

THE UNIFIED SOIL CLASSIFICATION SYSTEM

Most manmade small- and medium-sized structures in Knox County are founded on unconsolidated material. Because engineers are primarily concerned with the physical properties of unconsolidated materials that directly affect engineering design and construction, they prefer to use the Unified Soil Classification System which stresses the engineering characteristics of unconsolidated materials. Soil or overburden as defined by engineers includes both the soil of the soil scientist and the weathered rock down to bedrock. Subdivisions of the Unified Soil Classification System are based on the size of particles and their proportions, physical behavior, and the amount of organic material. Descriptive terms such as clay, silt, sand, and gravel encompass different size ranges in the unified system than the same terms used by the Soil Conservation Service. The unified system does not distinguish between silt- and clay-sized particles, but includes these as particles less than 0.074 mm (millimeter) in diameter. Sand-sized particles range from 0.074 to 4.7 mm in diameter,

and gravel from 4.7 to 75.2 mm in diameter. In the Soil Conservation Service textural classification, clay is less than 0.002 mm in diameter, silt is 0.002 to 0.05 mm in diameter, sand is 0.5 to 2 mm in diameter, and gravel is greater than 2 mm in diameter. This difference in usage makes direct comparison of soil description by engineers and soil scientists difficult. However, reports by the Soil Conservation Service commonly contain tables that aid in comparing these systems. Based on unpublished data from the Tennessee Valley Authority and reports of the Soil Conservation Service (Roberts and others, 1955; Elder and others, 1959; Elder and others, 1961), the Unified Soil Classification System has been used to subdivide the unconsolidated materials in Knox County into six map units. The accompanying map, although generalized, is intended as a guide in the early planning stage of an engineering project. Actual site selection and construction design should be based on a more complete field and laboratory study.

GLOSSARY

- ALLUVIUM - Unconsolidated sediments deposited by streams.
- BEDROCK - Solid rock underlying soils and weathered rock.
- CALCAREOUS - A rock containing some calcium carbonate (CaCO₃).
- CHERT - A dense form of silica (SiO₂) that breaks into angular fragments.
- COLLUVIUM - Mixed deposits of soil material and rock fragments that have accumulated near the base of slopes through soil movement, slides, and local wash.
- DOLOMITE - A rock composed chiefly of calcium magnesium carbonate [CaMg(CO₃)₂].
- GRAVEL - In the Unified Soil Classification System a particle ranging from 4.7 to 75.2 mm in diameter.
- LIMESTONE - A rock composed chiefly of calcium carbonate (CaCO₃).
- LIQUID LIMIT - Moisture content of a soil at which the soil passes from a plastic to a liquid state. The moisture content is expressed as a percentage of the dry weight of soil.
- OVERBURDEN - Includes all soil and weathered rock, down to fresh bedrock, that can be easily removed by common excavation methods.
- PARENT ROCK - Rock from which the parent materials of soils are formed.
- RESIDUUM - Material derived from weathering of rocks in place.
- SAND - In the Unified Soil Classification System a particle ranging from 0.074 to 4.7 mm in diameter.
- SANDSTONE - A rock composed dominantly of particles ranging from 0.05 to 2.0 mm in diameter.
- SHALE - A rock composed dominantly of particles less than 0.002 mm in diameter.
- SILT AND CLAY - In the Unified Soil Classification System particles less than 0.074 mm in diameter.
- SILTSTONE - A rock composed dominantly of particles ranging from 0.002 to 0.05 mm in diameter.
- SOIL - As defined by the soil scientist, the unconsolidated material above weathered or hard rock that supports plant growth.

LAND RESOURCE ANALYSIS MAPS OF KNOX COUNTY

Knox County has a 1972 population in excess of 270,000. The Metropolitan Planning Commission (1968) projects an increase in population to approximately 360,000 by 1990. As the population grows and favorable areas like west Knox County approach their limit of development, more and more marginal land will be utilized. In order to utilize the existing land resources safely and efficiently, and in order to maintain a suitable environmental quality, knowledge concerning the physical environment and its limitations should be readily available to planners and decision makers. To provide some of these data, a series of maps, I-767, summarizing current knowledge about critical aspects of the physical environment has been prepared.

EXPLANATION

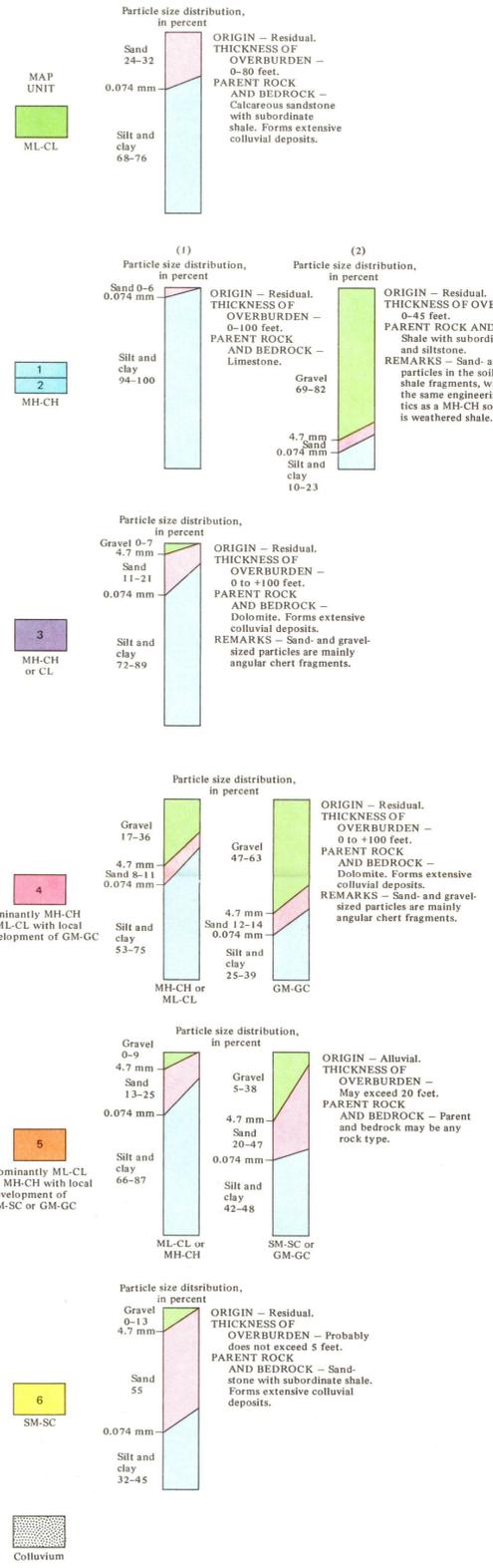
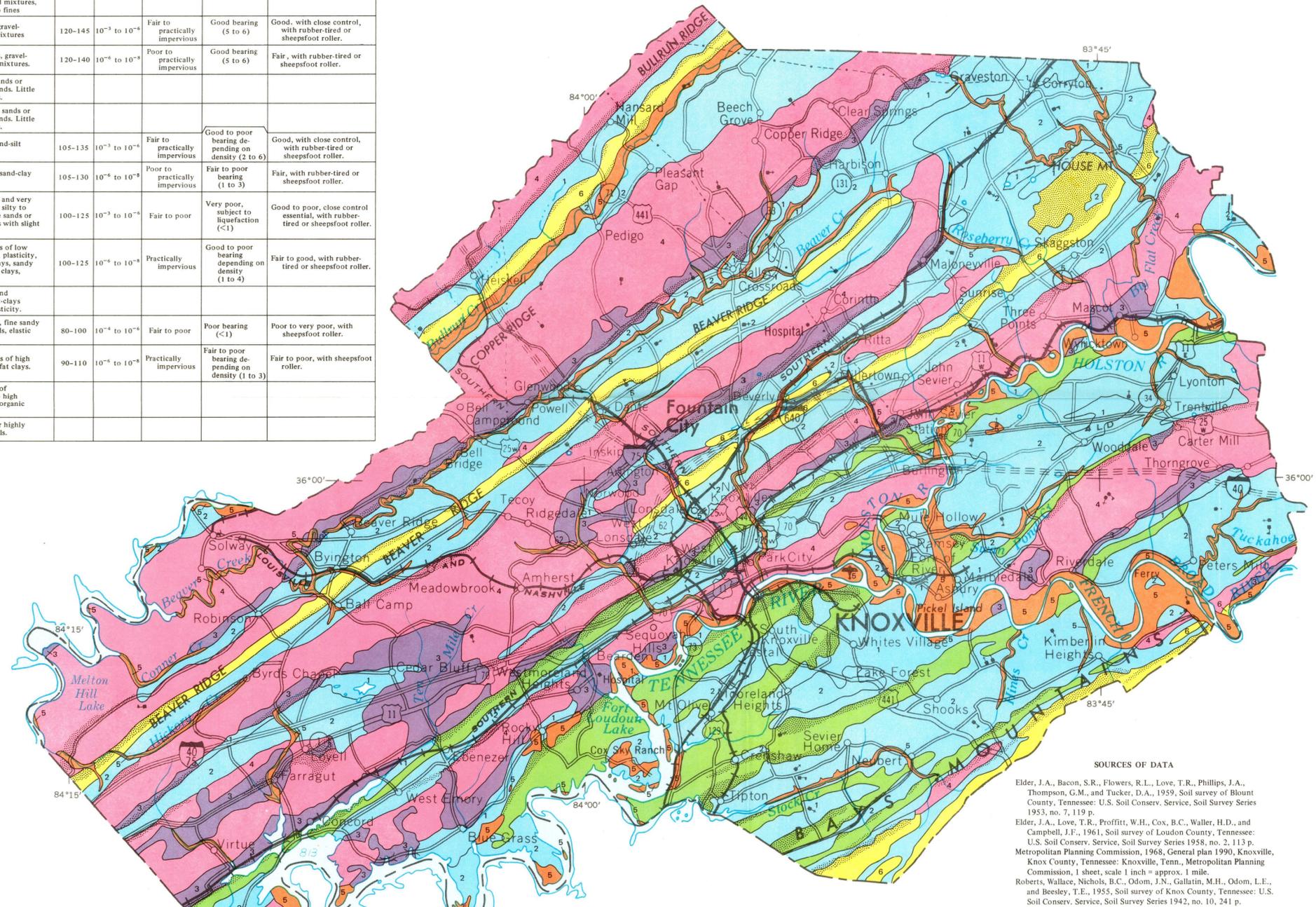
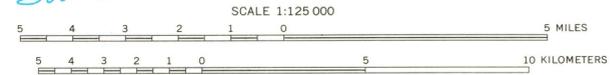


TABLE 1. - Unified Soil Classification System and other engineering characteristics of overburden in Knox County, Tennessee

UNIFIED SOIL CLASSIFICATION SYSTEM (from U.S. Army Corps of Engineers, 1953)		ENGINEERING CHARACTERISTICS (given only for units present in Knox County)						
Major divisions	Symbol	Description	Unit dry weight (lb/cu ft)	Permeability (ft/min)	Drainage characteristics	Value for foundations (tons/sq ft)	Compaction characteristics for fill	
COARSE-GRAINED SOILS More than 4.7 mm (No. 40 sieve size) (0.074 mm)	GRAVELS More than 4.7 mm (No. 40 sieve size) (0.074 mm) fraction is larger than No. 4 sieve size (4.7 mm)	GW	Well-graded gravel or gravel-sand mixtures, little or no fines.					
		GP	Poorly graded gravels or gravel-sand mixtures, little or no fines.					
		GM	Silty gravels, gravel-sand mixtures.	120-145	10 ⁻³ to 10 ⁻⁶	Fair to practically impervious	Good bearing (5 to 6)	Good, with close control, with rubber-tired or sheepfoot roller.
	SANDS More than 4.7 mm (No. 40 sieve size) (0.074 mm) fraction is smaller than No. 4 sieve size (4.7 mm)	SW	Well-graded sands or gravelly sands. Little or no fines.					
		SP	Poorly graded sands or gravelly sands. Little or no fines.					
		SM	Silty sands, sand-silt mixtures.	105-135	10 ⁻³ to 10 ⁻⁶	Fair to practically impervious	Good to poor bearing depending on density (2 to 6)	Good, with close control, with rubber-tired or sheepfoot roller.
FINE-GRAINED SOILS More than 0.074 mm (No. 200 sieve size) (0.074 mm)	SILTS AND CLAYS Liquid limit less than 50	ML	Inorganic silts and very fine sands, silty to clayey fine sands or clayey silts with slight plasticity.	100-125	10 ⁻³ to 10 ⁻⁶	Fair to poor	Very poor, subject to liquefaction (<1)	Good to poor, close control essential, with rubber-tired or sheepfoot roller.
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.	100-125	10 ⁻⁶ to 10 ⁻⁸	Practically impervious	Good to poor bearing depending on density (1 to 4)	Fair to good, with rubber-tired or sheepfoot roller.
		OL	Organic silts and organic silt-clays of low plasticity.					
	SILTS AND CLAYS Liquid limit greater than 50	MH	Inorganic silts, fine sandy or silty soils, elastic silts.	80-100	10 ⁻⁴ to 10 ⁻⁶	Fair to poor	Poor bearing (<1)	Poor to very poor, with sheepfoot roller.
		CH	Inorganic clays of high plasticity, fat clays.	90-110	10 ⁻⁶ to 10 ⁻⁸	Practically impervious	Fair to poor bearing depending on density (1 to 3)	Fair to poor, with sheepfoot roller.
		OH	Organic clays of medium to high plasticity, organic silts.					
HIGHLY ORGANIC SOILS	Pt	Peat and other highly organic soils.						



Base from U.S. Geological Survey, 1:250 000, Chattanooga, Corbin, 1965; Johnson City, Knoxville, 1966



SOURCES OF DATA

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ENGINEERING CHARACTERISTICS OF OVERBURDEN IN KNOX COUNTY, TENNESSEE

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Blackline copies of this map are available at cost on transparent scale-stable material from the U.S. Geological Survey, Washington, D.C. 20242