

Relative importance of sliding in landslide mechanism<sup>6</sup>

Relative importance of wet flow in landslide mechanism<sup>6</sup>

Dry flow<sup>6</sup>

Landslide Class	Transport Mechanism <sup>1</sup>	Location and Geometry	Parent Material	Moisture <sup>2</sup>	Scar Characteristics	Deposit Characteristics	Damage From:	Common triggers
Debris Flow; (Debris Avalanche) Mud Flow	Non-cohesive slurry flow (non-Newtonian viscous flow); extremely rapid to rapid	Steep to moderate slopes on hillsides and in channels	Colluvium; parts of other landslides; and other engineering soils <sup>3</sup>	Very wet to wet; storm-related	Steep channels scoured bare; lesser gradients may pass slurries without scour or deposition	Debris trains in confined channels; Debris lobes, fans, and sheets on unconfined gentle slopes	Lateral impact; lateral pressure; inundation; burial; buoyancy	Landslides in saturated materials; landslides into or beneath water; earthquake shaking; volcanic eruption; heavy rainstorm
Rapid Earth Flow; Quick Clay Flow <sup>5</sup> ; Wet Sand Flow; Wet Silt Flow		Gentle slopes; may occur in channels	Unconsolidated <sup>4</sup> deposits of clay silt, and sand	Very wet to wet; storm-related and/or season-cumulative	Arcuate crown; may be "bottlenecked" in plan	Fans and sheets, flat-lying deposits (soupy when fresh); may have hummocky surface	Foundation failure; inundation and burial	Earthquake or other dynamic load; changes in pore water chemistry
Earth Flow; Mud Slide; Mud Flow	Cohesive ("plastic") flow; bounded by discrete lateral shear surfaces; rapid to slow	Steep, moderate and gentle slopes	Clay-bearing unconsolidated or poorly consolidated deposits and other engineering soils	Wet to moist; storm-related and/or season-cumulative	Arcuate crown; lateral shears well-developed; commonly no bared slip surface at crown	Steep lobate toe with transverse ridges and radial cracks; may have longitudinal ridges; shear cracks	Foundation failure; lateral pressure	Surcharge/undercut; ground water rise
Soil Creep; Solifluction; Block Stream	Complex: gravity folding and sliding on discontinuous surfaces; and plastic flow; extremely slow to slow	Steep to moderate slopes	Colluvium; talus accumulations; and other engineering soils	Moist to wet; storm-related and/or season-cumulative	Commonly no scar formed	Colluvium, in sheets on hillslopes and in wedges at bases of hillslopes; solifluction lobes; rock fragment streams, lobes and tongues	Foundation failure; lateral pressure	Moisture change (shrink/swell); root wedging; animal burrows; thaw of ice-bearing soils; rock fall loading.
Sackung; Bedrock Creep; Cambering and Valley Bulging	Complex: gravity spreading; sliding on discontinuous surfaces; extremely slow	Steep, mountain relief; valleys and valley walls in plateau terrain	Consolidated bedrock	Moist to wet; season-cumulative	Ridge crest trenches; gulls; scars indistinct	Deformed and fractured bedrock; can be difficult to distinguish from tectonic folds and faults	Foundation failure	Mountain canyon erosion; plateau canyon erosion; earthquake; tectonic uplift
Bedrock Slump	Rotational sliding (can initiate flows); slow to rapid	Curved slip surface; Steep to moderate slopes	Consolidated to poorly consolidated bedrock	Moist to wet; season-cumulative	Arcuate crown scarp and cracks; no bared basal slip surface	Blocks rotated into slope	Foundation failure; lateral pressure	Ground water rise; undercut/surcharge
Debris Slump; Earth Slump (Soil Slump)		Curved slip surface; Steep, moderate, and gentle slopes	Unconsolidated deposits; and other engineering soils	Moist to wet; storm-related and/or season-cumulative	Arcuate crown scarp and cracks; no bared basal slip surface	Blocks rotated into slope	Foundation failure; lateral pressure	Ground water rise; undercut/surcharge
Soil Slip	Translational sliding; can initiate flows if sufficient moisture present; extremely rapid to rapid	Planar; parallel to steep and very steep slopes	Colluvial soil with vegetation	Very wet to wet; storm-related	Thin planar scar (missing slab), and bare flow channel	Sod slabs and various debris flow deposits	Lateral pressure; rare foundation failure; see debris flow effects	Heavy rainstorm; ground water rise; earthquake shaking
Debris Slide (Debris Avalanche)		Planar; parallel to steep and very steep slopes	Natural rock detritus and soil	Wet, moist (storm-related), or dry	Arcuate crown; lateral shears may be poorly developed	Debris sheets, lobes, aprons; irregular surfaces	Lateral impact and pressure; burial; rare foundation failure	Earthquake shaking; heavy rainstorm; volcanic eruption
Earth Lateral Spread; Bedrock Lateral Spread		Planar; parallel to flat or gently dipping geologic discontinuities	Unconsolidated deposits; consolidated bedrock	Wet to moist; season-cumulative	Linear or arcuate breakaway; no bared slip surface	Translated blocks; horst and graben surface fractures	Foundation failure; lateral pressure	Earthquake shaking; undercut/surcharge
Earth Block Slide Rock Block Slide		Planar; parallel to gentle, moderate, or steep discontinuities	Unconsolidated deposits; consolidated bedrock	Wet, moist (season-cumulative), or dry	Linear breakaway; slip on preexisting bedding surfaces	Translated blocks; little disruption of parent material	Foundation failure; lateral pressure	Ground water rise; undercut/surcharge
Rock Slide	Translational sliding; extremely rapid to moderate	Planar; parallel to steep or very steep geologic discontinuities	Consolidated bedrock	Wet, moist, (season-cumulative), or dry	Bare, steep, bedrock slopes and cliffs	Rock detritus; debris sheets, debris lobes; extreme disruption of parent material	Lateral impact and pressure; foundation failure; burial	Earthquake shaking; ground water rise; frost/root wedging
Soil Fall; Soil Topple	Falling, rolling, sliding; extremely rapid to very slow	Irregular; nearly parallel to steep bluff faces	Unconsolidated deposits; and other engineering soils	Moist to dry	Bare bluffs and steep slopes	Debris aprons with soil blocks; blocks rotated outward; disrupted	Impact from above or laterally; foundation failure; burial	Earthquake shaking; undercut/surcharge
Rock Fall; Rock Topple		Irregular; nearly parallel to steep and vertical cliffs	Consolidated bedrock	Moist to dry	Bare cliffs and steep bedrock slopes	Rock detritus - talus deposits; blocks rotated outward	High velocity impact from above or laterally; burial	Earthquake shaking; undercut/surcharge; frost/root wedging
Rock Fragment Flow (Debris Avalanche)	Grain interaction; air fluidized(?) sediment flow; extremely rapid to rapid	Very steep initial slopes; may run out on gentle slopes	Rock fall and rock slide detritus (large, active rock falls)	Dry to moist	Bare cliffs and steep slopes; bared planar or channeled surface	Debris cones, sheets, fans, lobes and aprons; talus; block streams	Lateral impact; lateral pressure; burial	Mountain rock fall or rock slide; earthquake shaking; volcanic erupt.
Dry Sand Flow; Loess Flow; Dry Sliding		Very steep to steep local relief	Unconsolidated deposits	dry	Arcuate, planar, or irregular bared surface	Sand and silt sheets, cones, fans, and aprons	Burial; lateral pressure; foundation failure	Earthquake; undercut/surcharge

<sup>1</sup> Including estimates of the ranges of rates of movement.

<sup>2</sup> Showing the most common range of visible wetness associated with each landslide class. Also attempts to identify whether the most common natural source for visible wetness is heavy rainfall and/or rapid snowmelt ("storm-related"), which infuse water into the ground from the surface relatively suddenly, or from a relatively slow ground-water-level rise associated with seasonal or multi-seasonal cumulative effects ("season-cumulative"), including migrating ground water from other areas.

<sup>3</sup> "Soil" is used in this chart in the engineering geology sense, i.e., as a term to refer to all unconsolidated earth materials above bedrock. It is approximately synonymous with "regolith", but includes unconsolidated and poorly consolidated sedimentary deposits.

<sup>4</sup> The terms "consolidated", "unconsolidated", etc., are used in this chart in the geologic sense to refer to the approximate state of consolidation, which is the process by which loosely aggregated or soft earth materials become firm and coherent rock. They are not directly comparable with terms like "overconsolidated", "underconsolidated", or "normally consolidated" which have more specific geotechnical reference to stress histories of the materials.

<sup>5</sup> Quick clay flows are commonly attributed to the disturbance of clay and silt deposits that are described as "sensitive". A sensitive clay is one whose shear strength is decreased to a fraction of its former value on remolding at constant moisture content.

<sup>6</sup> Solid line where dominant; long dashes where required but can be subordinate; short dashes where not required but commonly present; dotted where possibly present.

TABULAR SUMMARY OF LANDSLIDE CLASSES, WITH FIELD RECOGNITION CRITERIA FOR LANDSLIDE RECOGNITION  
(See text for explanation of terms used.)