General engineering properties and behavior of lithologic units shown on plate 1

Map unit	Type of deposit	Structure	Percolation and drainage	Ground-water conditions	Slope stability	Suitability for foundations[1]	Workability	Rate of erosion	Susceptibility to frost action	Earthquake reaction characteristics
Sm	Nonindurated sand and silt of fluvial and lacustrine(?) origin.	Natural levees adjacent to present river channels and beach deposits. Probably crossbedded.	Rapid percolation and good surface drainage.	Water table tends to seek pool-stage level of the Ohio River.	Cut slopes stand in moderately high, steep slopes, but break down rapidly with increased moisture and active undercutting. Fill slopes unstable. Low cohesion.	Fair to good.	Easily moved with hand or power equipment.	Moderate to rapid.	Insignificant.	Fair to poor. Susceptible to compaction. Probably would have high mobility. Where wet would be susceptible to liquefaction.
MC	Nonindurated silt and clay of lacustrine and fluvial origin.	Generally massive bedding. Crudely to well bedded locally. Uniform texture.	Slow to moderately slow percolation. (See table 2.) Surface drainage is very poor in low areas where land becomes inundated by heavy rains unless artificially drained. In upland areas drainage is fair to good, but artificial drainage may be required locally.	Vary considerably with season. The water table is very close to the surface during wet seasons and may drop many feet during dry seasons. Generally moisture content is very high.	Cut slopes will stand in 20-foot high, nearly vertical slopes when dry. Height of slope decreases with increase of moisture content. When used as fill material, 2:1 slopes are generally satisfactory if material is compacted to maximum density. Fill slopes are susceptible to swelling, slumping, and gullying. Moderate to high cohesion.	Moderate shear strength when dry but decreases rapidly as moisture content increases. Swell pressures are negligible in undisturbed material but become noticeable in reworked material. Consolidation properties and bulk densities have a wide range. (See table 2.) Differential consolidation is probably a major cause of structural failures. Most foundations designed for low stress concentration would be stable on undisturbed material; however, site testing is strongly recommended.	Easily moved with hand or power equipment. Compacts well and has low compressibility when used as fill material.	Erodes rapidly where exposed to waves and currents of rivers and lakes. Rainfall will cause severe gullying on unprotected slopes.	Very susceptible to frost heave, especially where drainage is poor and water table is close to surface.	Poor. Would be susceptible to compaction, high-amplitude ground motion, and possible liquefaction. On slopes where soil-moisture content is high, landslides would be expected.
	Nonindurated silt and clay of eolian origin. Occur as mantle 0–20 feet thick covering much of highlands.	Massive bedding, and uniform texture.	Slow to moderately slow percolation. (See table 2.) Surface drainage is fair to good, primarily because of relatively high relief. Artificial drainage may be required in locally depressed areas where drainage is poor.	Unit is generally above the level of the water table. Because of retention of pore water, unit will have high moisture content during wet season but will dry out during dry season. Where drainage is fair to good, will dry more rapidly than where drainage is poor.						
G	Nonindurated, generally well-graded gravel of varying thickness underlies fluvial and lacustrine deposits (MC) and overlies an irregular erosional surface. Unit is generally not exposed except where it occurs as gravel in beach bars and ridges.	Probably crossbedded.	Probably rapid percolation where exposed.	Below water table except where exposed.	Where exposed, stands in moderate slopes.	Where exposed, probably fair to good for small structures depending on thickness and extent of deposit. Where unexposed, not suitable for shallow foundations, but resistance to drilling, using a power auger, suggests that it may be suited for pile foundations.	Easily moved with power equipment. Difficult to move with hand equipment.	Slow, stable.	Insignificant.	Fair. Susceptible to some compaction. Probably would be mobile to some degree in response to large magnitude earthquakes.
Gsc	Poorly indurated, generally well-graded gravel.	Poorly to well-defined nearly horizontal bedding.	Rapid percolation. (See table 2.) Excellent surface drainage.	Unit is generally above the water table. Because of the low permeability of the underlying units, perched water tables and springs occur near the base.	Cut slopes stand nearly vertical. Fill slopes are stable. Moisture does not effect slope stability.	Excellent for foundations. Has cohesion caused by ferruginous cementation. Probably has moderate to high shear strength. It is nearly everywhere overlain by silt of eolian or lacustrine origin (MC) and would be far more suitable for foundations than the overlying silt.	Easily moved with power equipment. Very difficult to move with hand equipment.	Slow, stable.	Insignificant.	Good. Susceptible to low-amplitude ground motion, brittle fracturing and faulting.
S	Poorly indurated sand and clay.	Chiefly massive bedding. Crossbedding developed locally. Thin horizontal lenses of clay in sand at places.	Probably moderate to slow percolation rates. Good surface drainage.	Perched water tables and springs occur above contact with underlying impermeable beds.	Where cemented with ferruginous material, 3- to 4-foot slopes stand vertically. Where not cemented, cut slopes tend to slump and retreat.	Good to poor for foundations. Where cemented, has cohesion and moderate shear strength. Where not cemented, shear strength is low.	Easily moved with power and hand equipment.	Rapid to moderate.	Insignificant.	Fair to good. Probably susceptible to some compaction and mobility. Generally susceptible to low-amplitude ground motion and faulting.
Cp	Slightly to moderately indurated clay and sand.	Nearly horizontal moderately defined bedding. In places beds at least 10 feet thick. Joints are abundant.	Slow percolation rates. (See table 2.) Good surface drainage.	Perched water tables and springs occur in the upper sandy part of this unit.	Cut slopes stand in 10-foot high nearly vertical slopes at a relatively high moisture content (24 percent). Generally 2:1 slopes are satisfactory on fill material compacted to maximum density.	Undisturbed material good for foundations. Moderate shear strength. Negligible swelling and consolidation observed in undisturbed samples. Noticeable swell pressures occur in reworked material. (See table 2.)	Easily moved with power equipment. Difficult to remove with hand equipment. Compacts well and has low compressibility when used as fill material.	Moderate.	Possible slight susceptibility.	Good. Generally susceptible to low-amplitude ground motion and faulting.
	Moderately indurated clay and sandy clay, glauconitic in part.	Nearly horizontal beds of medium thickness. Abundant conchoidal desiccation fractures at weathered outcrops.	Probably moderate to rapid percolation rate within weathered zone because of numerous fractures. Elsewhere rate is very low. Good surface drainage.	Unit is below water table. Perched water water tables and springs occur in sands that are underlain by clay.	Despite the moderate shear strength of this material (see table 2), the slope stability may be poor. The predominant clay mineral is calcium montmorillonite. Clay has high water content. On exposure, the clay desiccates, producing a large volume decrease. Thus, there is a continuous breakdown of a slope until a stable talus pile is formed. Clay is not suitable for fill material.	Weathered outcrops provide poor foundation materials because of numerous fractures and swelling activity that takes place with increased water content. In areas where the unit is concealed, it probably would provide good support for pile foundations. Has moderate shear strength and low consolidation. (See table 2.)	Requires power equipment to remove. High compressibility when used as fill material.	Rapid to moderate.	Insignificant.	
SCM	Poorly indurated sand. Well cemented locally.	Massive bedding, crossbedded.	Moderate to rapid percolation rate. Good surface drainage.	Unit is below water table. Perched water tables are common in sands that are underlain by clay.	Fair to good. Poorly cemented sand stands in vertical bluffs along the south bank of the Tennessee River.	Fair to good. High shear strength in cliff-forming sand.	Power equipment needed for removal.	Slow.	Insignificant.	Good. Generally susceptible to low-amplitude ground motion and faulting.
	Poorly indurated clays, silts, and sands.	Thin alternate horizontal beds of sand and silty clays. Sand occurs locally in pods or lenses.	Slow to moderate percolation rates. Lateral permeability better than vertical permeability. Good surface drainage.	Unit is below water table. Perched water tables are common in sands that are underlain by clay.	Slopes are unstable where undercut by streams and rivers. Ancient and modern slide blocks occur along the Clarks and Tennessee Rivers. (See pl. 1.). Thin-bedded clays provide low-friction slippage planes for large mass movement. The shape and size of slide blocks is probably related to jointing in part.	Good for foundations except where undercutting is threatened. Low to moderate shear strength. Probably is capable of supporting pile foundations where confined laterally.	Power equipment needed for removal. Hard to remove with hand equipment.			

[1] Shear strengths are based on compressive strengths given in table 2. Approximate values are arbitrarily chosen as follows:

Shear strength	*Compressive strength*
Low	Less than 5 tons per sq. ft.
Medium	5 to 15 tons per sq. ft.
High	More than 15 tons per sq. ft.