

# Unified Soil Classification System

Primary Divisions for Field and Laboratory Identification			Group Symbol	Typical Names	Laboratory Classification Criteria	Supplementary Criteria for Visual Identification
Coarse grained soils (More than half of material finer than 3-inch sieve is larger than No. 200 sieve size)	Gravel (More than half of the coarse fraction is larger than No. 4 sieve size about 1/4 inch)	Clean gravels (Less than 5% of material smaller than No. 200 sieve size)	GW	Well graded gravels, gravel-sand mixtures, little of no fines*	$C_U = \frac{D_{60}}{D_{10}}$ greater than 4 $C_Z = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3	Wide range in grain size and substantial amounts of all intermediate particle size
			GP	Poorly graded gravels, gravel-sand mixtures, little or no fines*	Not meeting both criteria for GW	Predominantly one size (uniformly graded) or a range of sizes with some intermediate sizes missing (gap graded)

\*Materials with 5 to 12 percent smaller than No. 200 sieve are borderline cases, designated: GW-GM, SW-SC, etc.

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...do...	...do...	Gravels with fines (More than 12% of material smaller than No. 200 sieve size)*	GM	Silty gravels, and gravel-sand-silt mixtures	Atterberg limits above "A" line, and PI greater than 7	Atterberg limits below "A" line, or PI less than 4	Nonplastic fines or fines of low plasticity
			GC	Clayey gravels, and gravel-sand-clay mixtures			Plastic fines
...do...	Sands (More than half of the coarse fraction is smaller than No. 4 sieve size)	Clean sands (Less than 5% of material smaller than No. 200 sieve size)	SW	Well graded sands, gravelly sands, little or no fines*	$C_U = \frac{D_{60}}{D_{10}}$ greater than 6 $C_Z = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ between 1 and 3		Wide range in grain sizes and substantial amounts of all intermediate particle sizes
			SP	Poorly graded sands and gravelly sands, little or no fines*			Not meeting both criteria for SW

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...do...	...do...	Sands with fines (More than 12% of material smaller than No. 200 sieve size.)*	SM	Silty sands, sand-silt mixtures	Atterberg limits below "A" line, or PI less than 4	Atterberg limits about "A" line with PI between 4 and 7 is border line case SM-SC	Nonplastic fines or fines of low plasticity
			SM	Clayey sands, sand-clay mixtures	Atterberg limits above "A" line with PI greater than 7		Plastic fines

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<b>Fine-grained soils (More than half of material is smaller than No. 200 sieve size)(Visual: more than half of particles are so fine that they can not be seen by the naked eye)</b>	<b>Silts and clays (Liquid limit less than 50)</b>	<b>ML</b>	<b>Inorganic silts, very fine sands, rock flour, silty or clayey fine sands</b>	<b>Atterberg limits below "A" line, or PI less than 4</b>	<b>Atterberg limits above "A" line with PI between 4 and 7 is borderline case ML-CL</b>	<b>Dry strength</b>	<b>Reaction to shaking</b>	<b>Toughness near Plastic Limit</b>
						<b>None to slight</b>	<b>Quick to slow</b>	<b>None</b>
	<b>...do...</b>	<b>CL</b>	<b>Inorganic clays of low to medium plasticity; gravelly clays, silty clays, sandy clays, lean clays</b>	<b>Atterberg limits above "A" line with PI greater than 7</b>		<b>Medium to high</b>	<b>None to very slow</b>	<b>Medium</b>
<b>...do...</b>	<b>OL</b>	<b>Organic silts and organic silt-clays of low plasticity</b>	<b>Atterberg limits below "A" line</b>		<b>Slight to medium</b>	<b>Slow</b>	<b>Slight</b>	

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...do...	Silts and clays (Liquid limit greater than 50)	MH	Inorganic silts, micaceous of diatomaceous fine sands or silt, elastic silts	Atterberg limits below "A" line	Dry Strength	Reaction to Shaking	Toughness Near Plastic Limit
	...do...	CH	Inorganic clays of high plasticity, fat clays	Atterberg limits above "A" line	Slight to medium	Slow to none	Slight to medium
	...do...	OH	Organic clays of medium plasticity	Atterberg limits below "A" line	High to very high	None	High
...do...	Highly organic soils.....	Pt	Peat, muck and other highly organic soils	High ignition loss, LL and PI decrease after drying	Medium to high	None to very high	Slight to medium
...do...					Organic color and odor, spongy feel, frequently fibrous texture		