

**Table S1.** Mechanical properties and geotechnical behavior of geological formations affected by ETLs in Greece. The main properties are from the Engineering Geological Map of Greece compiled by Andronopoulos et al. (1993).

No	Formation type	Symbol	Main properties
1	Limestones - dolomitic limestones - dolomites	LD	<p>Thick-bedded to unbedded.</p> <p>Groundwater restricted to the fractured zone of limestones.</p> <p>Dolomites practically impermeable or semipermeable.</p> <p>Rockmass behavior controlled by discontinuities' properties.</p> <p>Slope failures usually observed: rockfalls.</p>
2	Neogene deposits of mixed phases	f-c	<p>Clays, sands, marls, sandstones, conglomerates and marly limestones in thin layers.</p> <p>Variation of permeability due to lithological alternations.</p> <p>Formation of local unconfined and confined aquifers.</p> <p>Non-uniform and anisotropic behavior as a whole due to lateral evolution and wedging out of the horizons.</p> <p>Rapid change of the mechanical characteristics in the different horizons both vertically and laterally.</p> <p>Sandstones and conglomerates with high cohesion and shear strength.</p>
3	Limestones	L	<p>Compact, thick-bedded or unbedded to thin-bedded.</p> <p>Usually fractured and strongly karstified in the upper beds.</p> <p>Intact rock characterized by high values of strength parameters.</p> <p>Rockmass characterized by medium to high permeability and satisfactory geomechanical behavior.</p> <p>Cases of large karstic forms (roof collapsing).</p> <p>Secondary loosening due to dense fracturing, unfavorable discontinuities' orientation and filling with clayey material.</p>

			Slope failures usually observed: rockfalls in steep slopes.
4	Quaternary loose deposits, mixed phases	f,c-l	<p>Clayey silts, sands, grits, gravels and cobbles.</p> <p>Frequent and rapid changes in lithological composition and grain size distribution.</p> <p>High erosion, leaching and medium to high permeability.</p> <p>Aquifers of high yield but with strong fluctuations.</p> <p>Geomechanical behavior controlled by their thickness, lithological anisotropy and the slope</p> <p>Settlements and ground movements usually observed.</p>
5	Limestones with nodules and lenses of silica	L-si	<p>Thin to medium-bedded, often microbrecciated with nodules or lenticular silica layers and thin intercalations of shales.</p> <p>Intense and multiple fracturing and varying permeability.</p> <p>Folded and locally multifolded due to tangential tectonics.</p> <p>Anisotropy and non-uniformity controlled by the density of chert and schist interbeds.</p> <p>Reduced shear strength due to increased density of discontinuities and heterogeneous contacts.</p> <p>Increased instability on steep slopes.</p> <p>Extended landslide phenomena mainly in Western Greece.</p>
6	Undivided flysch	F	<p>Alternating siltstones and sandstones.</p> <p>Less frequent conglomerates, calcareous schists, and limestones.</p> <p>Usually thin - bedded.</p> <p>Strong traces of horizontal tectonic deformation</p> <p>Occurrence of small springs</p> <p>Medium to strong weathering and dense net of discontinuities at surface.</p> <p>Landslide phenomena occur with an increased frequency.</p>

			<p>Instability and geotechnical problems connected with the numerous heterogeneous layer contacts and the steep beds, in conjunction with the strong relief and the action of water.</p>
7	Neogene deposits (f), mainly fine-grained	f	<p>Clays, marls, clayey marls, calcitic marls, and marly limestones.  Frequent intercalations of thin horizons of grits and conglomerates.  Medium to high coherence, depending on their lithological composition.  Low resistance to weathering.  Practically impermeable.  Isolated lenticular aquifers in the coarse - grained phases.  Intensive fracturing.  Mechanical characteristics and behavior strongly related to the degree of saturation.  Shallow rotational and/or translational slides.  Differential settlements in areas with clays and clayey-marls.</p>
8	Volcanic rocks (lavas)	v	<p>Coherent rocks of varying chemism in Northern Greece and the Aegean islands.  Dense net of oriented joints-fractures.  Low strength parameters and poor hardness in cases of extended weathering.  High strength parameters, great hardness and resistance to weathering in the unweathered rocks.  Increased water bearing capacity in the fractured zone.</p>
9	Molassic sediments of the Mesohellenic trench	M	<p>Sands, clays, maris, calcareous maris, sandstones and mainly conglomerates, in alternating layers.  Medium permeability.  Locally rich aquifers in the coarse-grained phases.</p>

			<p>Landslides of small extend, limited in the weathered horizons of the fine-grained phase.</p> <p>Rockfalls in the cohesive conglomerates.</p> <p>Strong non-uniformity and anisotropy in the mixed formations.</p> <p>Sandstones, marls and conglomerates usually with high values in both shear and compressive strength.</p> <p>Sands and clays with wide fluctuation in the values of their mechanical characteristics</p>
10	Volcanic tuffs	tf	<p>Very coherent to porous-loose tuffs, volcanic breccia, pumice and pyroclastic materials, usually coarse-grained.</p> <p>Great range of coherence.</p> <p>Permeability ranging between high-medium to low values.</p> <p>Mechanical properties and rockmass behavior depending on the initial lithology and the natural state of the formation.</p>
11	Quaternary coherent, coarse-grained deposits	c-cm	<p>Sands, grits, gravels and cobbles in ranging proportions and medium to cementation with calc-marly or calc-sandy material.</p> <p>Susceptible to base erosion.</p> <p>Medium to high permeability.</p> <p>Rapid discharge of the formed aquifers.</p> <p>Satisfactory bearing capacity.</p> <p>Good geomechanical behavior.</p>
12	Metamorphic carbonate rocks	mr	<p>Micro - or coarse - crystalline marbles.</p> <p>Compact, medium to thick-platy rock, homogeneous.</p> <p>Highly permeable.</p> <p>High strength parameters.</p> <p>Good behavior in the foundations of technical works.</p>

			<p>Detachments and rockfalls in case of intense local fracturing and unfavorable orientation of the discontinuities</p> <p>Slides and displacements to a limited extent in case of weathered schist layers, intense water action and unfavorable orientation of the discontinuities</p>
13	Semi-metamorphic rocks	ph	<p>Phyllites locally folded, wrinkled, with intense deformation. Easily weathered, often covered by thick and loose weathering mantle. Impermeable formations.</p> <p>Springs of usually low yield in the contact of bedrock and weathering mantle.</p> <p>High mechanical strengths and satisfactory behavior in unweathered state.</p> <p>High instability and loosening to a considerable depth under the influence of secondary processes</p> <p>Serious landslide phenomena, along weakness surfaces of the phyllite beds.</p>
14	Basic and ultrabasic igneous rocks	o d s	<p>Ophiolites (o), serpentized peridotites (s), diabases (d). Coherent, usually intensively fractured and deformed. Strongly altered and weathered in the upper parts. Impermeable in general.</p> <p>Increased permeability in intensively fractured zones. Soil movements restricted in the weathering mantle.</p> <p>Sliding, usually of local character.</p> <p>Mechanical properties strongly related to the natural state of the rockmass.</p>
15	Quaternary loose, mainly fine-grained deposits	f-l	<p>Silts, clays and loams with ranging, but usually low proportions of sands, grits and gravels.</p>

			<p>Poor coherence.</p> <p>Low to medium permeability.</p> <p>Geomechanical behavior and properties depending on their particle size distribution and mineralogical composition.</p> <p>Small scale subsidence and swelling phenomena.</p>
16	Quaternary, coherent deposits with mixed phases	f,c-cm	<p>Clayey marls, sandstones, conglomerates and breccia.</p> <p>Frequent and rapid changes in the lithological composition.</p> <p>Strong cementation.</p> <p>Coherence with strong variations due to primary differences in the cementation degree.</p> <p>Low to medium permeability.</p> <p>Creation of local aquifers.</p> <p>Strong heterogeneity resulting high anisotropy of their mechanical behavior.</p> <p>Satisfactory shear strength, especially in areas with gentle morphology.</p>
17	Shales and cherts	sh	<p>Thin alternations mainly of cherts and shales with scattered limestones and sandstone interbeds in places.</p> <p>Intensively fractured and multifolded formation.</p> <p>Upper beds intensively weathered and loosened often at great depth.</p> <p>Loosening due to very dense fracturing, thin-bedded structure, intense deformation and the activity of water.</p> <p>Springs of low yield occur between the weathering mantle and the intact bedrock.</p> <p>Natural slopes susceptible to easy erosion.</p> <p>Artificial slopes require support or gentle inclination to be stable.</p> <p>Mechanical behavior of the rockmass on the slopes characterized by relatively low shear strength.</p>

			Landslide phenomena restricted in small depths, mainly in the thick weathering mantle and the fractured zone.
18	Neogene, coarse-grained deposits	c	<p>Sandstones, grits and conglomerates with coarse-grained elements of different origin and size.</p> <p>Rich aquifers and contact springs of medium to high discharge.</p> <p>Loosening, detachments, falls and more rarely manifestation of translational slides.</p> <p>Very coherent and of satisfactory behavior for the construction of technical works in case of strong cementation.</p>
19	Quaternary loose, mainly coarse-grained deposits	c-l	<p>Pebbles, cobbles, grits and sands with low proportions of clayey silts and sandy silts.</p> <p>Loose deposits, forming screes, talus, torrential fans and rarely glacial deposits.</p> <p>High permeability and yield, without creating shallow aquifers due to easy drainage.</p> <p>Satisfactory behavior under static loading.</p> <p>Easy erosion and leaching by surface water.</p>
20	Gypsum and calcareous-dolomitic breccia, unbedded	G	<p>Mixture of gypsum material and carbonate rocks of diapiric origin.</p> <p>Unfavorable behavior due to the deformation and the erosion processes occurring in the gypsum.</p> <p>Foundation of technical works on gypsum and calcareous-dolomitic breccia must be avoided.</p>
21	Metamorphic rocks	gn	<p>Gneisses, mica-amphibole and other schists, quartzites and amphibolites with frequent marble and cipolin interbeds.</p> <p>Impermeable formations.</p> <p>Characteristic homogeneity and satisfactory uniform behavior in static and dynamic loadings.</p>

			<p>High strength parameters in unweathered state.</p> <p>Springs of usually low yield, in the contact of the weathering mantle with the intact rock.</p> <p>Geotechnical behavior and mechanical properties controlled by the intensity and extent of secondary processes.</p> <p>Important failures due to endogenic alteration and weathering processes leading to loosening.</p> <p>Slope failures and displacements of extended rockmasses due to disturbance of the natural stability conditions, the presence of dense discontinuities and the weathered-loosened rock.</p>
22	Limestones, alternating with cherts, schist-cherts or schist-marly layers	L-sh	<p>Limestones, alternating with cherts, schist-cherts or schist-marly layers.</p> <p>Thin-bedded, intensively folded and fractured.</p> <p>High degree of loosening in the upper beds resulted mainly by the heterogeneity of the lithological material.</p> <p>Geotechnical behavior of the rockmass mainly determined by the physical condition and the lithological composition of the formation.</p> <p>Easily weathered on slopes.</p> <p>Shear failures and detachments as well as large slope movements in artificial slopes.</p>
23	Acid to intermediate plutonic rocks	Y	<p>Undivided granites, granodiorites.</p> <p>Rare fracturing net and surface weathering.</p> <p>Thick weathering mantle in sites of intense fracturing and strong hydrothermal alterations.</p> <p>Impermeable formations.</p> <p>Uniform (isotropic) mechanical behavior and high strengths in unweathered state.</p>



			Intensively weathered loosened and altered to granitic sand in the surface within the zones of strong hydrothermal alterations and aplitepegmatite veins.
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