

# RDA NEWS

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## Landslides in Pittsburgh and Surrounding Areas

Landslides or slope failures may be defined as the downhill movement of materials that compose a man-made or natural slope. These materials consist of rock, natural soil deposits, fill, or combinations of these materials. There are three principle types of slope failures: falls, slides, and flows. Falls involve the downhill descent of soil and/or rock masses primarily by free falling, tumbling, rolling or bouncing. Slides typically refer to failures in which the slope materials move along a well-defined failure surface. The fundamental characteristic of a flow is that the material moves downhill as a viscous fluid. Most slope failures in Pittsburgh and surrounding areas are slides.

Figure 1 presents an illustration of a typical slide. Usually the first indication of a landslide is the appearance of tension cracks in the upper part of the slope. These cracks are generally oriented in a direction perpendicular to the movement (usually parallel to the contour of the slope). Such cracks can fill with

water, which encourages water infiltration into the materials on the slope, weakens the slope materials, and increases the forces acting to cause a landslide. As the slide progresses, the slide mass takes on a tongue shape, and lateral ridges and transverse cracks can form. Mounding of material occurs at the toe of the slide.

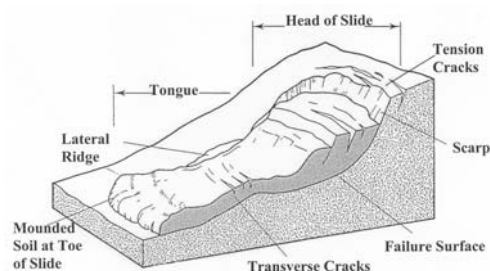


Figure 1: Typical Landslide for the Pittsburgh Area

### Causes of Landslides

Landslides are primarily caused by gravitational forces. However, a number of factors can contribute to initiate a landslide, including:

- geologic and hydrologic conditions
- construction activities

- topography
- climate or weather
- erosion
- changes in surface and subsurface water movement

The cause of a landslide can seldom be attributed to only a single factor.

Many landslides occur during the Spring in association with snow melt or periods of heavy rainfall. The addition of water to a slope increases the weight of the slope materials as void spaces in the materials fill with water. Simultaneously, the strength of the slope materials, such as fill and clayey soils, is reduced as water pressure builds within the slope. Water has been implicated as a principle controlling factor in many, if not most, landslides.

Landslides also often occur as a consequence of construction activities. Excavation into the toe of a natural or man-made slope

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reduces the forces resisting downhill movement of the slope materials. The placement of fill on hillsides to obtain level areas for building sites can surcharge the top of a slope and result in slope failure by increasing the weight of materials that act to drive or push the slope materials downhill. Development of properties on or adjacent to slopes can alter the surface and/or subsurface flow of water creating wetter conditions in slope materials and ultimately slope movements.

**Pittsburgh and Surrounding Areas**

The climate, geology and topography of Western Pennsylvania, West Virginia, and Eastern Ohio combine to produce conditions favorable to the occurrence of landslides. The sedimentary rocks in these areas, which consist predominantly of silty shales, sandstones, and claystones, weather to produce silty, clayey soils. The steep hillsides of the region are covered with relatively thin layers of residual or colluvial soil deposits. Residual soils are those that have been formed in place by weathering of underlying rock. Colluvial soils are soil deposits, usually found at the base of steep hills, created by downhill movement of soil

and rock fragments. Colluvial deposits of soils are only marginally stable because of the nature of their deposition; they have essentially slid to their present locations. Residual soils are generally stiff, but have a tendency to creep down slope under the influence of gravity.

Major slides in both of these materials are rare without disturbances from man. Because of the topography of the region, development for the construction of homes and businesses often involves excavating into a slope or loading a slope by placing fill. If not done following appropriate engineering/construction practices, large slope failures can occur that result in loss of ground and severe damage to homes, businesses, roadways, and other facilities.

**Litigation and Remediation**

Because of the severity of damage that can be sustained by properties or structures, landslides often result in litigation. The destruction caused by landslides to homes and property can be extensive. The cost of landslide remediation is often high (tens to hundreds of thousands of dollars). In most cases, little or no financial relief is available from local, state, or federal

agencies. The cost of landslide remediation is often too high for individual businesses or homeowners to afford. Consequently, litigation is often the only recourse to finance the repair of a landslide.

The repair of a landslide can involve the construction of retaining structures, excavation of the landslide and reconstruction of the slope, installation of drainage systems and/or other engineering solutions. Often, geotechnical investigations, including soil borings and laboratory testing programs, are necessary to facilitate the design of a landslide repair. If a repair is not properly engineered and constructed, movement of the slope may recur.

**RDA Experience**

Drs. Richard A. Bragg and Hugh L. Davidson of Romualdi, Davidson & Associates, Inc., have conducted numerous investigations of landslides for law firms and insurance companies. In addition, we are affiliated with GAI Consultants, Inc., a large civil engineering consulting firm. Their staff of geologists and geotechnical engineers provide additional expertise and resources.

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