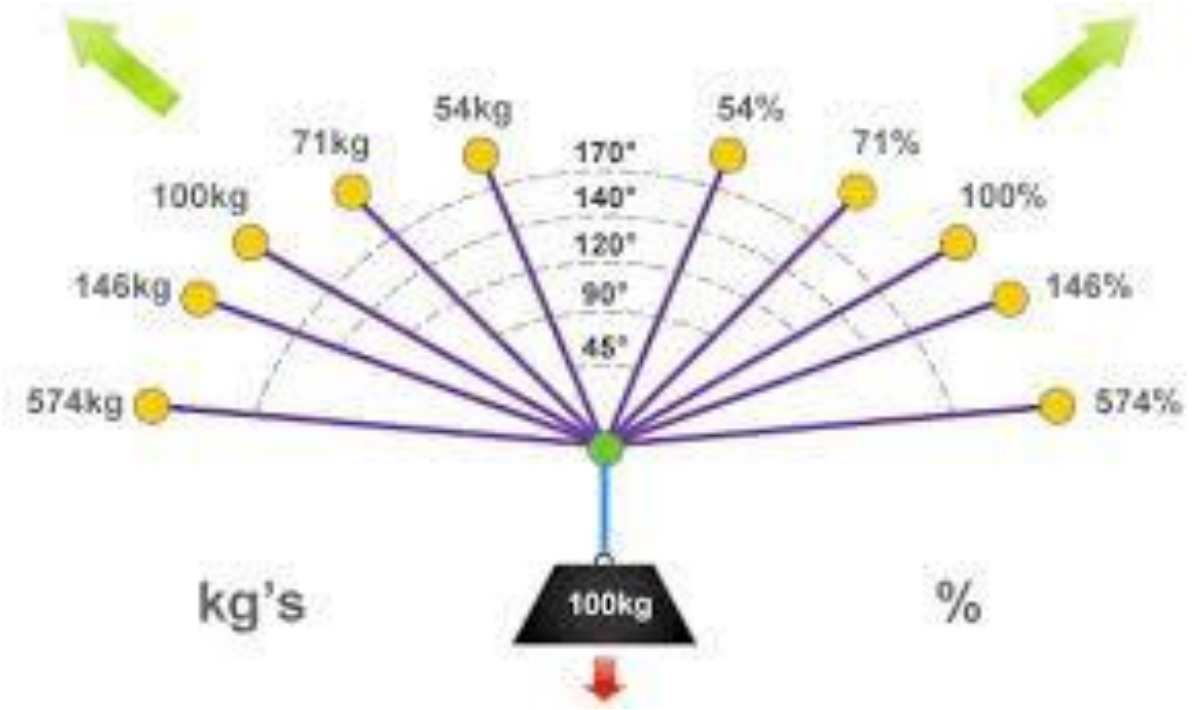
CIC Training For Tyroleans

At CIC Training level we are concerned with giving enough information to be aware of the forces involved when setting up and using a Tyrolean, with standard SRT kit and being able to pass this information onto club cavers. If a CIC wants to deliver the Tyrolean Module or be a Technical Adviser for Tyroleans it is suggested that they become a Trainer/Assessor for the Tyrolean module.

What information do we need?

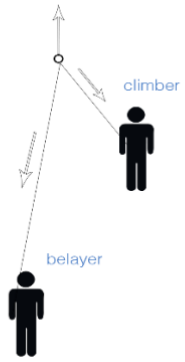
Awareness of the forces involved is important. The diagram below shows the relative weight change with angle change.



As a compromise we need to rig

- Tight to reduce sag, make it manageable to negotiate, **clear all hazards and avoid rub points**
- Not so tight as to create huge forces on the anchors and equipment involved
- It is very difficult to estimate the angle when the load is mid-rope
- Mountain rescue has historically worked on a group of 12 applying a steady pull with no mechanical advantage, so two people pulling 6:1 or 3 people pulling 4:1.
- NB the new Stop 2019 does not show use in tyroleans in the guidelines.

What forces are normal?



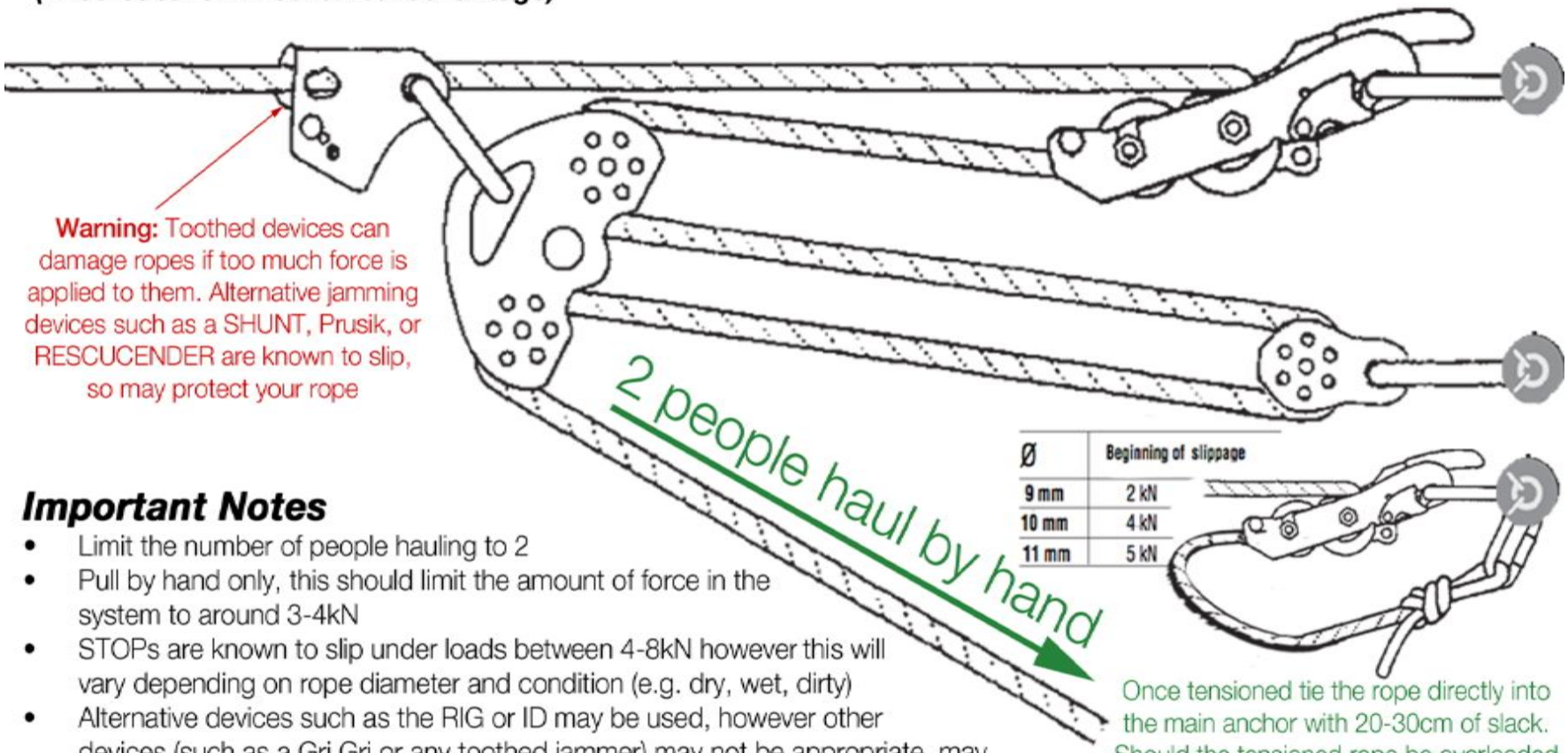
1kN on each side of the top rope leads to what at the anchor?

SRT tests – short pitch c2kN at the anchor with poor technique….

Factors of safety – the components (note: wet rope is 20% weaker)

equipment	Strength - EN standard (or tested/assumed failure)
Resin bolt anchors, axial load	**15kN**
Screwgate karabiner	**20kN**
Type A 10mm rope EN1891	**22kN slow pull**
Knotted rope (figure 8)	**15kN (assume 50% weaker in pract**
Sling	**22kN**
Stop, Rig and ID	**12kN**
Spit, axial load	**Nope**
Used wet knotted rope	**22kN x 50% x 80% = 8.8kN**
Jammer on rope	**4kN damages the rope**
Rope abrasion resistance lost	4kN

8.1. Haul system for rigging a Tyrolean (or hauling a heavy casualty)
(Theoretical 5:1 mechanical advantage)



Important Notes

- Limit the number of people hauling to 2
- Pull by hand only, this should limit the amount of force in the system to around 3-4kN
- STOPs are known to slip under loads between 4-8kN however this will vary depending on rope diameter and condition (e.g. dry, wet, dirty)
- Alternative devices such as the RIG or ID may be used, however other devices (such as a Gri Gri or any toothed jammer) may not be appropriate, may not slip under excessive loads, and could damage ropes
- Toothed devices (such as the Traxion) must not be used in place of the STOP in this illustration as they will damage ropes

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The following pictures show the forces involved using a variety of steady pulls with different systems.

3:1 system, peak load - two people pulling

3:1 settled down – two people pulling

4:1 system – one person settled down (peak reads 1.20kN)

4:1 system two people – after first tensioning (peak reads 2.89kN)

4:1 with central load – reading at anchors (was 1.69kN when first tensioned)

4:1 tensioned system after central load removed

Conclusions/other considerations?

- Using usual cave equipment it would be difficult to attain forces high enough to damage equipment due to slippage, stretch and ability with just hands to grip hard enough
- But – repeated tensioning could reach unacceptable loads…and using more efficient kit
- High take offs and egress reduces shock loads on the system
- Tensioned ropes are bad at coping with abrasion – so rub points are a huge negative – avoid or pad well
- Half threaded stops are very difficult to unload – use the fully threaded trickery method…
- As always, be wary of toothed devices as damage to the rope at 4kN due to slippage. Shunts slip at 2kN so can't get high tension with these