Problem Soils

(Left) Large cracks in soil indicate extensive drying and shrinking of expansive clay. This type of crack appears during dry seasons. *(Photo by Raymond C. Harris)*

(Right) Repeated shrinking and swelling of clay produces a characteristic "popcorn" texture. *(Photo by Larry D. Fellows)*

How Can Soil Cause Problems?

Damage to structures in Arizona is commonly related to soil characteristics, with expansive (shrink/swell) soils and collapsing soils causing the most problems. Cracking of foundations, walls, driveways, swimming pools, and roads costs millions of dollars each year in repairs. Severe or recurring damage can lower the value of a house or property. According to the American Society of Civil Engineers, about half of the houses built in the United States each year are situated on unstable soil, and about half of these will eventually suffer some soil-related damage.

The causes of soil expansion or collapse are related to the type and amount of clay minerals in the soil, conditions under which the clay originated, and original density of the soil. Clay minerals can form in-place by weathering of rocks, or they can be transported and deposited by water or wind. A change in the moisture content of a soil can cause clay minerals to swell like a sponge or to lose cohesion and collapse.

Expansive (Shrink/Swell) Soils

Many soils have a high content of clay minerals, some of which can act like sponges and absorb large quantities of water, causing the clay mineral to increase substantially in volume. When the clay mineral dries out, it shrinks. Clays that are high in sodium can expand as much as a thousand percent when water is added. Because soils are usually not composed entirely of clay minerals, expansion is typically much less than in pure clay. However, structures may be damaged when a soil expands by as little as five percent.

Expansion of clay minerals can cause walls and foundations to crack and roads and sidewalks to warp, in a manner similar to frost heaving. The first sign of expanding soil beneath a building may be misalignment of doors and windows. Another indication of soil expansion is when patio or driveway slabs buckle or move away from the house. Non-load-bearing walls, which do not have enough weight to resist the pressure produced by expansion, typically crack before load-bearing walls do.

Upon drying, expansive soil shrinks, forming large, deep cracks or "popcorn" texture in surface exposures.