

# CALIFORNIA DEPARTMENT OF TRANSPORTATION (CALTRANS)

## UNIFIED SOIL CLASSIFICATION SYSTEM

UNIFIED SOIL CLASSIFICATION AND SYMBOL CHART		
<b>COARSE-GRAINED SOILS</b> (more than 50% of material is larger than No. 200 sieve size.)		
Clean Gravels (Less than 5% fines)		
<b>GRAVELS</b> More than 50% of coarse fraction larger than No. 4 sieve size		GW Well-graded gravels, gravel-sand mixtures, little or no fines
		GP Poorly-graded gravels, gravel-sand mixtures, little or no fines
	Gravels with fines (More than 12% fines)	
		GM Silty gravels, gravel-sand-silt mixtures
		GC Clayey gravels, gravel-sand-clay mixtures
Clean Sands (Less than 5% fines)		
<b>SANDS</b> 50% or more of coarse fraction smaller than No. 4 sieve size		SW Well-graded sands, gravelly sands, little or no fines
		SP Poorly graded sands, gravelly sands, little or no fines
	Sands with fines (More than 12% fines)	
		SM Silty sands, sand-silt mixtures
		SC Clayey sands, sand-clay mixtures
<b>FINE-GRAINED SOILS</b> (50% or more of material is smaller than No. 200 sieve size.)		
<b>SILTS AND CLAYS</b> 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, gravelly clays, sandy clays, silty clays, lean clays
		OL Organic silts and organic silty clays of low plasticity
<b>SILTS AND CLAYS</b> Liquid limit 50% or greater		MH Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
		CH Inorganic clays of high plasticity, fat clays
		OH Organic clays of medium to high plasticity, organic silts
<b>HIGHLY ORGANIC SOILS</b>		PT Peat and other highly organic soils

LABORATORY CLASSIFICATION CRITERIA		
GW	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{D_{30}}{D_{10} \times D_{60}}$ between 1 and 3	
GP	Not meeting all gradation requirements for GW	
GM	Atterberg limits below "A" line or P.I. less than 4	Above "A" line with P.I. between 4 and 7 are borderline cases requiring use of dual symbols
GC	Atterberg limits above "A" line with P.I. greater than 7	
SW	$C_u = \frac{D_{60}}{D_{10}}$ greater than 4; $C_c = \frac{D_{30}}{D_{10} \times D_{60}}$ between 1 and 3	
SP	Not meeting all gradation requirements for GW	
SM	Atterberg limits below "A" line or P.I. less than 4	Limits plotting in shaded zone with P.I. between 4 and 7 are borderline cases requiring use of dual symbols.
SC	Atterberg limits above "A" line with P.I. greater than 7	

Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows:

Less than 5 percent ..... GW, GP, SW, SP  
 More than 12 percent ..... GM, GC, SM, SC  
 5 to 12 percent ..... Borderline cases requiring dual symbols

