

SUBSIDENCE DUE TO MINING

Purpose

This activity allows you to explore some of the effects of coal mining on the land surface. It simulates the effects of starting and then extending a mine along a coal seam.

Instructions

The wooden strip marked "A" represents the coal seam and pulling it out represents mining the coal. The rice represents all the rock and soil above the mine.

- 1 Check that the top of the rice is level.*
- 2 Slowly and carefully pull out the long piece of wood marked "A". Watch what happens to the rice. Stop when you have pulled it out sufficiently for there to be about 10cm of flat rice in the centre of the area of subsidence. Make a sketch. Measure the amount of subsidence, the angle of the slope and the distance of the surface affected either side of the coal face. Include these figures on your sketch.*
- 4 Place the strip of rubber with the "buildings" on it just ahead of the subsided area. Pull the wooden strip out slowly and note carefully what happens to the houses.*
- 5 Now describe what happens as mining advances under an area. Note where the buildings are likely to be under tension and where they will be under compression. Most buildings are able resist compression better than tension. so buildings in compressive areas may not show damage while those in areas under tension will.*

Teacher's Section

Requirements

Glass sheet 6mm thick 30cm by 100cm

Board 32cm by 102cm by 4cm

Wood 2cm by 4cm, one piece 102cm, 1 piece 30cm, 1 piece 27cm long

Wood as above but rebated 5.5 mm

Wood (coal seam) 2cm by 4cm with hole drilled to fit small piece of dowelling

10 5cm screws, 2 4cm screws

Supports for board, 2 pieces of wood 15cm by 4cm by 2cm

4 kg rice (Sand, however well sieved, gets between the glass and the "coal seam" and stops it being pulled out)

Strip of thin rubber 1.5cm wide 5cm long with 2 pieces of wood 1.5 by 1.5 by 5cm glued to it (see diagram c)

Making the apparatus (2 hours)

Glue or pin the wood without rebate around edge of board leaving a gap for the "coal seam" to be pulled out. Place glass on top. Fit rebated wood over glass and screw down. The fit between the coal seam and the glass must be tight. Screw on the supports at right angles to the frame. Place the coal seam so that it underlies all but 10cm as in diagram. Then fill the area behind the glass with rice.

Notes

Rock gives an angle of about 60°. Rice gives a much lower angle than that. It is best done as a class demonstration. Students can then come in pairs and do the measuring and repeat instruction 4 if they want.

A piece of wood which fits tightly over the top can be placed there and the apparatus turned upside down to allow the "coal seam" to be re-inserted without removing the rice.

It is also possible to vary the thickness of the seam by having a section which drops down as shown in the second photo.

Reference

Waltham, A. C. 1989 Ground Subsidence. Blackie London

Results

The area affected by subsidence is larger than the area of coal extracted. The maximum subsidence is the same as the thickness of coal but occurs over an area smaller than the area of coal extracted. The ground under buildings first undergoes tension, then tilts towards the area of extraction and then undergoes compression before levelling out.

Time

20 minutes plus time for questions

Cost

Glass £10. Rice £5

Side view

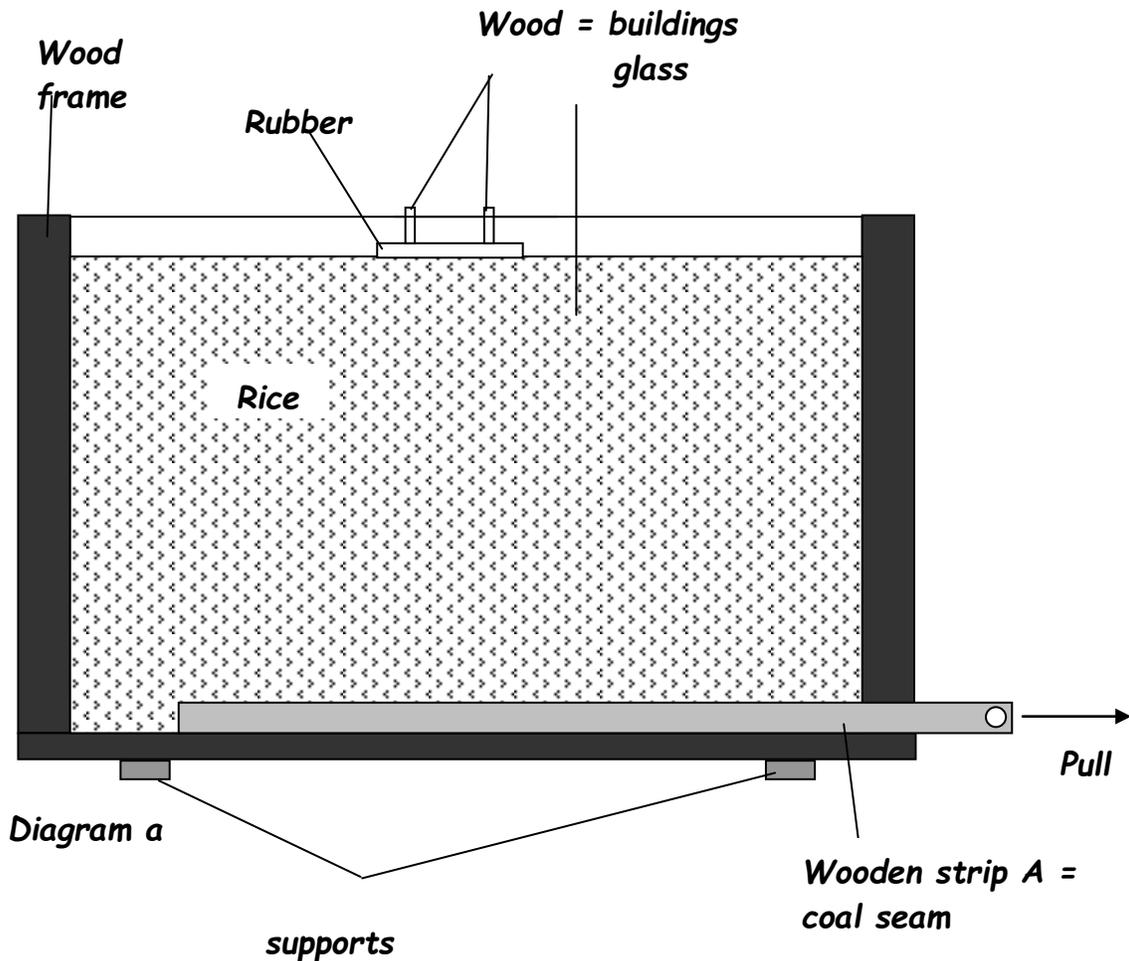


Diagram b
Top view

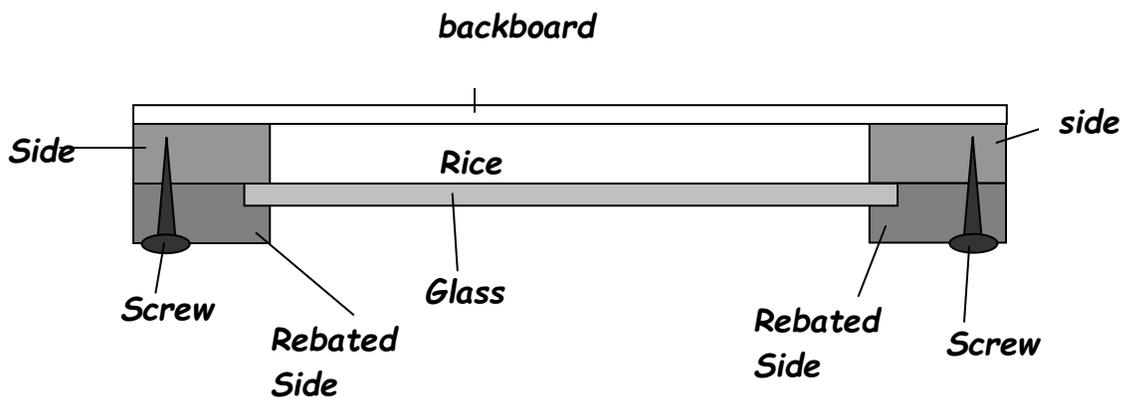
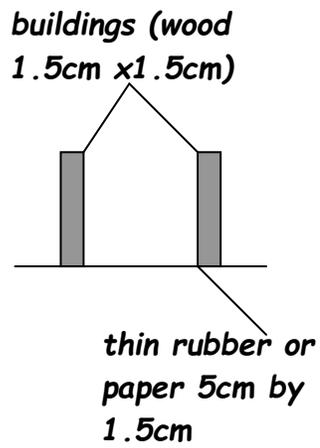


Diagram c





Apparatus for subsidence



Varying the thickness of the seam



Detail showing the tilting of buildings caused by subsidence