Unified Soil Classification System

Criteria for assigning group symbols				Group symbol
Coarse-grained soils More than 50% of retained on No. 200 sieve	**Gravels** More than 50% of coarse fraction retained on No. 4 sieve	Clean Gravels Less than 5% fines[a]	$C_u \geq 4$ and $1 \leq C_c \leq 3^c$	GW
			$C_u < 4$ and/or $C_c < 1$ or $C_c > 3^c$	GP
		Gravels with Fines More than 12% fines[a,d]	$PI < 4$ or plots below "A" line (Figure 5.3)	GM
			$PI > 7$ and plots on or above "A" line (Figure 5.3)	GC
	Sands 50% or more of coarse fraction passes No. 4 sieve	Clean Sands Less than 5% fines[b]	$C_u \geq 6$ and $1 \leq C_c \leq 3^c$	SW
			$C_u < 6$ and/or $C_c < 1$ or $C_c > 3^c$	SP
		Sands with Fines More than 12% fines[b,d]	$PI < 4$ or plots below "A" line (Figure 5.3)	SM
			$PI > 7$ and plots on or above "A" line (Figure 5.3)	SC
Fine-grained soils 50% or more passes No. 200 sieve	**Silts and clays** Liquid limit less than 50	Inorganic	$PI > 7$ and plots on or above "A" line (Figure 5.3)[e]	CL
			$PI < 4$ or plots below "A" line (Figure 5.3)[e]	ML
		Organic	$\frac{\text{Liquid limit—oven dried}}{\text{Liquid limit—not dried}} < 0.75$; see Figure 5.3; OL zone	OL
	Silts and clays Liquid limit 50 or more	Inorganic	PI plots on or above "A" line (Figure 5.3)	CH
			PI plots below "A" line (Figure 5.3)	MH
		Organic	$\frac{\text{Liquid limit—oven dried}}{\text{Liquid limit—not dried}} < 0.75$; see Figure 5.3; OH zone	OH
Highly organic soils	Primarily organic matter, dark in color, and organic odor			Pt

[a] Gravels with 5 to 12% fine require dual symbols: GW-GM, GW-GC, GP-GM, GP-GC.

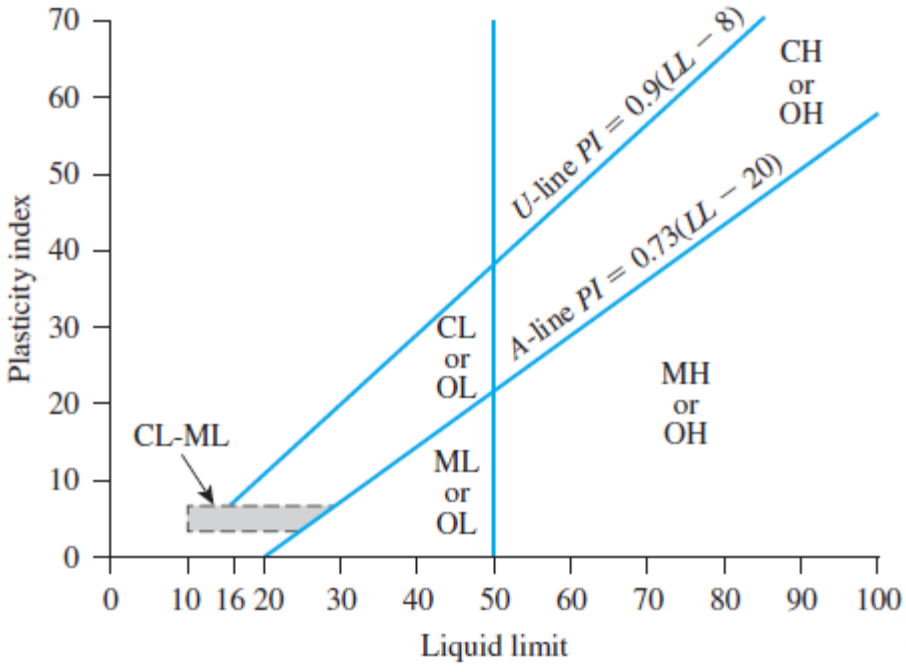
[b] Sands with 5 to 12% fines require dual symbols: SW-SM, SW-SC, SP-SM, SP-SC.

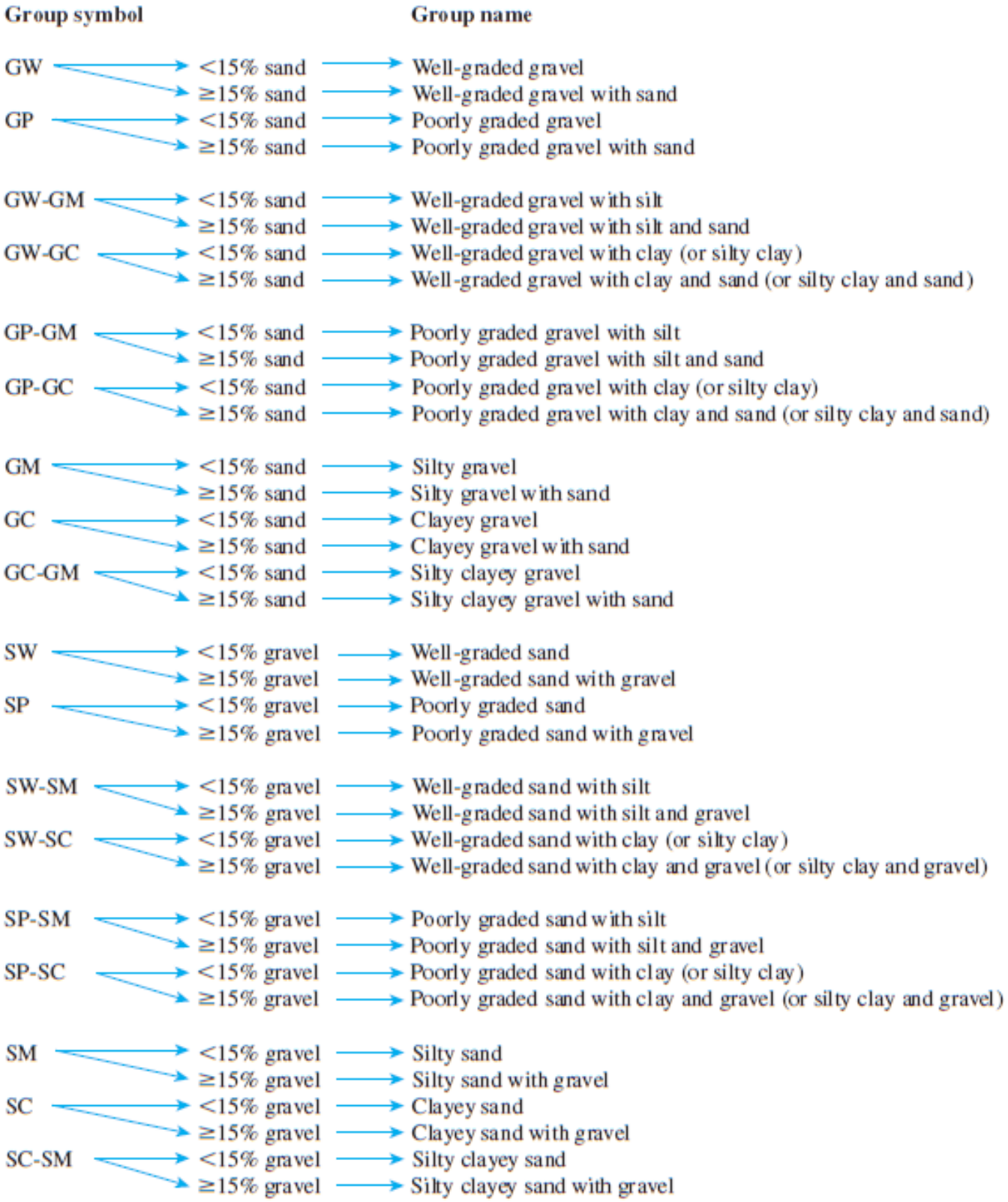
[c] $C_u = \frac{D_{60}}{D_{10}}; \quad C_c = \frac{(D_{30})^2}{D_{60} \times D_{10}}$

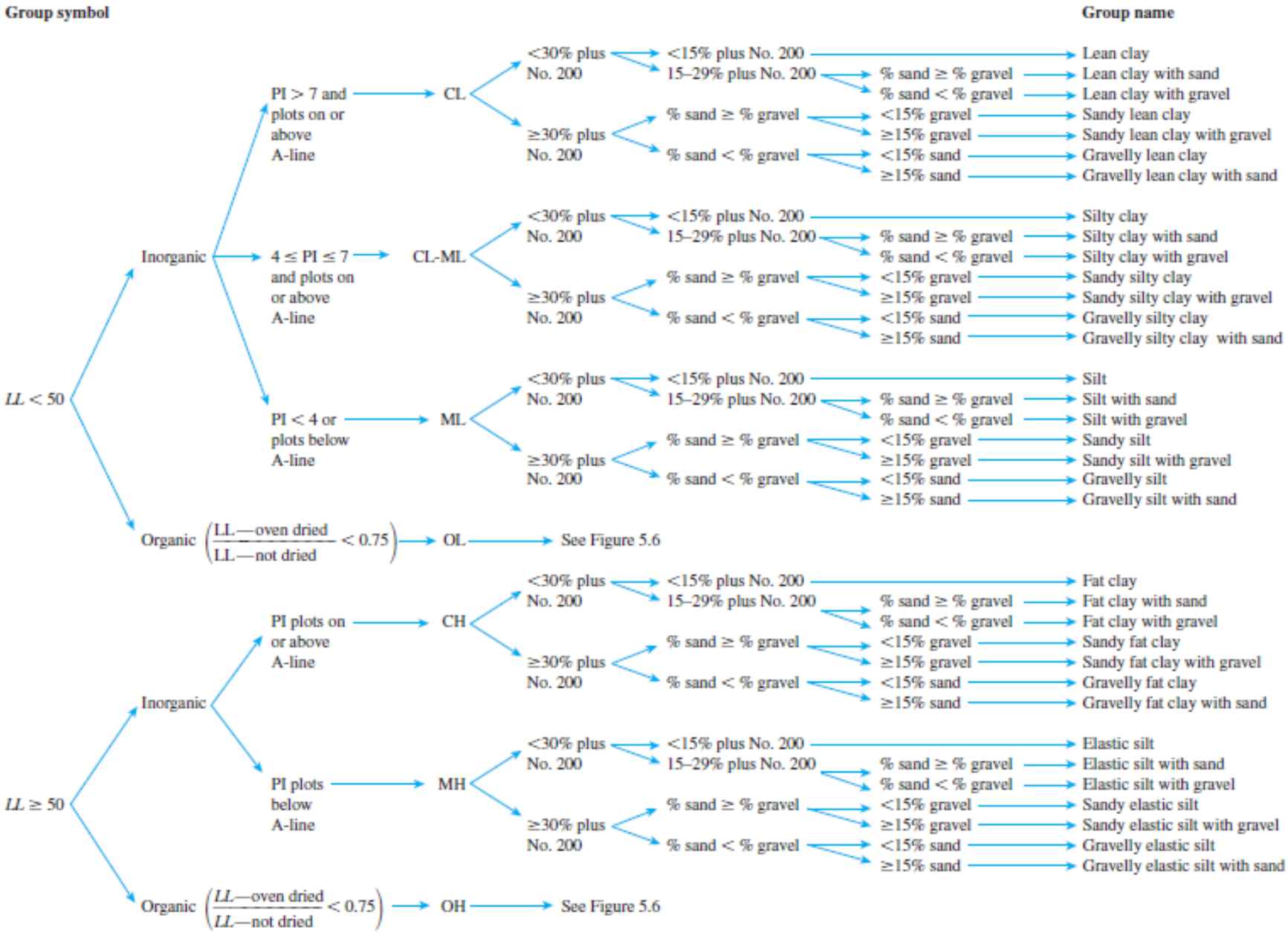
[d] If $4 \leq PI \leq 7$ and plots in the hatched area in Figure 5.3, use dual symbol GC-GM or SC-SM.

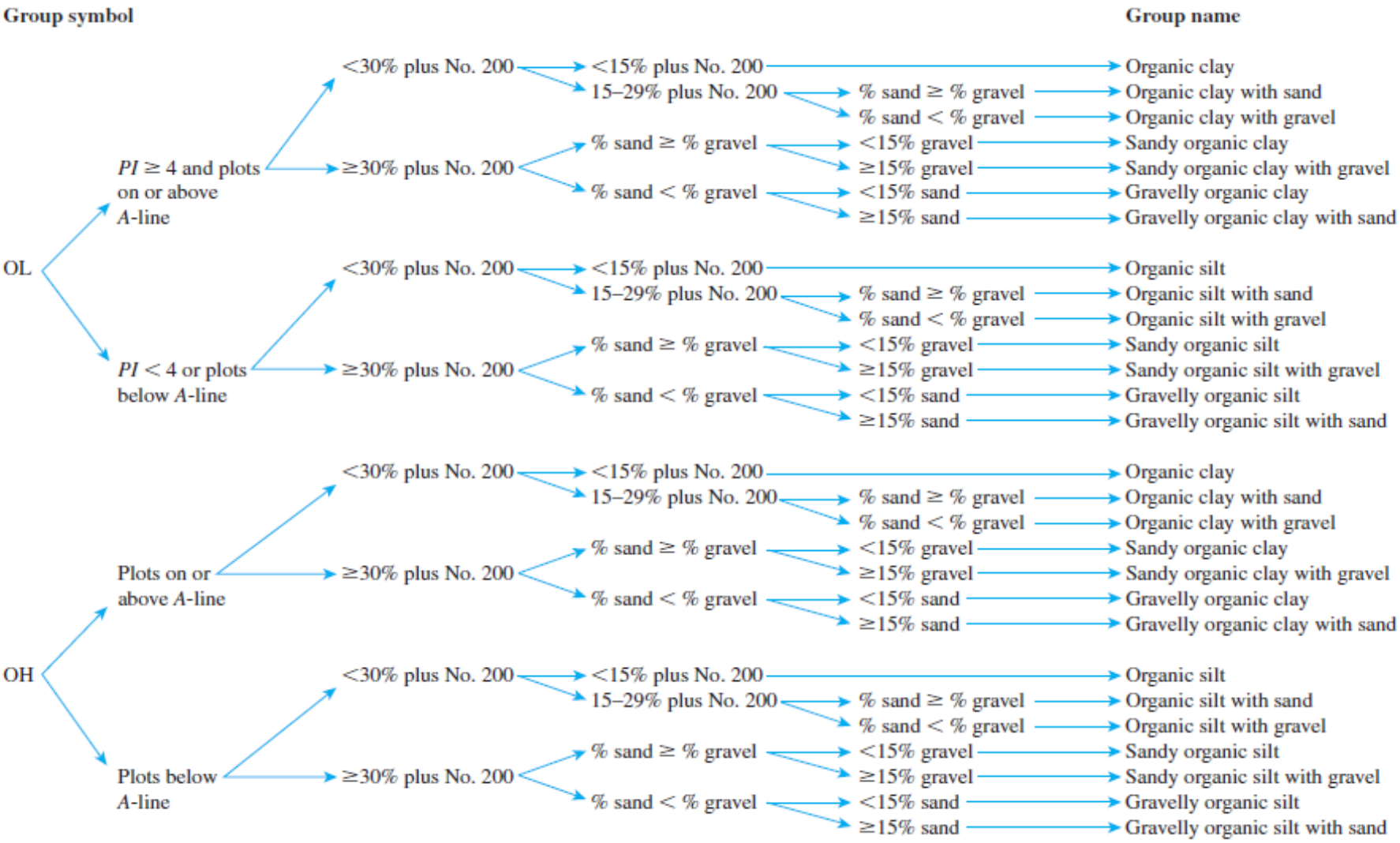
[e] If $4 \leq PI \leq 7$ and plots in the hatched area in Figure 5.3, use dual symbol CL-ML.

Plasticity chart




Group symbol
Group name
GW
<15% sand
Well-graded gravel
≥15% sand
Well-graded gravel with sand
GP
<15% sand
Poorly graded gravel
≥15% sand
Poorly graded gravel with sand
GW-GM
<15% sand
Well-graded gravel with silt
≥15% sand
Well-graded gravel with silt and sand
GW-GC
<15% sand
Well-graded gravel with clay (or silty clay)
≥15% sand
Well-graded gravel with clay and sand (or silty clay and sand)
GP-GM
<15% sand
Poorly graded gravel with silt
≥15% sand
Poorly graded gravel with silt and sand
GP-GC
<15% sand
Poorly graded gravel with clay (or silty clay)
≥15% sand
Poorly graded gravel with clay and sand (or silty clay and sand)
GM
<15% sand
Silty gravel
≥15% sand
Silty gravel with sand
GC
<15% sand
Clayey gravel
≥15% sand
Clayey gravel with sand
GC-GM
<15% sand
Silty clayey gravel
≥15% sand
Silty clayey gravel with sand
SW
<15% gravel
Well-graded sand
≥15% gravel
Well-graded sand with gravel
SP
<15% gravel
Poorly graded sand
≥15% gravel
Poorly graded sand with gravel
SW-SM
<15% gravel
Well-graded sand with silt
≥15% gravel
Well-graded sand with silt and gravel
SW-SC
<15% gravel
Well-graded sand with clay (or silty clay)
≥15% gravel
Well-graded sand with clay and gravel (or silty clay and gravel)
SP-SM
<15% gravel
Poorly graded sand with silt
≥15% gravel
Poorly graded sand with silt and gravel
SP-SC
<15% gravel
Poorly graded sand with clay (or silty clay)
≥15% gravel
Poorly graded sand with clay and gravel (or silty clay and gravel)
SM
<15% gravel
Silty sand
≥15% gravel
Silty sand with gravel
SC
<15% gravel
Clayey sand
≥15% gravel
Clayey sand with gravel
SC-SM
<15% gravel
Silty clayey sand
≥15% gravel
Silty clayey sand with gravel


Group symbol
Group name
LL < 50
Inorganic
PI > 7 and plots on or above A-line
CL
<30% plus No. 200
<15% plus No. 200
Lean clay
15–29% plus No. 200
% sand ≥ % gravel
Lean clay with sand
% sand < % gravel
Lean clay with gravel
≥30% plus No. 200
% sand ≥ % gravel
<15% gravel
Sandy lean clay
≥15% gravel
Sandy lean clay with gravel
% sand < % gravel
<15% sand
Gravelly lean clay
≥15% sand
Gravelly lean clay with sand
4 ≤ PI ≤ 7 and plots on or above A-line
CL-ML
<30% plus No. 200
<15% plus No. 200
Silty clay
15–29% plus No. 200
% sand ≥ % gravel
Silty clay with sand
% sand < % gravel
Silty clay with gravel
≥30% plus No. 200
% sand ≥ % gravel
<15% gravel
Sandy silty clay
≥15% gravel
Sandy silty clay with gravel
% sand < % gravel
<15% sand
Gravelly silty clay
≥15% sand
Gravelly silty clay with sand
PI < 4 or plots below A-line
ML
<30% plus No. 200
<15% plus No. 200
Silt
15–29% plus No. 200
% sand ≥ % gravel
Silt with sand
% sand < % gravel
Silt with gravel
≥30% plus No. 200
% sand ≥ % gravel
<15% gravel
Sandy silt
≥15% gravel
Sandy silt with gravel
% sand < % gravel
<15% sand
Gravelly silt
≥15% sand
Gravelly silt with sand
Organic (LL—oven dried / LL—not dried < 0.75)
OL
See Figure 5.6
LL ≥ 50
Inorganic
PI plots on or above A-line
CH
<30% plus No. 200
<15% plus No. 200
Fat clay
15–29% plus No. 200
% sand ≥ % gravel
Fat clay with sand
% sand < % gravel
Fat clay with gravel
≥30% plus No. 200
% sand ≥ % gravel
<15% gravel
Sandy fat clay
≥15% gravel
Sandy fat clay with gravel
% sand < % gravel
<15% sand
Gravelly fat clay
≥15% sand
Gravelly fat clay with sand
PI plots below A-line
MH
<30% plus No. 200
<15% plus No. 200
Elastic silt
15–29% plus No. 200
% sand ≥ % gravel
Elastic silt with sand
% sand < % gravel
Elastic silt with gravel
≥30% plus No. 200
% sand ≥ % gravel
<15% gravel
Sandy elastic silt
≥15% gravel
Sandy elastic silt with gravel
% sand < % gravel
<15% sand
Gravelly elastic silt
≥15% sand
Gravelly elastic silt with sand
Organic (LL—oven dried / LL—not dried < 0.75)
OH
See Figure 5.6


Group symbol
Group name
OL
OH
PI ≥ 4 and plots on or above A-line
PI < 4 or plots below A-line
Plots on or above A-line
Plots below A-line
<30% plus No. 200
≥30% plus No. 200
<15% plus No. 200
15–29% plus No. 200
% sand ≥ % gravel
% sand < % gravel
<15% gravel
≥15% gravel
<15% sand
≥15% sand
Organic clay
Organic clay with sand
Organic clay with gravel
Sandy organic clay
Sandy organic clay with gravel
Gravelly organic clay
Gravelly organic clay with sand
Organic silt
Organic silt with sand
Organic silt with gravel
Sandy organic silt
Sandy organic silt with gravel
Gravelly organic silt
Gravelly organic silt with sand