TABLE 2.—*General engineering properties and behavior of engineering geologic units*

Map unit	Percolation and drainage	Ground-water conditions	Slope stability	Rate of erosion	Susceptibility to frost action	Suitability for foundations	Suitability for roads	Earthquake-reaction characteristics [1]	Use and workability
Smc	Fast percolation and good drainage, particularly in the beach deposits associated with the gravel ridges (G) and in the upper parts of the natural levee deposits.	In levee deposits, water table tends to seek pool stage level of Ohio River, about 20 ft below crest of levee. Water table is below beach deposits.	Cut slopes stand steeply to near vertical when dry, break down with infiltration of slight amount of moisture. Fill slopes unstable.	Moderate to rapid.	Insignificant	Good	Poor, unstable when wet, soft when dry.	Tendency for granular response on dry steep slopes and for fluid reaction if wet.	Foundation-fill material for buildings (Finch, 1966). Easily moved with hand and power equipment.
G	Fast percolation and good drainage.	Above water table.	Cut slopes stand steeply to near vertical. Fill slopes probably unstable, depends on amount of interstitial sand and silt.	Slow, stable.	Insignificant	Fair where thin and good where thick	Good for subgrade as well as base.	Chiefly elastic reaction, initial reaction might be somewhat fluid.	Road metal (Finch, 1966). Easily moved with power equipment.
MC	Slow to moderately slow percolation. Surface drainage very poor in low areas where land becomes inundated by normal rainfall unless artificially drained. In uplands drainage is fair to good.	Seasonal in alluvial and lacustrine deposits. During wet season water table is within a few feet of surface, but during dry season it may be 10–15 ft deep (Pree and others, 1957, p. 26). Ground water is generally absent in loess, but during wet season loess has high moisture content because of low permeability. Likewise, it becomes very dry during dry season.	Cut slopes will stand in 10-foot-high nearly vertical slopes when dry; height decreases with increase of moisture content. For fill material slopes as much as 2:1 (26° from horizontal) are satisfactory if compacted to maximum dry density at optimum moisture content. Fill slopes are susceptible to swelling, settling, and severe erosion.	Rapid; unprotected slopes gully.	Very susceptible to frost heave, particularly where drainage is poor or water table is near the surface. A freeze-thaw test [2] on sample D–8–4 (loess) having a height of 3$\frac{9}{16}$ in. showed a height increase of about 0.05 in. on the first cycle and an increase of about 0.10 in. over the initial height on the second cycle (G.S. Erickson, written commun., 1964).	Moderate shear strength when dry, decreases rapidly as moisture content increases. Swell pressures are neglible in undisturbed material, but become noticeable in remolded material (Nichols, 1968). Percent consolidation and bulk density values (table 1) have a wide range. Differential consolidation is believed to be the major cause of structural failures. Foundations designed for low stress concentrations (on order of 500 lbs per ft^2) would be stable in undisturged material. Site testing is strongly recommended.	Unsatisfactory for subgrade and base. (See columns, Percolation and drainage, Ground-water conditions, and Susceptibility to frost action.)	Viscous or visco-elastic response. Susceptible to differential compaction. Steep slopes, particularly in loess and other materials with a high moisture content, are susceptible to landslides. Failure of loess described by Terzaghi (1950, p. 90–91) and at New Madrid by Fuller (1912, p. 60). Susceptible to ground-wave motion from distant earthquakes.	Fill. Compacts well and has low compressibility. Fairly suitable for fill, but requires measures (sodding) to prevent erosion. Retaining walls are recommended to prevent settling and slides. Easily moved with hand and power equipment.
Gsc	Fast to very fast percolation and good to excellent surface and subsurface drainage. Pree, Walker, and MacCary (1957, p. 39) describe percolation tests in Rolling Hills [Lakeview] Country Club subdivision.	Water bearing above Cl, CS, and Cp. Springs common at contact with clay. Where below alluvium and lacustrine MC deposits it is saturated with water.	Cut slopes stand nearly vertical. Fill slopes stable.	Slow, stable.	Insignificant	Excellent in areas of outcrop, where it probably has moderate to high shear strength. It should be considered for pile foundation, particularly where overlain by MC below altitudes of 350 ft (See section *A–A′*).	Good to excellent for subgrade and good for base. (See Use and workability.)	Elastic reaction, constitutes "good ground."	Excellent for road metal because of interstitial clay and silt which are good binders. Chief source of road metal (Finch, 1966). Preponderance of iron oxide-coated chert pebbles makes it unsuitable for portland cement and bituminous concretes. Most is easily moved with power equipment.
S	do.	Commonly water bearing above Cl, CS, and Cp. Springs common at contact with clay. Good aquifer in the Lone Oak area. Outcrops are important ground-water recharge areas. Use of sand for septic tank and other waste disposal may contaminate ground water over wide area.	Cut slopes stand at steep to moderate angles depending on grading and amount of silt and clay; clean loose sand unstable. Fill slopes generally unstable.	Moderate to rapid.	Little or insignificant	Good	Good for subgrade.	Generally elastic reaction, loose clean sand should have tendency for fluid response if wet and granular response if dry, indurated ledges on steep slopes southeast of Lone Oak may have a brittle response.	Foundation-fill material (Finch, 1966). Easily moved with hand and power equipment.
Cl	Slow to moderately slow percolation and poor drainage. Water saturated in stream bottoms.	Springs common at contacts with overlying S and Gsc.	Cut slopes tend to slump and retreat. Fill slopes unstable.	Slow	Insignificant	Poor	Poor for subgrade.	Elastic reaction, constitutes "good ground."	Not used for construction. Easily moved with power equipment.
CS	Slow percolation and poor drainage. Pree, Walker, and MacCary (1957, p. 37) describe percolation tests in Cherokee Heights (north of Mount Kenton Cemetery) subdivision.	do.	do.	Slow to moderate.	Insignificant	Poor, low shear strength, negligible swelling	do.	do.	Do.
Cp	Very slow percolation and good surface drainage. Generally not water saturated in stream bottoms.	Springs common at contacts with overlying S and Gsc and in places at base of glauconitic sand beds near erosional surface cut on bedrock materials.	Cut slopes in typical clay are unstable and if more than 10 ft deep should be terraced. Unweathered clay consists chiefly of calcium montmorillonite and has a high natural water content; where exposed, it desiccates rapidly and fractures conchoidally into chips, and forms talus slopes. Weathered clay tends to slide and slump when water saturated. Clay not suitable for fill material, but according to Nichols (1968), clayey sand and sandy clay will stand in slopes of 2:1 if compacted to maximum density and optimum moisture.	Slow to moderate. Stable.	Insignificant	Clay at or near surface poor for foundations because of large swell pressures and fractures. Should be good for pile foundations where covered and below thin (0–5 ft) weathered zone common beneath S and Gsc. Based on tests in Paducah East quadrangle, probably has moderate shear strength (Nichols, 1968). Glauconitic sand, particularly where clay content is low, is good for foundations.	Clayey sand probably good for subgrade. Road failure south-southwest of Bellview Church is related to spring at base of glauconitic sand bed about 10 ft below Cp-Gsc contact. Clay poor for subgrade.	do.	Do.
SCM	Not exposed	Below water table. Good aquifer	Not exposed	Not exposed	Not exposed	Not exposed. At the Metropolis Bridge, Modjeski (1919, p. 67) reports maximum bearing values at each of seven piers were more than 21 tons per square foot.[3] Silty clay or clayey silt probably good for pile foundations.	Not exposed	do.	Not exposed.

[1] Classification based on Schlicker, Deacon and Twelker's (1964) terminology: elastic, fluid, brittle, viscous or visco-elastic, and granular. See text for definitions.

[2] Sample was mixed to optimum moisture content, compacted to maximum density in a mold 4 in. in diamater and 3$\frac{9}{16}$ in. high, then placed in a freezer having temperature 18–22°F, and supplied with a constant amount of water. The first cycle was run for 6 days and height increase measured. Sample was allowed to thaw in a humidifier. The second cycle was run for 4 days and height increase measured.

[3] Maximum foundation loads in tons per square foot for the Metropolis Bridge. (Modjeski, 1919, figs. 18–24)

	Pier 1	Pier 2	Pier 3	Pier 4	Pier 5	Pier 6	Pier 7
Direct load	5.14	5.54	5.07	5.39	5.24	4.77	4.76
Horizontal load	2.30	3.31	2.83	2.90	2.87	1.82	0.75
Total	7.44	8.85	7.90	8.29	8.11	6.59	5.51

298-635 O - 68 (In pocket)