

Soil Classification

Engineering Soil Classification

แบ่งตามการใช้งานด้านวิศวกรรม มีหลายระบบ เช่น
ASTM, U.S. Bureau, Atterberg, M.I.T, Unified, AASHTO, CAA, USDA

แต่ที่นิยมใช้มี 2 ระบบ คือ

1. Unified Soil Classification System (USCS)
2. American Association of State Highway and Transportation Officials (AASHTO)

GERD

จัดทำโดย เชิดพันธุ์ อมรกุล
นิสิตวิศวกรรมปฐพี ม.เกษตรศาสตร์

UNIFIED SOIL CLASSIFICATION SYSTEM , USCS

Soil Sample

Run sieve analysis

ดินเม็ดหยาบ

ดินเม็ดละเอียด

<50% pass #200

>50% pass #200

>50% of coarse
fraction
retained on #4

<50% of coarse
fraction
retained on #4

Use
Plasticity chart

Gravel , G

Sand , S

Silt(M), Organic(O),
or Clay(C)

Coarse Grained Soil

Gravel , G
Sand , S

<5 % pass #200

Use gradation curve
to designate.

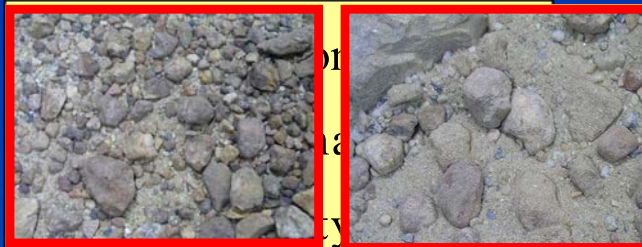
$C_u > 4$, $C_c = 1-3$
 $C_u > 6$ (sand)

GW SW

$C_u > 4$, $C_c \neq 1-3$
 $C_u < 6$ (sand)

GP SP

5-12 % pass #200



GW

GM



GP-GM

SP-SM

>12 % pass #200

Use Plasticity Chart
to designate.

เหนียว

A-Line

GC SC

ไฉ่

A-Line

GM SM

Fine Grained Soil

Silt(M) , Clay(C)

$w_L < 50\%$

$I_P = 4-7\%$

CL-ML

$w_L > 50\%$

MH CH

$w_L < 50\%$

ML CL

Organic(O)

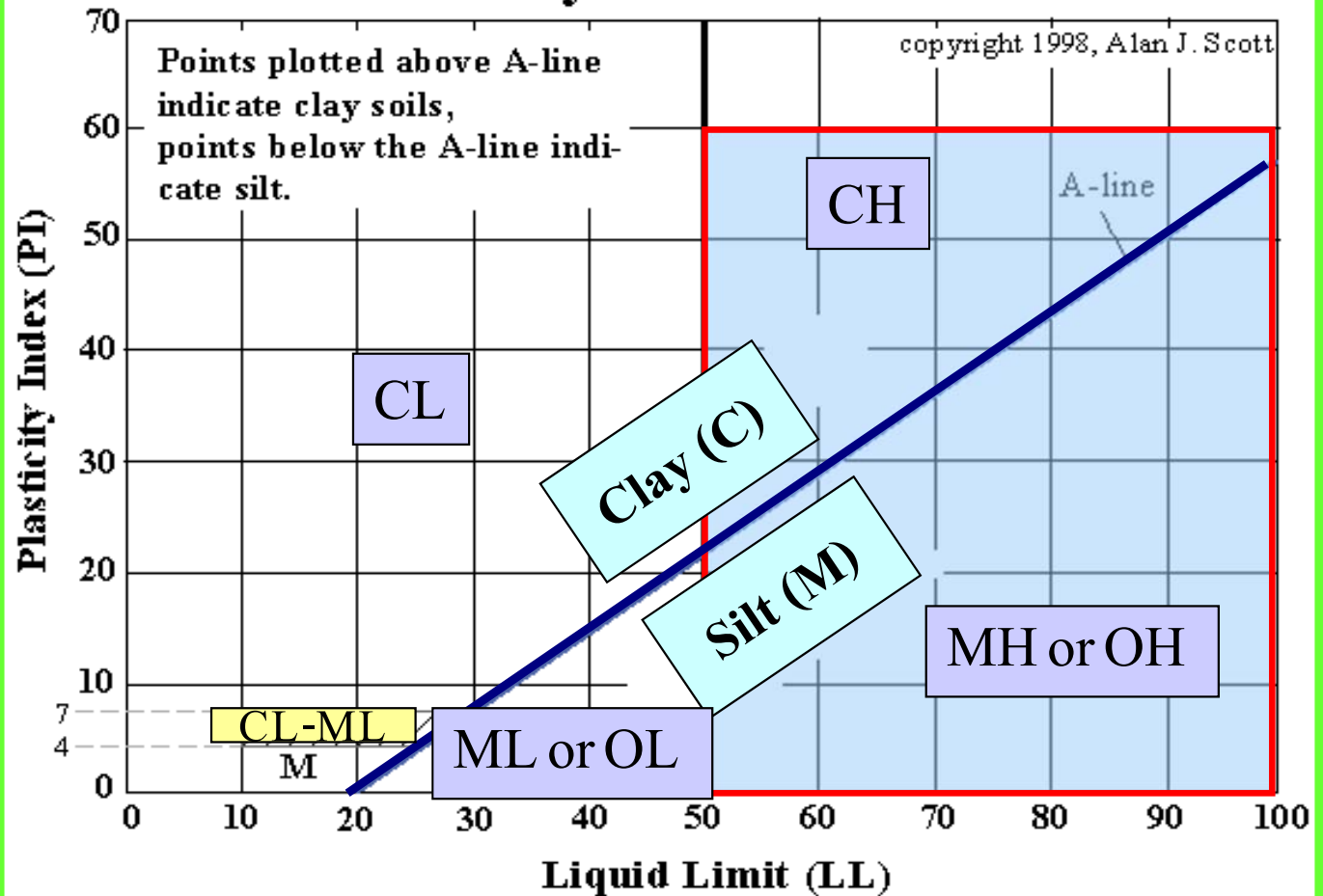
$w_L > 50\%$

OH

$w_L < 50\%$

OL

Plasticity Chart for USCS



UNIFIED SOIL CLASSIFICATION SYSTEM , USCS



GW



SW



GW-GM



GW-GC



MH



ML



GP



SP



GP-GM



GP-GC



CH



CL



GC



SC



SW-SM



SW-SC



OH



OL



GC



SC



SP-SM



SP-SC

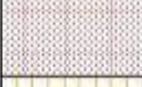
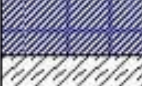


CL-ML

Unified Soil Classification System

Adapted from Basic Soils Engineering

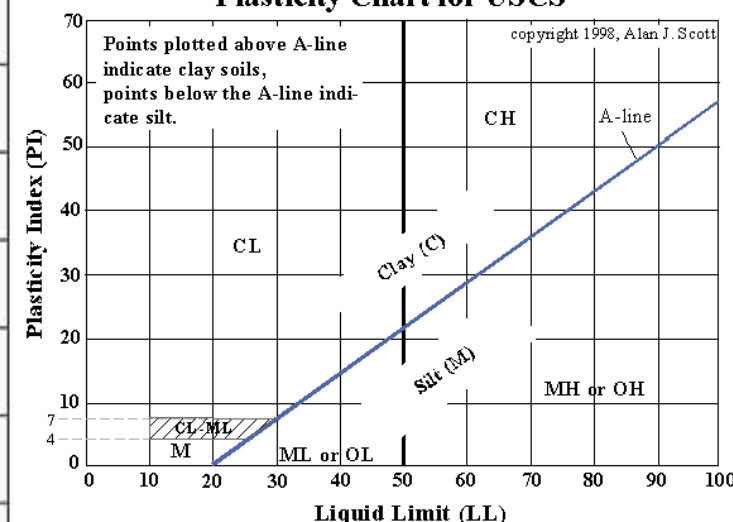
B.K. Hough copyright 1957 The Ronald Press Company

Major Divisions			Pattern	Code	Description
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS (little or no fines)		GW	Well-graded gravels or gravel-sand mixtures, little or no fines
				GP	Poorly graded gravels or gravel-sand mixtures, little or no fines
				GM	Silty gravels, gravel-sand-silt mixtures
				GC	Clayey gravels, gravel-sand-clay mixtures
	SAND AND SANDY SOILS	CLEAN SANDS (little or no fines)		SW	Well-graded sands or gravelly sands, little or no fines
				SP	Poorly graded sands or gravelly sands, little or no fines
				SM	Silty sands, sand-silt mixtures
				SC	Clayey sands, sand-clay mixtures
FINE GRAINED SOILS	SILTS AND CLAYS	Liquid limit less than 50		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, or clayey silts with slight plasticity
				CL	Inorganic clays of low to medium plasticity
				OL	Organic silts and organic silt-clays of low plasticity
				MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
		Liquid limit greater than 50		CH	Inorganic clays of high plasticity, fat clays
			OH	Organic clays of medium to high plasticity, organic silts	
				PT	Peat and other highly organic soils
	HIGHLY	ORGANIC	SOILS		

Unified Soil Classification

Coarse-grained Soils	Gravels	Clean Gravels Dirty Gravels
	Sands	Clean Sand Dirty Sand
Fine-grained Soils	Silts Non-plastic	
	Clays Plastic	
Predominantly Organics		

Plasticity Chart for USCS



American Association of State Highway Transportation Officials System (AASHTO)

รายละเอียดการจำแนกดินระบบ AAHSO Classification

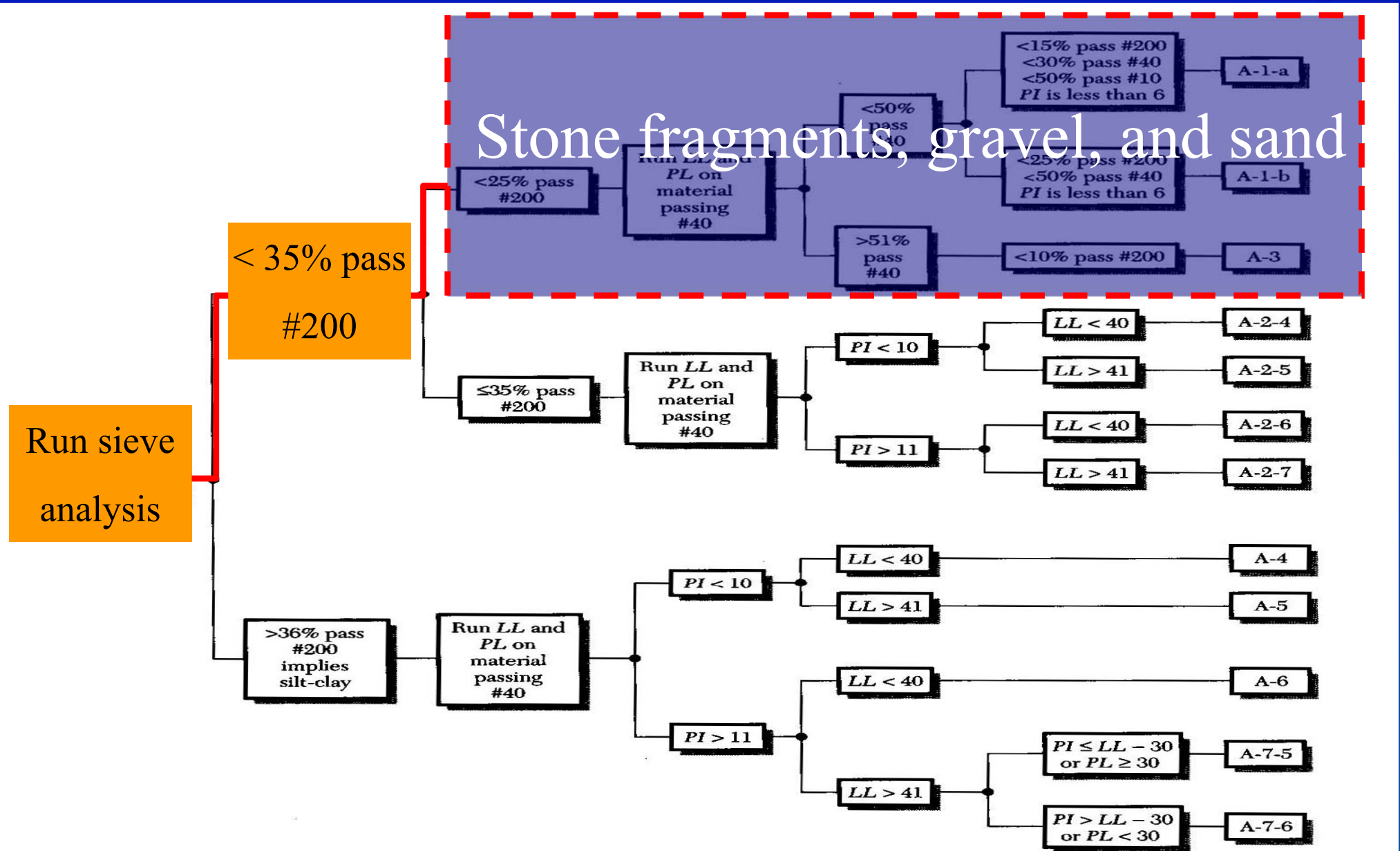
coarse

Fine

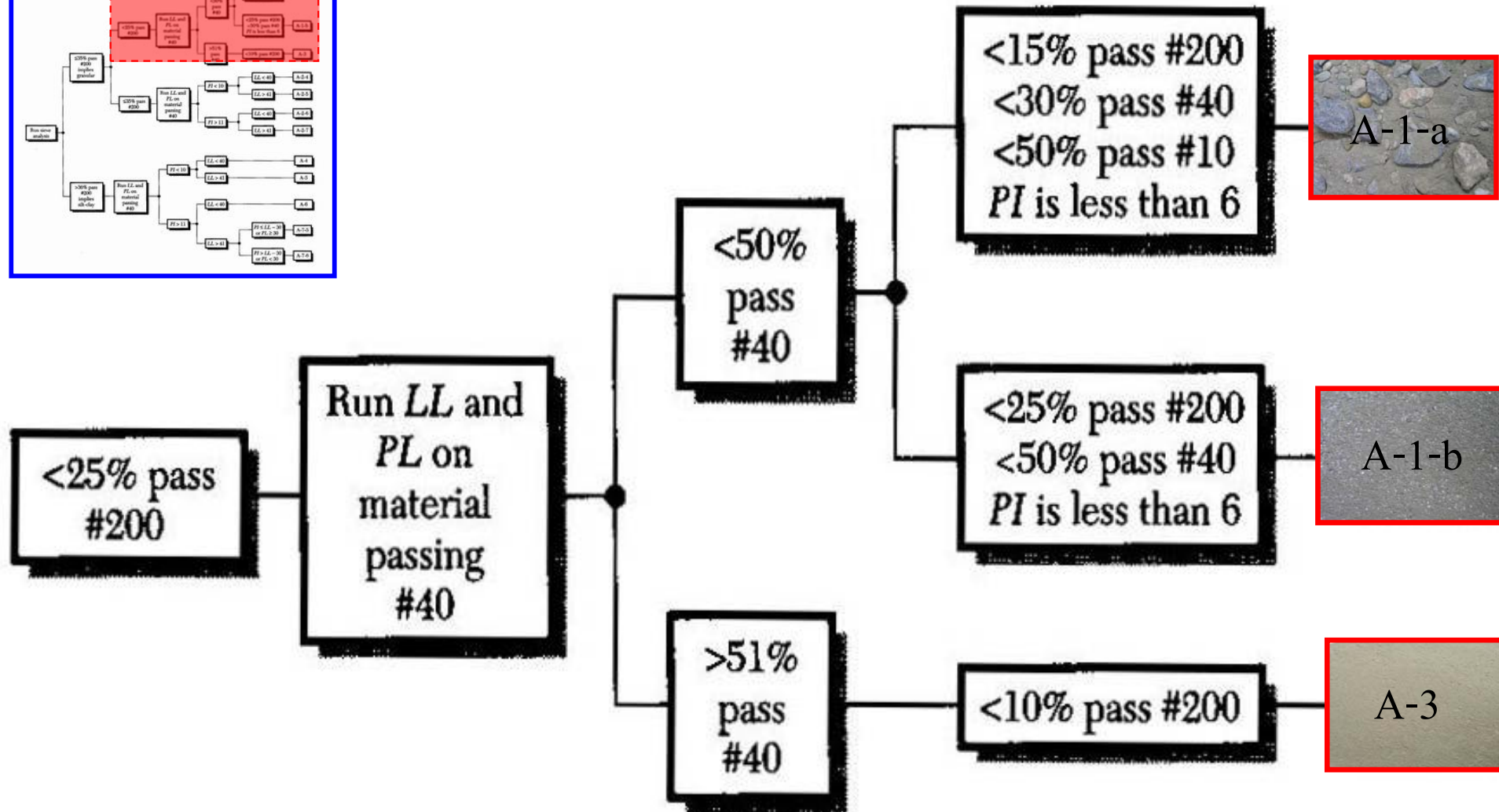
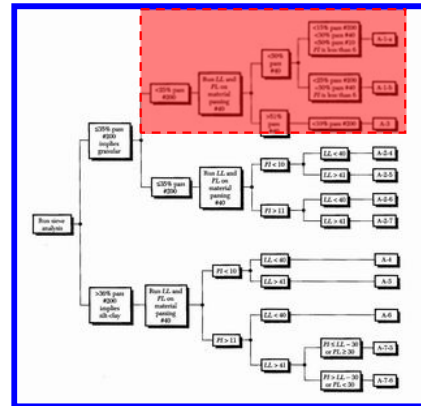
General classification	Granular Materials (35% or Less Passing No. 200)							Silt-Clay Materials (More than 35% Passing No. 200)			
Group classification	A-1		A-3	A-2				A-4	A-5	A-6	A-7
	A-1-a	A-1-b		A-2-4	A-2-5	A-2-6	A-2-7				A-7-5, A-7-6
Sieve analysis, percent passing:											
No. 10	50 max	—	—	—	—	—	—	—	—	—	—
No. 40	30 max.	50 max.	51 min.	—	—	—	—	—	—	—	—
No. 200	15 max.	25 max.	10 max.	35 max.	35 max.	35 max.	35 max.	36 min.	36 min.	36 min.	36 min.
Characteristics of fraction passing No. 40:											
Liquid limit	—	—	—	40 max.	41 min.	40 max.	41 min.	40 max.	41 min.	40 max.	41 min.
Plasticity index	6 max.	—	N.P.	10 max.	10 max.	11 min.	11 min.	10 max.	10 max.	11 min.	11 min.*
Usual types of significant constituent materials	Stone fragments, gravel and sand		Fine sand	Silty or clayey gravel and sand				Silty soils		Clayey soils	
General rating as subgrade	Excellent to good							Fair to poor			

*Plasticity index of A-7-5 subgroup is equal to or less than L.L. minus 30. Plasticity index of A-7-6 subgroup is greater than L.L. minus 30.

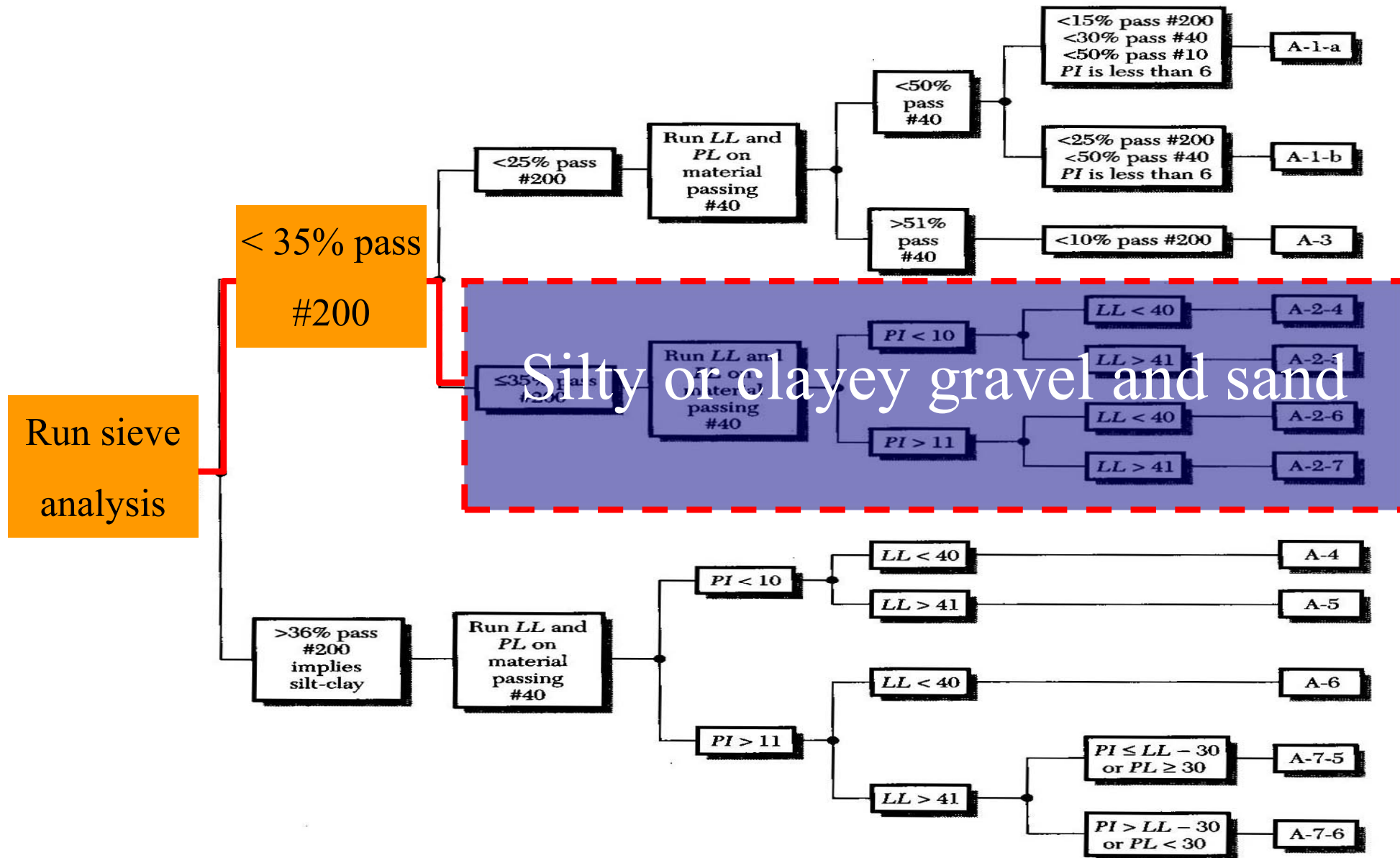
การจำแนกดินตามระบบ AASHTO



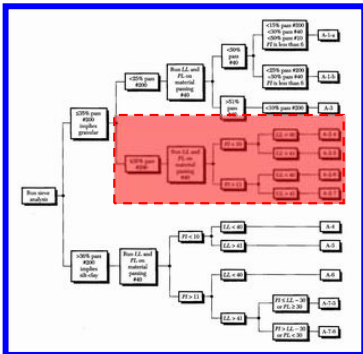
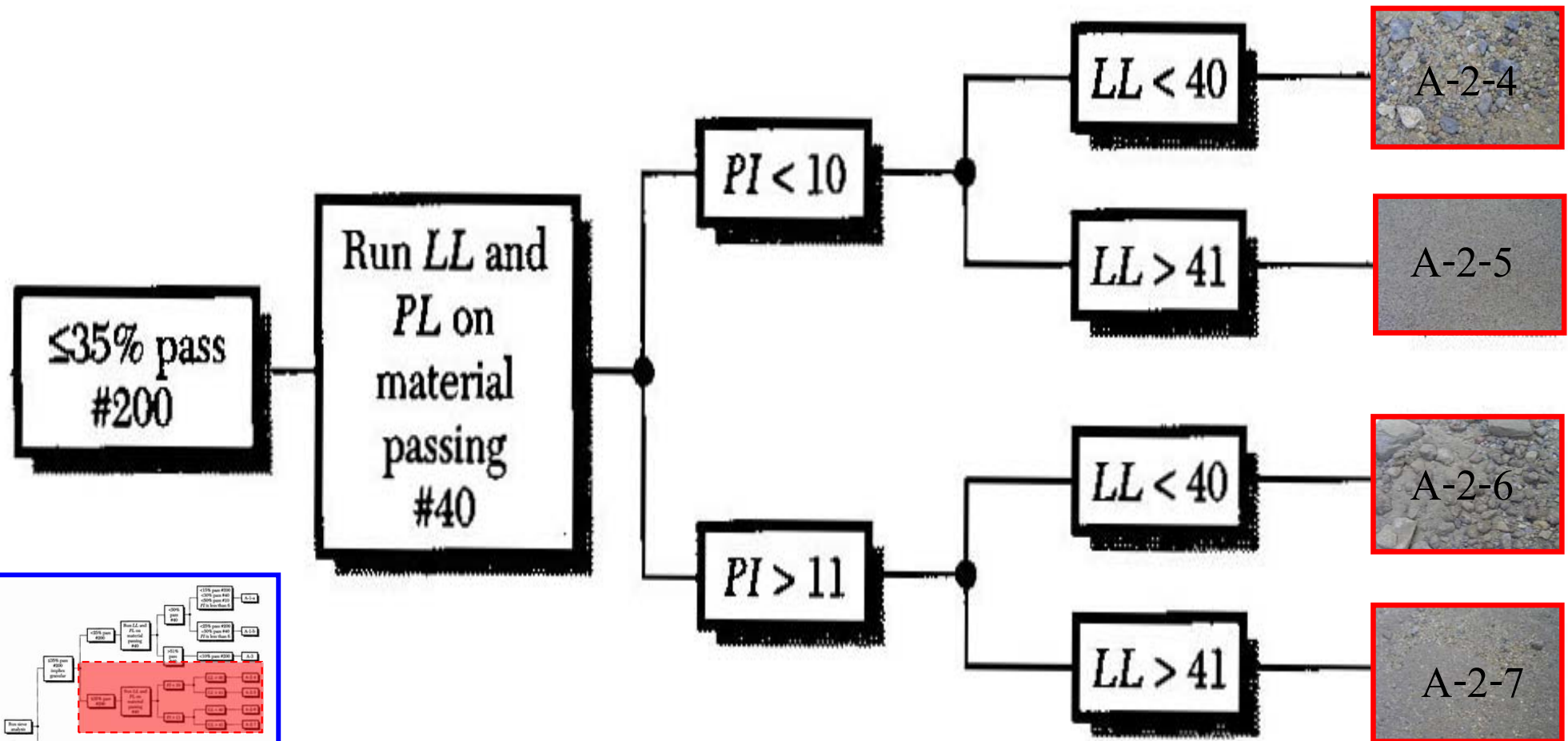
Stone fragments, gravel, and sand



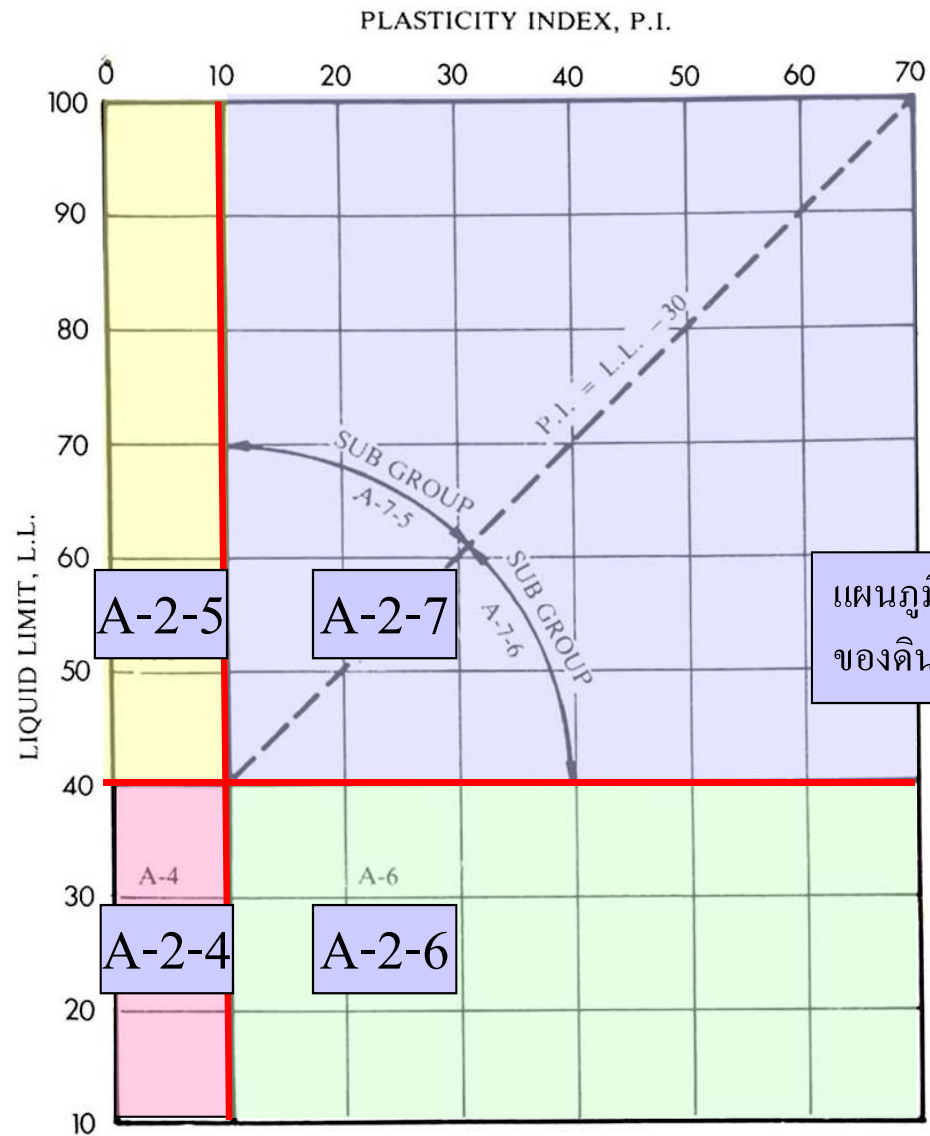
การจำแนกดินตามระบบ AASHTO



Silty or clayey gravel and sand

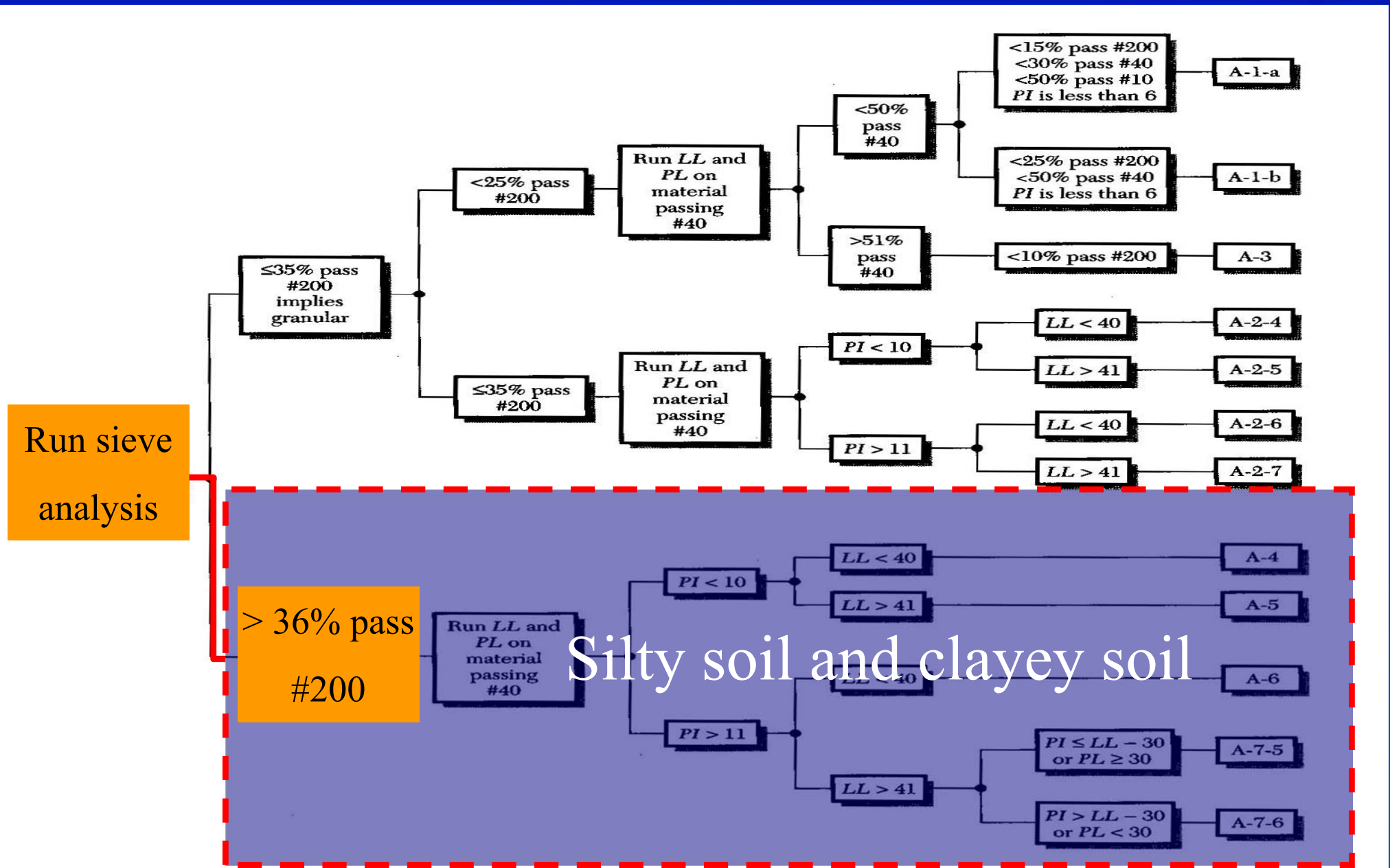


AASHTO

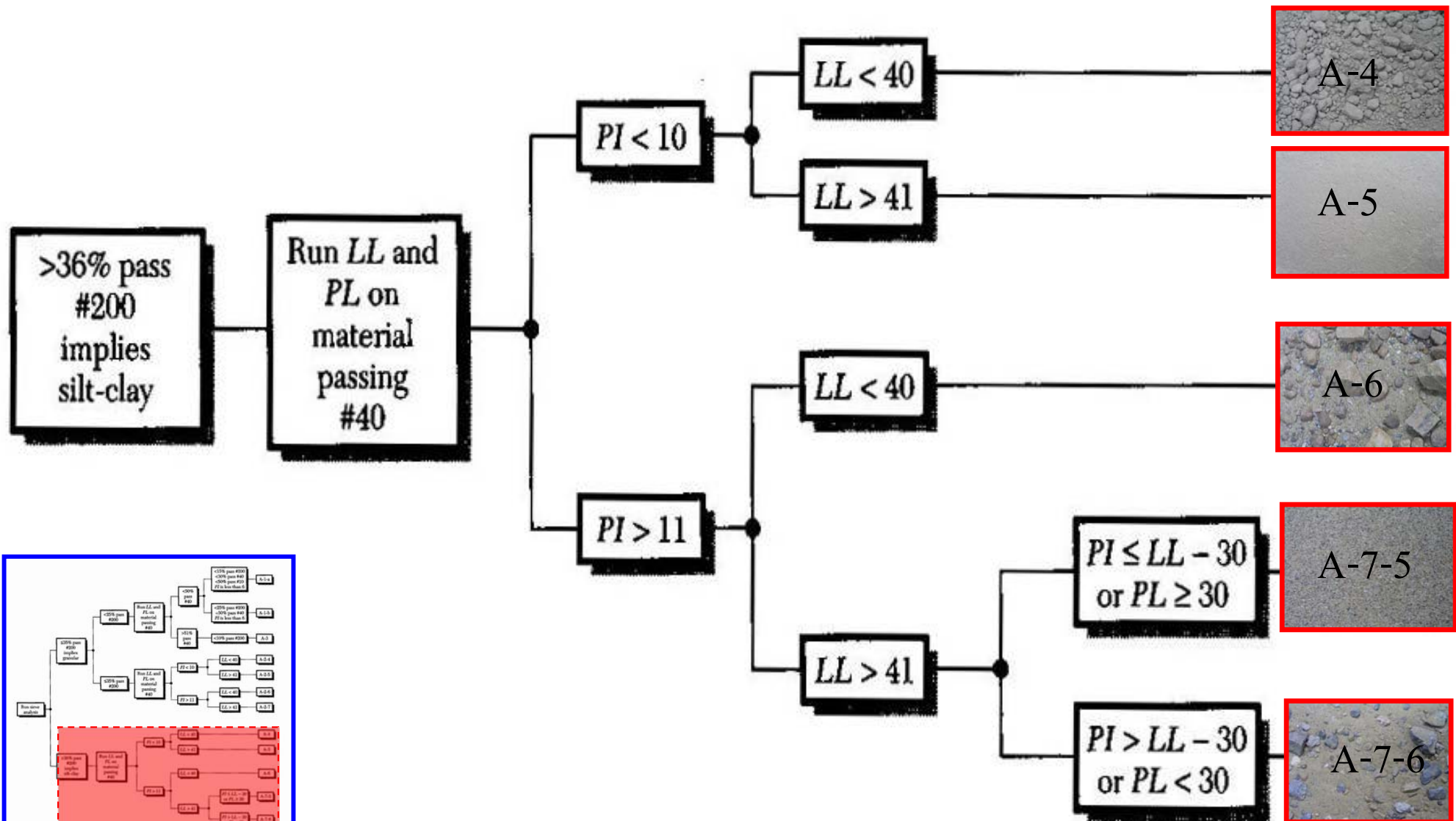


แผนภูมิความเหนียวสำหรับการจำแนกประเภท
ของดินพวกเม็ดละเอียดโดยระบบ AASHTO

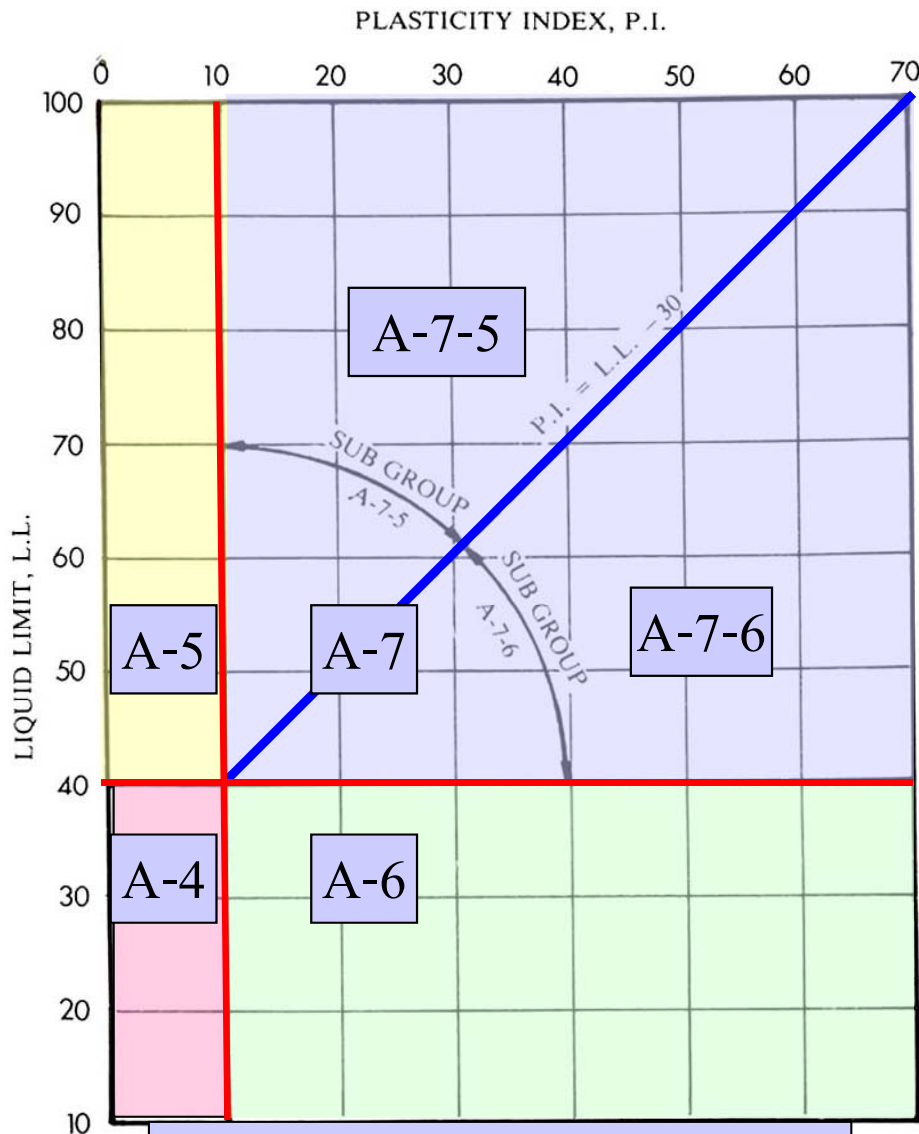
การจำแนกดินตามระบบ AASHTO



Silty soil and clayey soil



AASHTO



แผนภูมิความเหนียวสำหรับการจำแนกประเภท
ของดินพวกเม็ดละเอียด โดยระบบ AASHTO

GI

Group Index ;

$$GI = (F - 35)[0.2 + 0.005(LL - 40)] + 0.01(F - 15)(PI - 10)$$

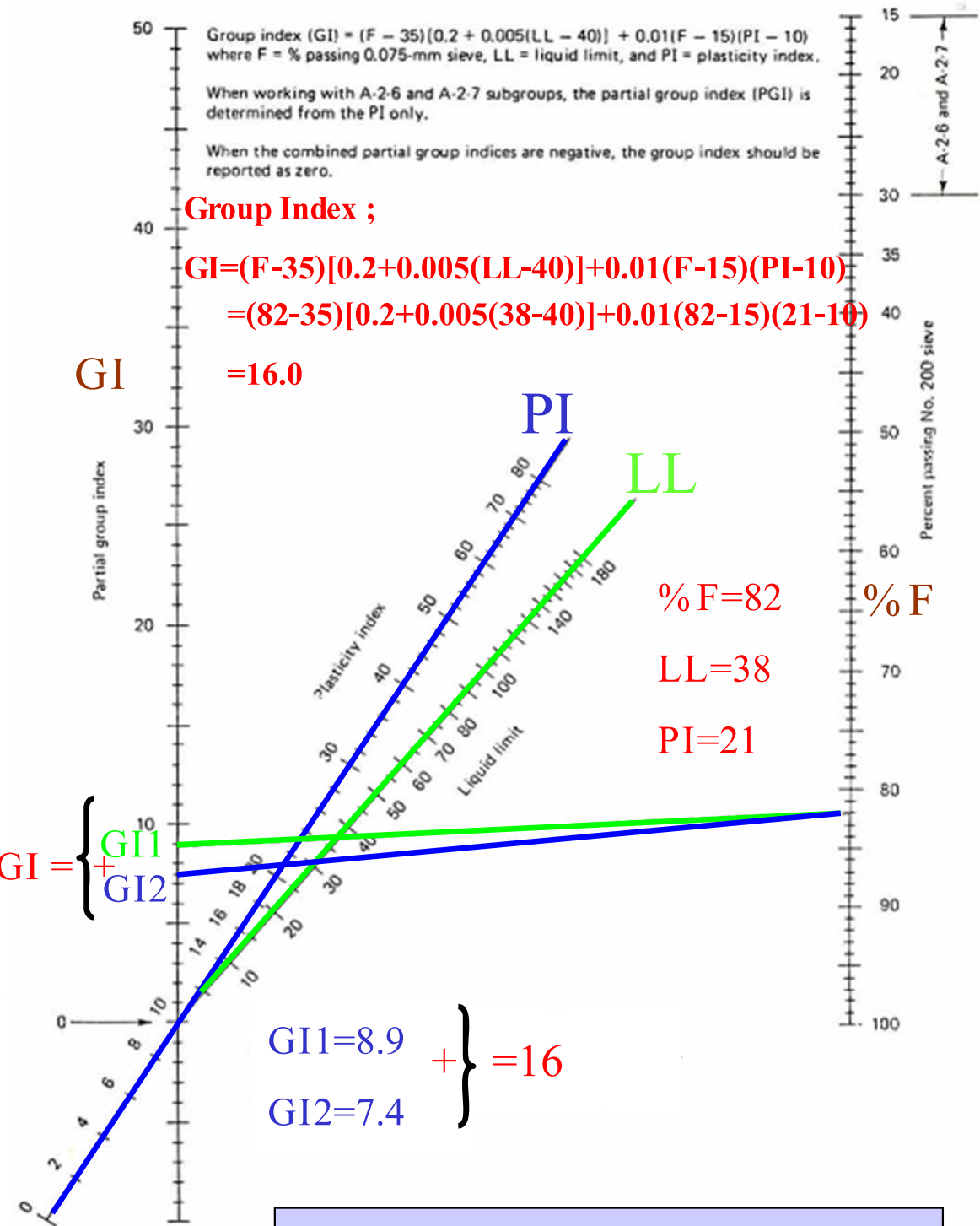
$$= (82 - 35)[0.2 + 0.005(38 - 40)] + 0.01(82 - 15)(21 - 10)$$

$$= 16.0$$

$$GI = \left\{ \begin{array}{l} GI1 \\ + \\ GI2 \end{array} \right.$$

$$\left. \begin{array}{l} GI1 = 8.9 \\ GI2 = 7.4 \end{array} \right\} = 16$$

แผนภูมิสำหรับหาครรชนีของกลุ่ม



การจำแนกดินตามระบบ AASHTO



A-1-a(0)



A-1-b(0)



A-2-4(0)



A-2-5(0)



A-2-6(0)



A-2-7(3)



A-3(0)



A-4(8)



A-5(9)



A-6(10)



A-7-5(17)



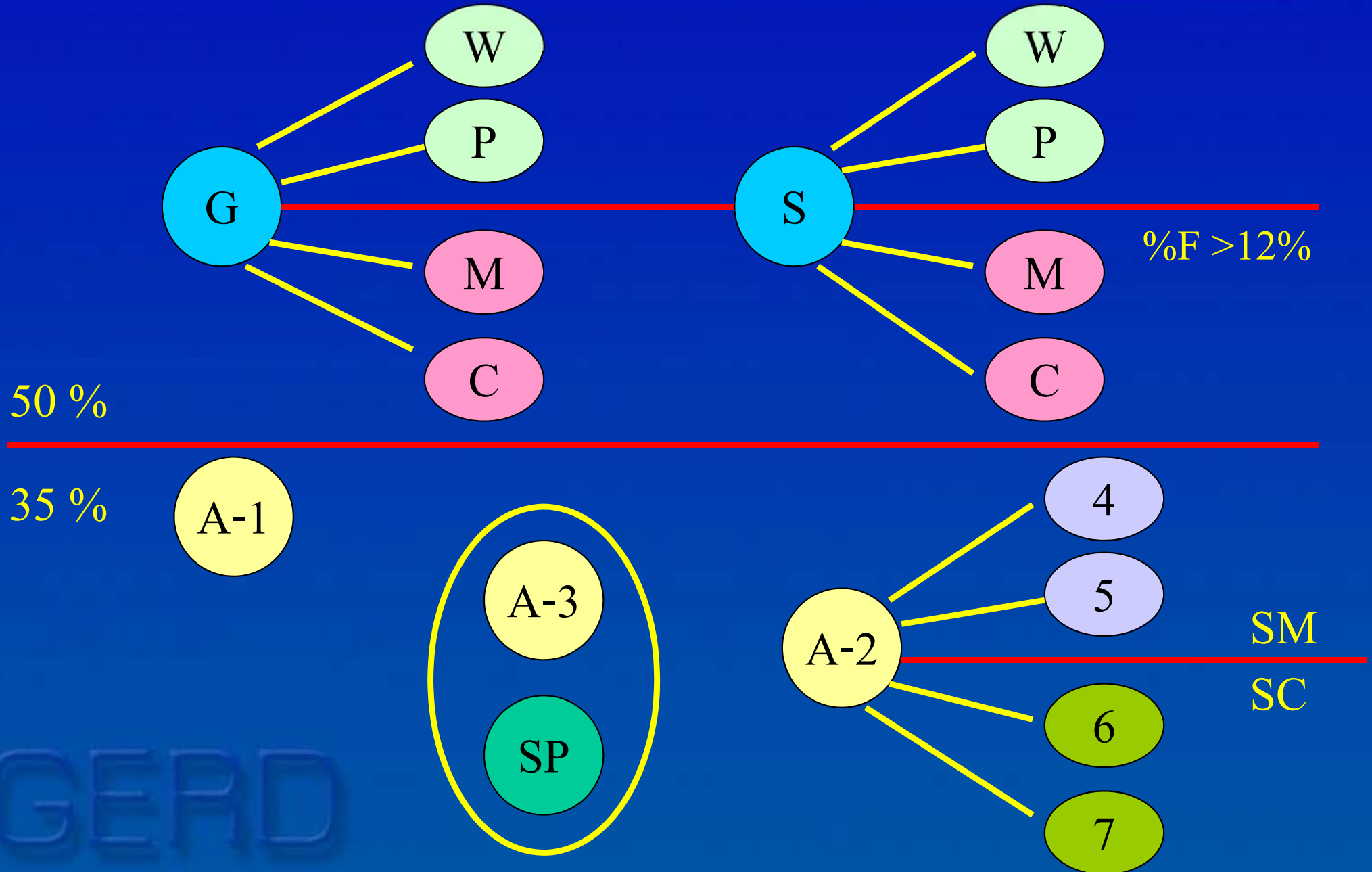
A-7-6(20)

Comparison of Soil Groups in USC and AASHTO System

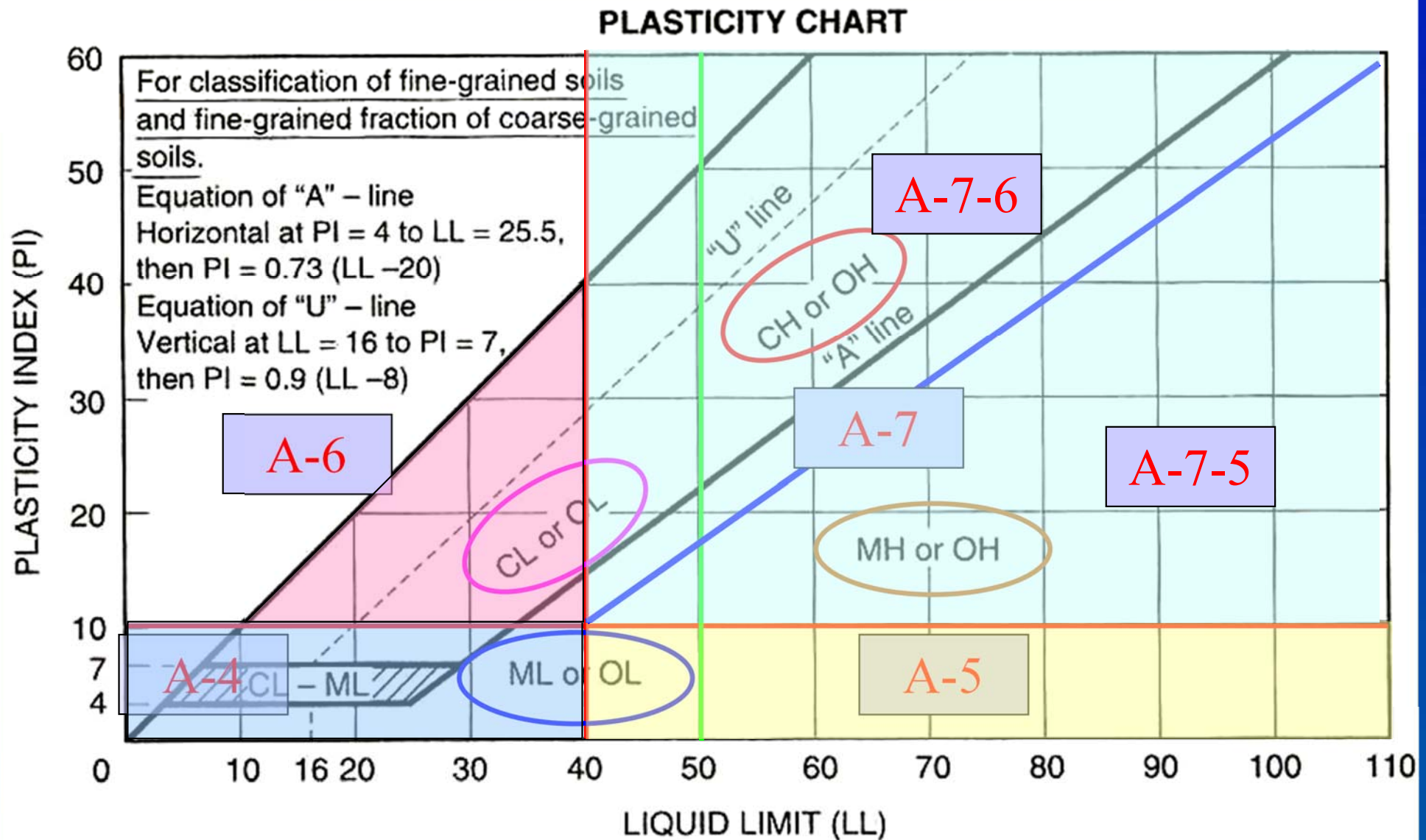
Soil Group in USC System	Comparable Soil Groups in AASHTO System		
	Most Probable	Possible	Possible but Improbable
GW	A-1-a	—	A-2-4, A-2-5 A-2-6, A-2-7
GP	A-1-a	A-1-b	A-3, A-2-4, A-2-5, A-2-6, A-2-7
GM	A-1-b, A-2-4 A-2-5, A-2-7	A-2-6	A-4, A-5, A-6, A-7-5, A-7-6, A-1-a
GC	A-2-6, A-2-7	A-2-4, A-6	A-4, A-7-6, A-7-5
SW	A-1-b	A-1-a	A-3, A-2-4, A-2-5, A-2-6, A-2-7
SP	A-3, A-1-b	A-1-a	A-2-4, A-2-5, A-2-6, A-2-7
SM	A-1-b, A-2-4, A-2-5, A-2-7	A-2-6, A-4, A-5	A-6, A-7-5, A-7-6, A-1-a
SC	A-2-6, A-2-7	A-2-4, A-6, A-4, A-7-6	A-7-5
ML	A-4, A-5	A-6, A-7-5	—
CL	A-6, A-7-6	A-4	—
OL	A-4, A-5	A-6, A-7-5, A-7-6	—
MH	A-7-5, A-5	—	A-7-6
CH	A-7-6	A-7-5	—
OH	A-7-5, A-5	—	A-7-6
Pt	—	—	—

Source: Liu, 1967.

เปรียบเทียบการจำแนกชนิดของดิน ระหว่างระบบ USC กับระบบ AASHTO



เปรียบเทียบการจำแนกชนิดของดิน ระหว่างระบบ USC กับระบบ AASHTO



	Boulders				
AASHTO		Gravel	Sand		Combined Silt and Clay
			Coarse	Fine	

	Cobbles						
USC		Gravel		Sand			Fine (Silt or Clay)
		Coarse	Fine	Co.	Medium	Fine	

Sieve Sizes									
3"	3/4"	4	10	40	60	200	270		
76.2	19.1	4.76	2.00	0.42	0.25	0.074	0.050	0.005	
Particle Size ^m mm									

Comparison of soil-size limits of AASHTO (AASHO) and USC systems. (From Liu, 1967)

A close-up, high-angle shot of a gold-colored pocket watch with a chain, resting on a thick, dark blue book. The watch face is white with black numerals and hands, showing a time of approximately 10:10. The book is placed on a wooden surface, and the lighting is warm and dramatic, casting soft shadows. The text 'จบการนำเสนอ' is overlaid at the bottom in a stylized orange font.

จบการนำเสนอ