TECHNIQUES, TRAINING & GEAR REVIEWS.

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UNDERSTANDING LOADINGS

Over the years I have seen many people confused over the way equipment is rated in terms of safe working loads, breaking strains, kilo newtons, kilograms, etc. So I would like to add some clarification and a better understanding of this important topic.

Most vertical equipment is rated in Kilo Newtons, either as a maximum breaking strain, Safe Working Load (SWL) or Working Load Limit (WLL).

A Kilo Newton (kN) is a measure of force.
1 kN = 101.97 kg.
1 kg = 0.00981 kN.

Gravity = 9.81 metres per second on earth. Other planets have a different gravity, so the amount of force applied will be different.

The SWL is calculated by taking the breaking strain of an object and dividing the result by a given Safety Factor (SF).

For example: a 1000 kg breaking strain divided by a safety factor of 10 gives a SWL of 100kg.

Safety factors are determined by industry standards. Each industry will apply of different SF depending on the product.

Manufacturers are no longer permitted to use SWL on lifting equipment due to legal reasons. Working Load Limit (WLL) is now the industry standard where breaking strains are not used.

Manufacturers often rate their equipment with a breaking strain only as there are too many variables that can affect the WLL.

Rope is a common example of a product given a Maximum Breaking Strain (MBS). There are countless types of knots all with different strength loss factors.

Bend radii also affect the strength loss, such as a rope running through a carabiner at a redirect or over an edge.

9 mm semi static rope has a breaking strain of approximately 21kN (depending on manufacturer) without knots. Knots can reduce the breaking strain by as much as 50%. Therefor a 21 kN rope with a 50% loss will be: 21 kN / 2 = 10.5 kN or 1070.7 kg.

If the person hanging on that rope weighs 80 kg, then the SF is: 1070.7 / 80 = 13.38 SF. This is more than adequate for a caver.

It's important to remember with ropes is that the SF is calculated AFTER the knot strength loss is taken into account, not before.

The Petzl Stop has a SWL of 150 kg with a minimum SF of 8, which is industry standard. Therefore the minimum breaking strain is 150 x 8 = 1200 kg or 11.77 kN.
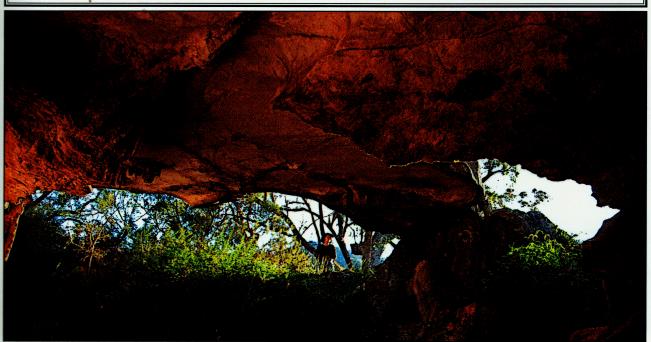
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SPELEO SCENE SECTION.

Photo 1: Christine Ellis at the entrance of Glass Cave, Wombeyan. Photo: *Ross Ellis.*