SOLUTIONS TO CHAPTER PROBLEMS

CHAPTER 1

(1-1) List should include occurrence of events such as earthquake, landslides, land subsidence and extreme settlement, cave-in from presence of sink holes (cavities), severe erosion.

(1-2) Igneous rock--formed from the cooling and hardening of molten rock.
Sedimentary rock--formed from the accumulated deposits of soil particles and certain organisms which have become hardened by pressure or cemented by minerals.
Metamorphic rock--formed where igneous or sedimentary rock have been subjected to the combined effects of heat, pressure and plastic flow.

(1-3) Texture of igneous rock is influenced by the rate at which the original molten rock cooled; rapid cooling results in a fine texture, whereas slow cooling produces a coarser texture.

(1-4) Typically, expect most igneous and metamorphic rock formations to be hard and durable; sedimentary rock formations can be sound and durable but compared to igneous and metamorphic rock more inconsistencies are expected because of presence/inclusion of foreign materials at the time of formation, or weak bonding and cementing.

(1-5) Color--rock types which are basic are dark while acidic types are light in color.

(1-6) Soil sediments may become hardened into sedimentary rock by great pressure or from the presence of minerals which cement the particles together.

(1-7) Shales are estimated to comprise approximately half of the rock exposed at the earth's surface and closest to the surface beneath the soil cover. Reasons relate to the surficial accumulation of sedimentary materials which are transposed to rock by geologic occurrences.

(1-8) Metamorphosis results when a rock material is subject to a combination of heat, pressure and plastic flow. These factors cause a change in the original rock minerals and structure.

(1-9) Generally, most igneous and metamorphic rocks are usually thought to be sound formations for foundation support, whereas certain types of sedimentary rock such as shale and some types of limestone can be poorer. There are exceptions to this generalization.

(1-10) Sinkhole topography is most prevalent in sedimentary rock formations such as limestones and shales because of inclusion of nondurable materials at the time of the rock formation, with underground erosion beginning and progressing in the weak materials due to flow of subsurface water.

(1-11) (I) The great volume of water taken by the glaciers reduced the depths of the major oceans (by approximately 125 to 150-m, or 400 to 500 ft), and a resulting effect was that ocean shore lines were located (extended) beyond the present-day limits , (ii) the considerable weight of the thick glacial ice sheets depressed (pushed down) the covered land surfaces (after the glaciers receded, the land tended to rebound/rise).

(1-12) Loess soils are wind-transported silt deposits whose stable structure can be broken down by water or vibration.

(1-13) A glacial terminal moraine would be expected to include soils of all sizes (from boulders or cobbles, to gravel, sand, silt and clay).

(1-14) The event(s) where a soil deposit is overrun by a large heavy glacier can cause the compressive loading associated with the development of sedimentary rocks such as the shales and the conglomerate-sandstone formations.

(1-15) Sand and gravel size particles rapidly drop from a flowing body of water when velocity decreases occur because of change of depth or change of direction, whereas smaller silt and clay particles remain in suspension in the moving water.

(1-16) For a given volume of flow, greater water velocities will occur in narrow, shallow streams. If the stream channel deepens or widens, the flow velocity decreases and the larger soil particles (e.g., gravel and sand sizes) which had been in suspension drop out. Smaller particles such as silt and clay will remain in suspension to be carried downstream.

(1-17) Natural levees occur where flowing rivers overflow their banks in periods of heavy precipitation and land surface runoff. The larger soil particles carried by the flowing water quickly drop from suspension when the overflowing water loses velocity as it tops the channel banks. Thus, natural levees typically consist of coarse soil.

(1-18) Sand or a sand-gravel mixture.

(1-19) If a terminal moraine dams up a valley area, the melt water from the receding glacier will be trapped in the resulting basin, creating a lake.

(1-20) If a natural basin exists in an area underlain by relatively impervious earth, and routes of water flow into the basin area, the water will be collected and stored, even though the created lake area is above the elevation of the natural ground water elevation.

(1-21) Old lake sites are frequently filled in with fine-grain silt and clay soils that have been carried by water flowing to the area. Coarse particles fall out of suspension where inflowing water (streams, rivers) enters the lake area, whereas the finer particles stay in suspension until reaching the quieter main body of the lake.

(1-22) Filled-in lakes often include fine-grained silt and clay soil particles which were deposited in an underwater environment; the result is a relatively loose soil structure with high water content, thereby creating a compressible soil deposit.

(1-23) Eskers are primarily coarse-grain soil deposits forming along locations where rivers flowed on or within glaciers. Drumlins represent deposits of till (mixture of soil sizes) dropped by the moving glacier; typically drumlins are in the form of long hills, the hills extending in the direction of glacier movement.

(1-24) Eskers, kames, lake deltas.

(1-25) Glacial till is typically a mixture of soil particle sizes. If the till had been deposited beneath the glacier, or at some subsequent time overrun by a glacier, the material is typically very dense and compact, and will provide excellent foundation support (an advantage).

(1-26) If sodium present during the deposition period is subsequently leached from the soil by percolating surface water or subsurface flow, the material loses strength and increases in sensitivity, and a less stable mass results.

(1-27) Typical beach deposits represent a good source of sand, a desirable material for construction fill and an important ingredient of portland-cement concrete and asphalt-cement concrete.

(1-28) (a) Residual soil formations are based on the characteristics of the parent rock; the variation/change from soil to rock (surface downward) is gradational/gradual. Even the well-weathered zones (virtually all soil, possibly including rock fragments, etc.) can show the fabric of the original rock structure. The texture or fabric of transported soil tends to be more consistent/uniform across the depth of each stratum with properties representative of particulate materials.

(b) Transported soil deposits are prevalent in temperate and cold climatic regions; geologic conditions associated with deposits of

transported soils include glaciation, severe earthquakes, severe weather (winds, rainfall, snow, temperature variations)

(c) Residual soil formations are prevalent in humid tropic regions, in areas absent of significant erosive forces to move/transport the newly formed soil materials (no glaciation, infrequent floods, etc.)

(1-29) Residual soil formation change gradationally (from soil to weathered rock to sounder rock) with depth; the soil zones that are weathered rock possess many of the textural and strength properties of the parent rock. Transported soils tend to be more uniform in texture/type through the depth of each soil stratum; strength versus depth variations are due to geologic and climatic conditions (such as effects of weight of overriding glaciers, erosion of soil overburden, wetting and drying, etc.) Properties of disturbed residual soils tends to be approximately similar unless the deposit was overconsolidated-compressed (such as from the previous weight of overriding glaciers, previous weight of now-eroded soil overburden, etc.) In clays, disturbance breaks cohesive bonds between particles to reduce shear strength and resistance to deformation (but some of the properties are regained with time).

(1-30) a. Expected areas of future earthquake:
--west coast of North America, Alaska
--west coast of South America, Central America
--regions of southern Europe, North Africa, and western Asia surrounding the Mediterranean Sea
--Japan, Indonesia
--east central Asia (China, northern India)

b. Expected areas of future volcanic activity:
--west coast of South America
--west coast of North America, Alaska
--Greenland/Iceland area
--Japan, Indonesia

(1-31) Throughout the asthenosphere some zones apparently are at a higher temperature due to channels of heat energy moving from the deeper mantle, and such high energy zones migrate-mix with the surrounding asthenosphere by the principle of convection.

(1-32) On a comparative basis, continental crust rock materials have lower specific gravity than ocean crust and the lithosphere-asthenosphere rock materials. Lithosphere and asthenosphere rock are similar, and heavier than ocean and continental crust. Ocean crust is intermediate to continental crust and lithosphere-asthenosphere.

(1-33) Where plates of lithosphere carrying continental crust converge, mountain ranges result as the crust rock is compressed accordion-style as