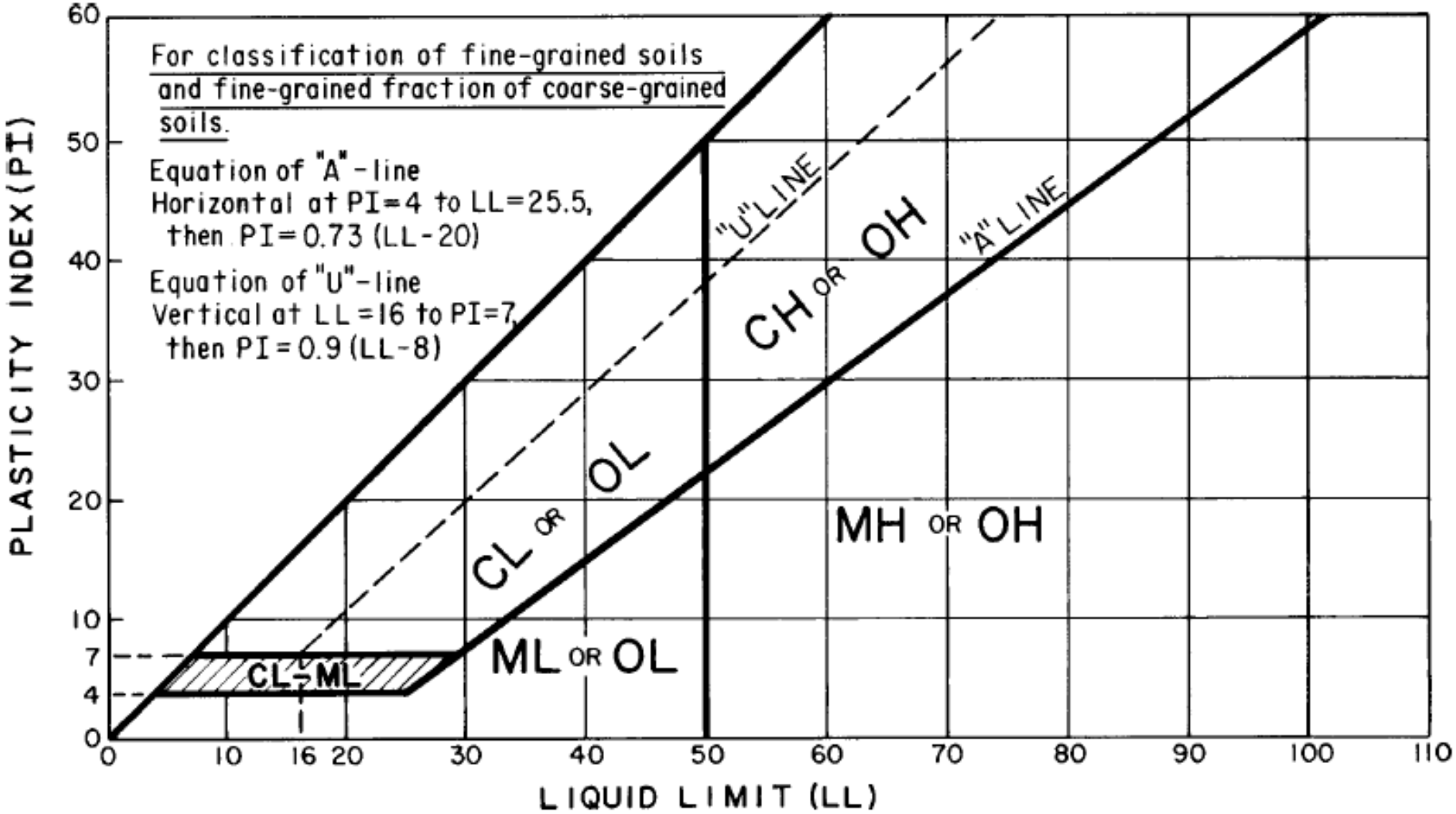


FIG. 4 Plasticity Chart

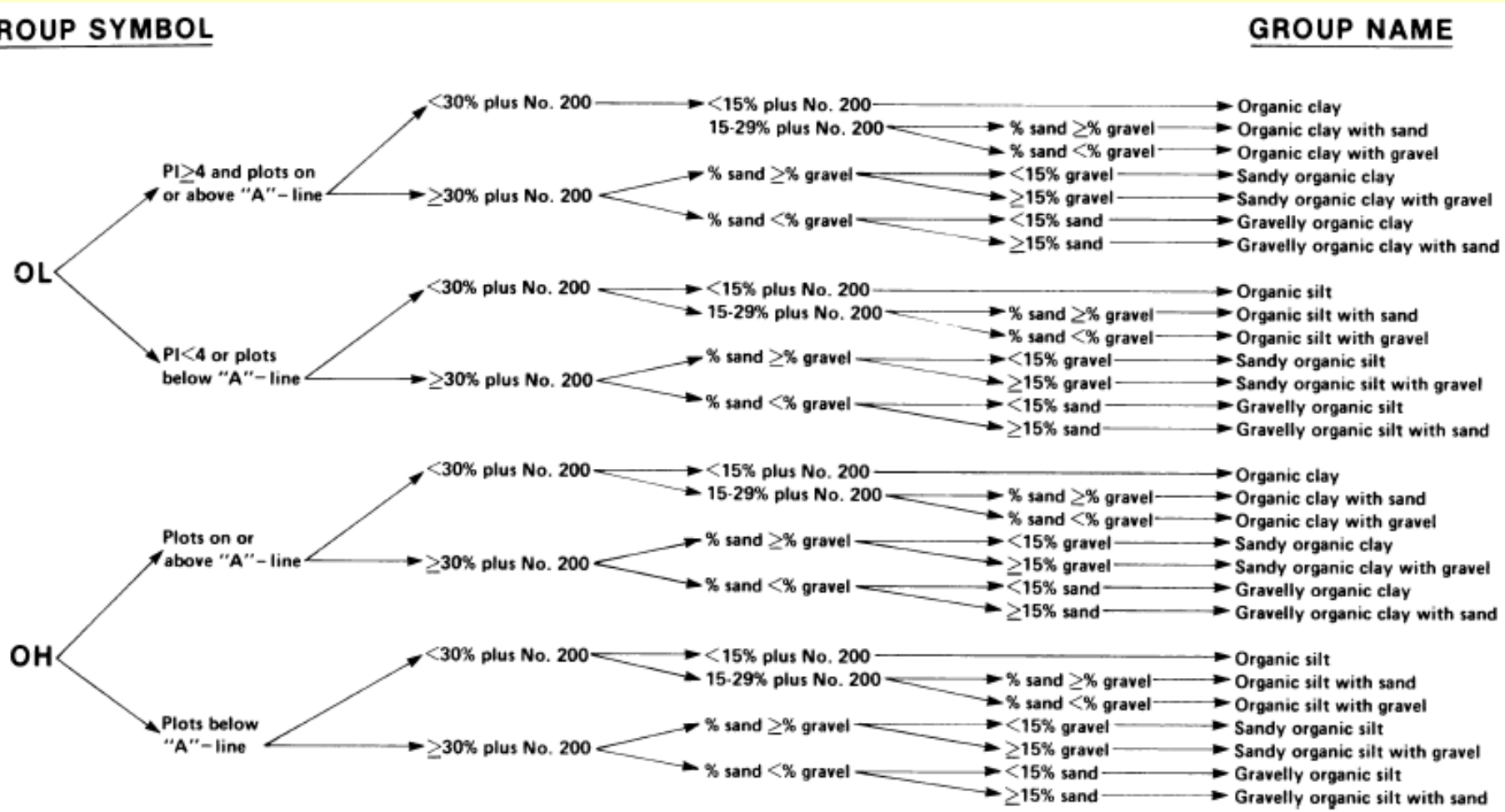


FIG. 2 Flow Chart for Classifying Organic Fine-Grained Soil (50 % or More Passes No. 200 Sieve)

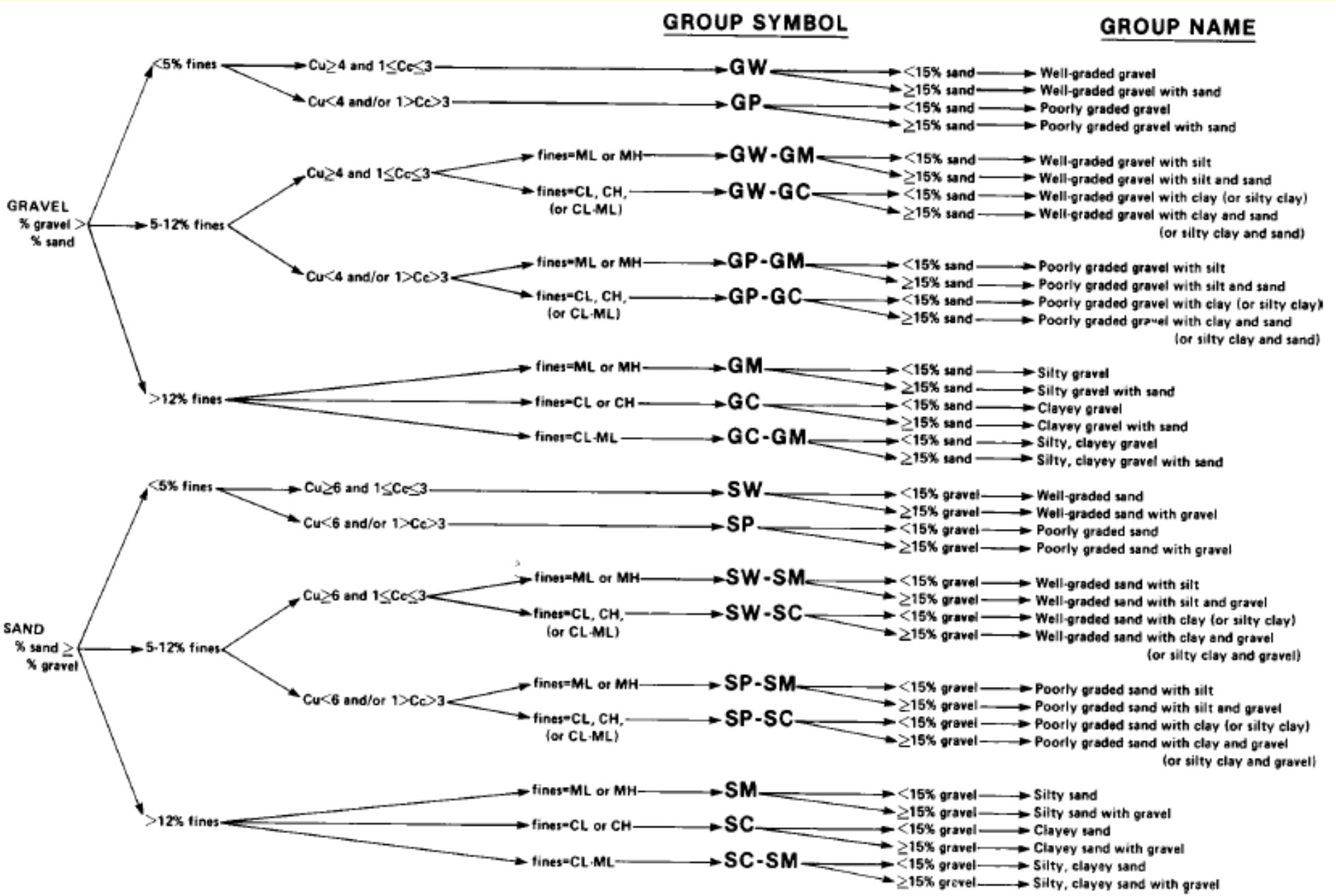


FIG. 3 Flow Chart for Classifying Coarse-Grained Soils (More Than 50 % Retained on No. 200 Sieve)

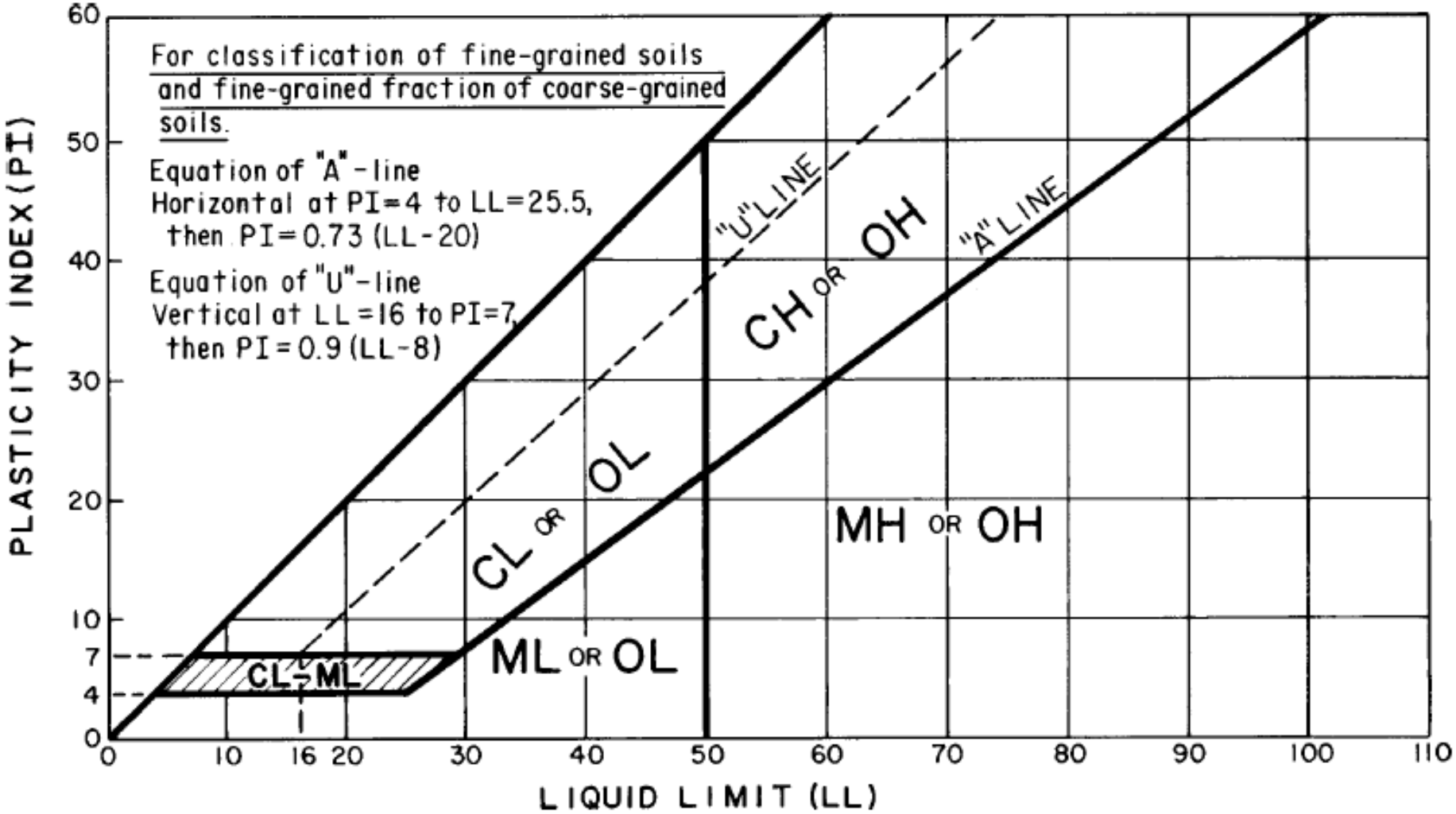
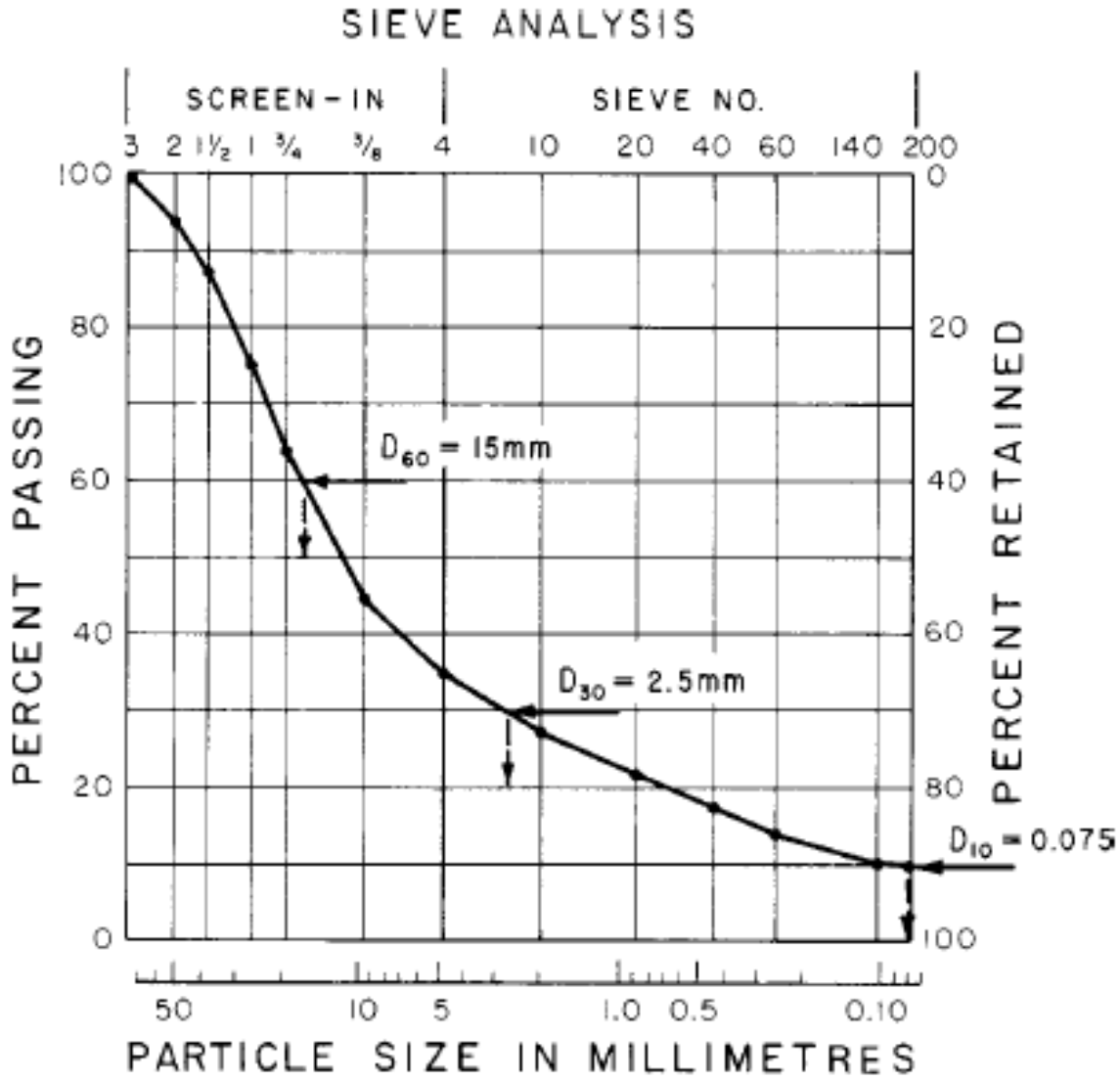


FIG. 4 Plasticity Chart



$$Cu = \frac{D_{60}}{D_{10}} = \frac{15}{0.075} = 200 \qquad Cc = \frac{(D_{30})^2}{D_{10} \times D_{60}} = \frac{(2.5)^2}{0.075 \times 15} = 5.6$$

FIG. 5 Cumulative Particle-Size Plot