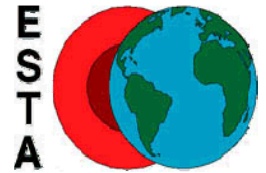




# Slope stability: Why do landslips happen?



The aim of these experiments is to investigate why slopes sometimes fail and cause landslips. Civil engineers (people who design buildings, roads, dams etc.) need to know whether it is safe to build on, or at the foot of, slopes before building starts. *Experiment 1* investigates the stability of different types of sediment, *Experiment 2* investigates the effect of changing friction along a slip surface.

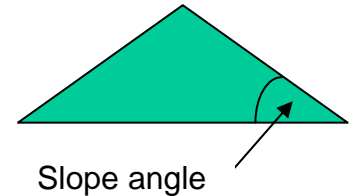
## Experiment 1: Investigating slopes made from different materials.

**You will need:** some containers with at least three different types of sediment (for example: pea gravel, washed/dried sand, builders sand, rock chippings), a plastic tray, something to measure slope angles.



(i) Slowly pour the sediment of your choice to make a hill in the plastic tray. When you think that the hill is as steep as it can possibly get (how do you know?) then measure and record the angle of the slope. Your teacher will probably discuss the best way to do this

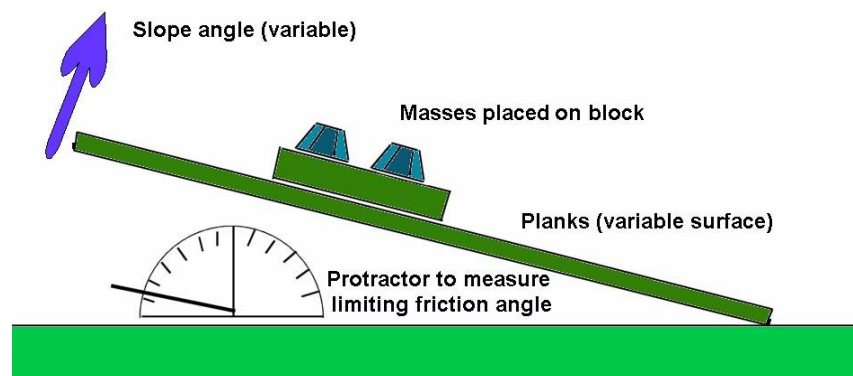
(ii) Repeat this for different types of sediment. Write your results in the table. Can you explain your findings?



<b>Sediment type</b>			
<b>Stable slope angle</b>			

## Experiment 2: Investigating slip surfaces.

**You will need:** a plank of wood with a special surface stuck to it, a wood block, suitable weights, sticky tack, and your angle measurer.  
*You need to work*



Place the plank flat on the bench with the weighted block on top near one end. One partner should carefully lift that end of the plank until the block *just* starts to move – and then *hold it still* whilst the other partner measures the slope angle. Try this for planks covered with different materials, making up your own table of results. You could also try investigating whether changing the mass makes any difference. Can you think of any other factors that might alter the stable slope angle? Write up your experiment with an explanation of your results.

## **Teacher/Technician Notes:**

### **1. Background:**

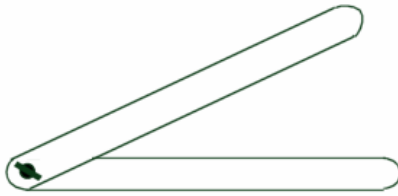
See web pages on Erosion and Transport of sediment.

### **2. Preparation for experiments:**

The experiments will most usefully follow some discussion and/or web research on the nature of landslides. In reality, landslides are complex phenomena, but the principles learned in these experiments have wide applications in physics and engineering as well as in landslide studies.

### **3. Apparatus & Materials:**

Apparatus & materials required are straightforward (see “What you will need”), except for a means to measure slope angle (below), and the planks required for experiment 2 (see details under Experiment 2 heading).



The simplest way to measure slope angle is to provide students with a simple set of callipers that can be used in conjunction with a protractor. These can be made from lollipop sticks or wooden spatulas hinged together with a small bolt and wing-nut.

### **4. Further points - Experiment 1:**

The aim here is to point out how grain affects the stability of loose sediments.

Note: an alternative, “fun” way to perform this experiment is to use breakfast cereals, e.g. Corn Flakes™, Rice Crispies™, Shreddies™, Oat clusters.

An interesting extension is to discuss (and possibly demonstrate) the likely effects of adding water to sediment such as sand. Most children will realise that dampening the sand will actually allow it to maintain almost vertical slopes (due to capillary action bonding grains together), but may not at first appreciate that adding excess water makes the sand run out very easily (due to the buoyant effect of water enabling grains to separate and move with ease).

### **Further points - Experiment 2:**

The aim here is to measure, in simple terms, coefficients of friction for different surfaces (based on an old Nuffield Physics experiment). Planks can be made from strips of plywood (or similar) about 8cm wide and 50 cm long, each with a different surface stuck to it using suitable glue (e.g. Copydex™). Possible surfaces include (apart from bare wood) a smooth nylon fabric, a rough denim fabric, coarse and fine sandpapers and so on.

*It is advisable to instruct students to use BluTack™ (or similar) to stick weights onto the wood block so as to prevent these sliding off with a crash!*

Again, the possible effects of wetting the surfaces can be discussed and possibly demonstrated – although the results can be surprising! It should be borne in mind that the main role of water in encouraging landslips is its buoyant effect (especially on clay mineral particles) – water in itself is not a particularly good lubricant.

### **5. Follow-up:**

This could involve further research on landslides or lead into further work on forces and friction.