Comparison of Alpine and Cavers Butterfly Knots

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British Caving Association

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Training Committee sought advice on the differences of Alpine verses Cavers Butterfly knots.

A small set of tests were conducted using the Bradford Pothole Club's dynamic Rope Test Rig to determine what difference was immediately apparent when both knots were subjected to dynamic testing by arresting a falling test mass.

It is noted that Marbach and Tourte as translated by Alspaugh in the book Alpine Caving Techniques (ACT) states that whilst the Alpine Butterfly knot "is really only useful as a mid line knot", the false Butterfly knot (as they call the Cavers Butterfly knot) "will slip much easier and it is recommended for different use: it is ideal as a shock absorbing knot". Ashley's Book of Knots recognises the Alpine Butterfly knot as ABoK 331 & 1053 (though it calls it a Linesman Knot) but not the Cavers Butterfly knot.

A batch of test samples were made up from new but washed 9mm SRT rope with either an Alpine Butterfly or a Cavers Butterfly knot tied at each end, see figure 1. The set up was designed to simulate the normal usage of these knots in a traverse situation.

Three out of three Alpine Butterfly knot samples broke whilst four out of five Cavers Butterfly knot samples survived. Although the Cavers Butterfly knot samples which survived the tests saw higher peak forces, they also absorbed some 15% more energy without breaking when compared to the energy absorbed in breaking the Alpine Butterfly knot samples.

This is in line with the observation by ACT of the Cavers Butterfly knot being a good shock absorbing knot. The breakage point was where the active rope end (between the knots) entered into the knot. In all cases, the loops extended in length.

A second test was conducted with a single sample each of the butterfly knot tied midway within a lanyard made with sewn loop ends, see Figure 2, so the majority of the energy measured would have been absorbed by the butterfly knot. (Previous work has shown that sewn loops absorb a small fraction of the total energy absorbed by a rope sample when compared to knotted loops).

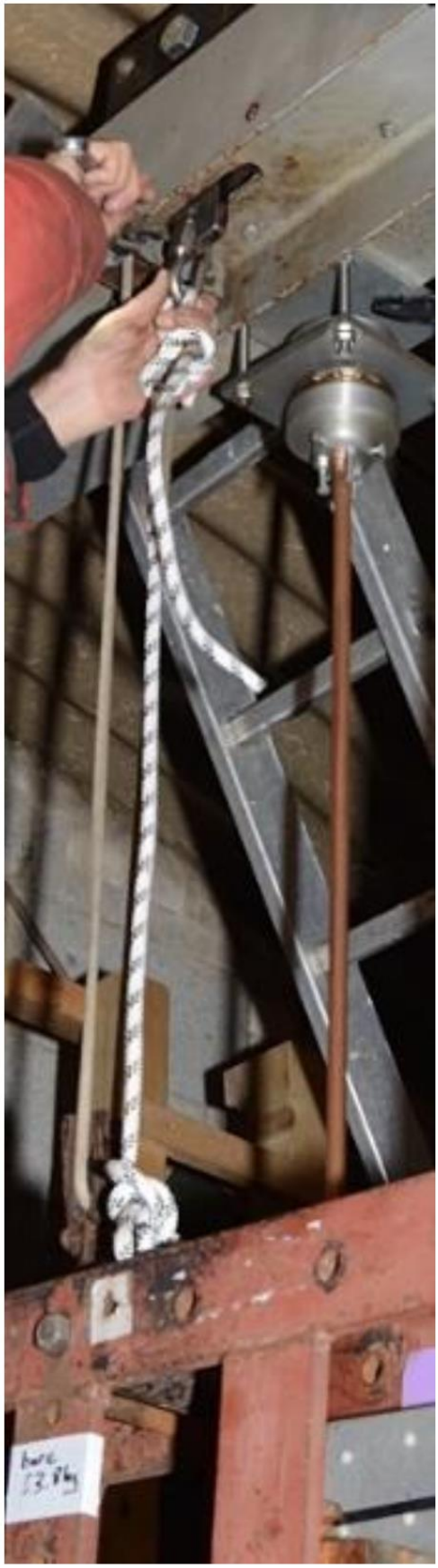

Figure 1: Set Up

Figure 2 Alpine & Cavers between sewn loops

This set up was designed to simulate using the butterfly knot to tie out a damaged section of rope when in use. The Alpine Butterfly knot sample broke in the knot with a peak force of 11.5kN with the sample consuming some 2000J of energy.

In significant contrast, the Cavers Butterfly knot completely undid by 'pulling out' with a peak force of 7.5kN with the sample consuming some 1000J of energy. For a typical caver of 100kg mass, that is equivalent to a fall of around 1m. This scenario would lead to the damaged section of the rope having to cope with the remaining energy of the fall arising from the additional distance that the caver was to fall.

There is also a contrast between the undoing of the Cavers Butterfly knot in this test set-up compared to the first test set up where the loops lengthened. Presumably this is down to the force being applied across the knot via both active ends as opposed to in the first test set up where the force is applied across one active end through the knot to the loop.

If a caver's butterfly is used in a traverse line, there could be a small benefit due to its better shock absorption, but the knot should be well dressed and both strands loaded across the traverse by good tensioned rigging. **The caver's butterfly is not recommended to tie out damaged rope** sections as shown in the tests above