Activity card **7**

Linesperson

plug in 2engineering

Rigging overhead lines

Overhead lines are generally the cheapest and easiest way of transporting electricity. However, putting up an overhead line isn't easy. If the tension in the line is too high, then it may snap in a high wind. If it is too low, the line may sag and swing uncontrollably in high winds, it may also hang too close to the ground and be a hazard to people and vehicles.

What you need

- Two retort stands and clamps
- One small mounted pulley wheel if possible
- About 2 m of thick cotton/ thin string
- One 5 N spring balance
- A set of slot masses – the size required will need to be decided on when you start the experiment
- A desk fan
- A piece of card measuring 15 cm by 5 cm
- A golf ball size lump of modelling clay
- Sticky tape

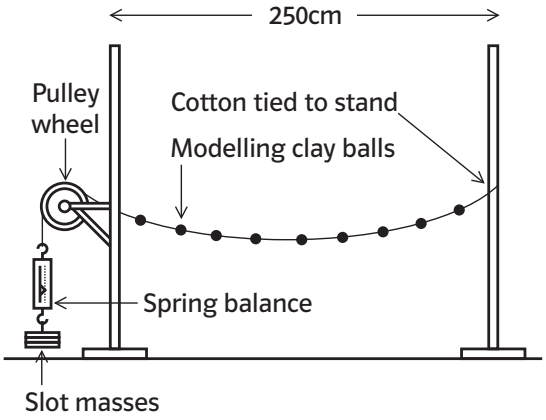
Investigating the effect of tension in overhead lines

Divide your modelling clay into 10 equally sized balls and, starting from one end of the cotton, measure 10 cm and then clamp them onto the cotton every 4 cm. This will give your 'cable' some weight.

Set up the apparatus as shown in the diagram below. If you don't have pulley wheels just hang your cotton over the smooth end of the clamp arm.

Start off by hanging a 10 g slot mass on the free end of the cotton. If the line touches the bench you may need to use heavier slot masses. If the line is pulled out straight, you may need to use lighter slot masses.

Find the amount of mass you need to put on each end of the line to get it to hang just above the bench. Record this mass, the reading from the spring balance and the height of the lowest point of the line from the bench.



Using your overhead line

Add some more mass to the end of your string and take the readings again. Try to do this about 7 or 8 times before the string becomes taught.

Now plot graphs of spring balance reading (tension) against mass and string height against mass. Once you have completed the readings stick the piece of card to the centre of the hanging 'cable' so that it will provide some air resistance. Repeat your readings with the fan blowing over your cotton.

Extension tasks

- What shape curves are your graphs?
- How does using the fan affect your results?
- Design a test to find the breaking tension of your piece of cotton and then use your graphs to make a prediction about what kind of conditions might cause your 'overhead line' to break.

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