<u>ASAP Use for Arresting Highline Reeve Failure</u>

ITRS 2019

Albuquerque, NM

Craig McClure – The Crackerjack Group

In conjunction with Ronin Rescue

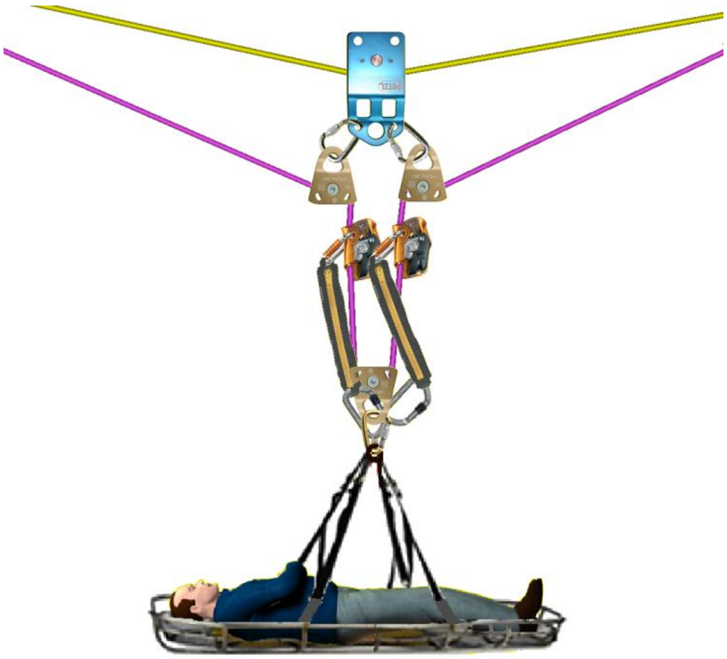
PURPOSE:

The purpose of this paper and accompanying presentation is to examine to potential functionality of replacing reeve line capture prusiks with Petzl ASAP. The question came to light following discussions of the technique being employed at GRIMP NA in 2019 and subsequent questions raised in online forums when photos of the setup were posted.

It is a commonly documented practice to use prusiks either side of the center pulley on a highline reeve. The prusiks are intended to prevent dropping the load in the event of a reeve line failure. The attendant must continually mind the prusiks during any movement of the load or the prusik opposing the direction of movement will grab and lock the system. Additionally the prusiks will loosen with movement and may not engage in failure if they are not tended to maintain proper tightness and friction.

Because of a documented unreliability of prusiks and the overtasking of the attendant in minding the prusiks in a complex system some users are replacing prusiks with ASAPS. This configuration was deployed at GRIMP NA 2019 and caused some confusion and discussion, as it is was believed to be an untested solution and could not be confirmed as functional.

This test series is intended to provide initial proof of concept in a controlled and documented situation. Should the results lean towards a positive result in favor of using ASAP in this manner it will require further and robust testing. The manufacturer does not endorse this use of ASAP. The manufacturer-endorsed method would be to use a separate vertical lifeline from the carriage and use the ASAP in accordance with instructions.



CONCERNS:

1) Does the ASAP effectively catch the load in a line failure with failure at any point between the ASAP and nearest anchor? Based on user experience and manner of function of the ASAP we believed this did not require testing.
2) Does the ASAP effectively catch a fall with a failure BETWEEN the ASAPs? This worst-case scenario would be failure at the center pulley, which leaves the least possible average distance to either ASAP and thus limited “run distance” for the ASAP to engage.
    a. How much rope length is required for “run” to activation?
    b. Because the line is tensioned it will retract to some degree. Does that retraction impact actuation?
    c. Does separation of rope sheath and core impact the ASAPs ability to grab? How much rope is needed below the device and does the ASAP action pull the sheath past the core and result in a catch failure?
3) Given testing of above questions, how much rope must be in service between the devices or between the device and pulley for reliable

actuation in a failure? Can this be quantified and does it result in a functional and reliable system?

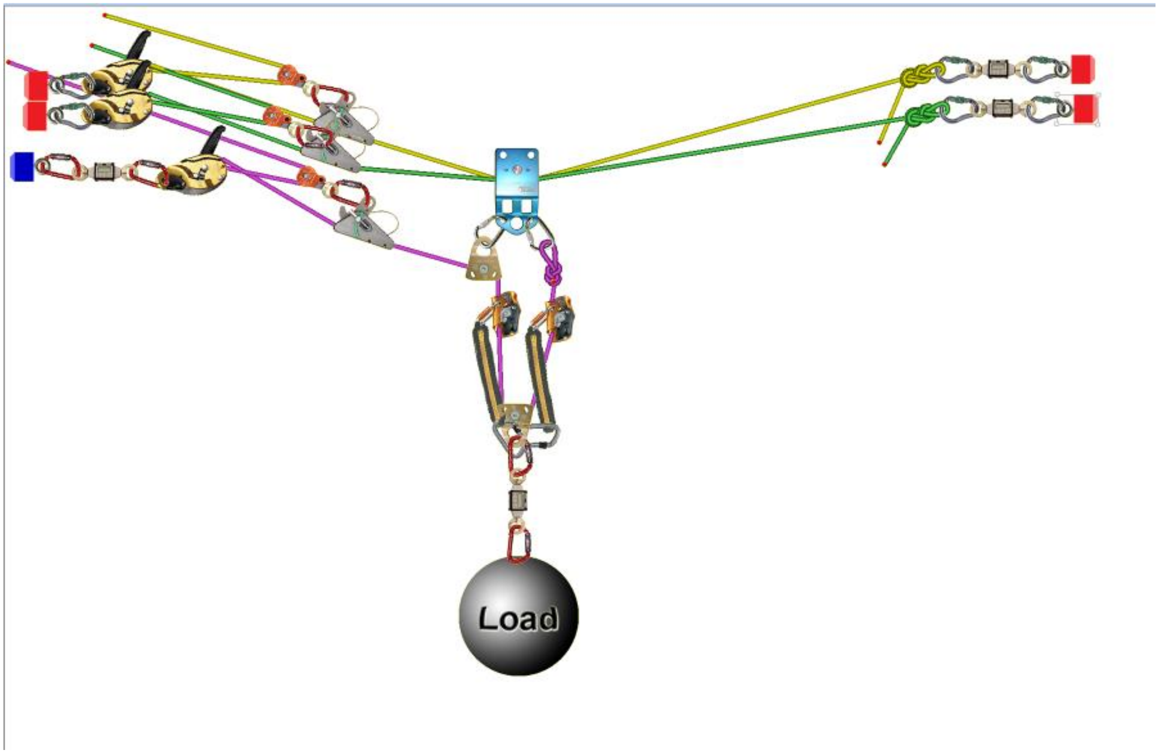
TEST CONSIDERATIONS:

We wanted testing to accurately reflect field use of the system. We set up a complete double track highline system with a Norwegian reeve. We selected a Norwegian reeve simply to reduce the amount of rope sacrificed with each test. We were concerned with the following criteria in the test setup.

1) Reeve line must be pre-tensioned in order to accurately reflect the reality of the tensioned line retracting when cut.
2) Load – accurate simulation of litter, patient, and rescuer. We loaded 200kg into a haul bag to reflect a commonly accepted unit of mass for an attended litter setup.
3) Controlled rope failure mechanism. We went old school with a brave man on a ladder with a razor knife duct taped to a broom handle.
4) Measurements
    a. Tension in each track line prior to and during failure
    b. Tension in reeve line prior to and during failure
    c. Force see at load attachment to reeve
    d. Slippage at any device
    e. Distance (rope run) at each ASAP
    f. ASAP lanyard deployment
    g. Subjective quality of the ASAP capture

TEST SETUP:

We built our test bed indoors at the Ronin facility in Vancouver BC. The test highline had an approximate span of 45 ft.
Trackline – Sterling HTP 11mm
Reeve line – PMI 11mm Extreme Pro (from a retired Tower Rescue Kit)
DCD- Petzl ID
ASAP Lock – unused
Lanyard – ASAP'Sorber Axess unused
Load Cells – CMC Enforcer (fast sample)
Load – 100 and 200kg sand



Given that the primary consideration in testing was the ability of the ASAP to catch a failure of the reeve line at the worst-case location we examined the following scenarios each at 100 and 200kg load:

A) The Norwegian reeve was described as short side (the section between the terminal end at the carriage and the pulley) and long side (the section between the load pulley and the redirect pulley at the carriage).

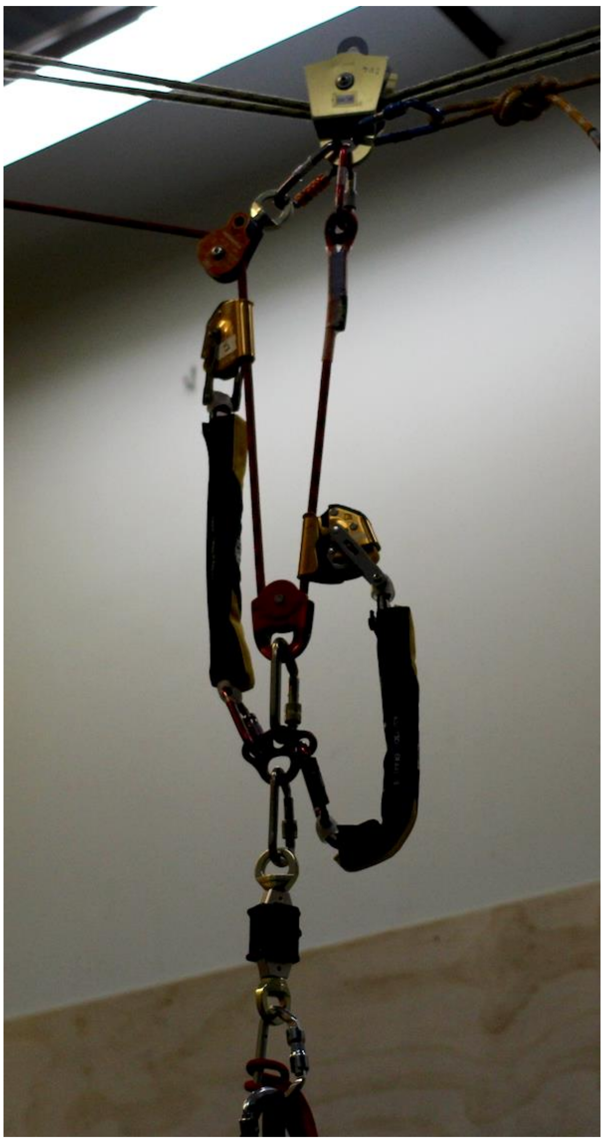
B) The ASAPs were placed in both high (ASAP pulled as high as the lanyard would allow – approx. 37-40cm) and low (ASAP allowed to ride above the load pulley).

C) All cuts were made just above the load pulley to most accurately simulate a failure at the pulley.

D) For 200kg loads the track lines were pre- tensioned to approximately 1.5kN each. For 100kg loads the track lines were pre-tensioned to approximately 1.0kN each.

TEST SERIES:

1) 200kg - ASAPs both low – cut to long side
2) 200kg - ASAPs both high – cut to long side
3) 200kg - ASAPs both high – cut to short side
4) 200kg - ASAPs both low – cut to short side
5) 100kg - ASAPs both high – cut to long side
6) 100kg - ASAPs both high – cut to short side
7) 100kg – ASAPs both low – cut to long side
8) 100kg – ASAPs both low – cut to short side
9) 200kg – prusiks substituted for ASAP



RESULTS:

We approached with a working with skepticism and the hypothesis that it was not a reliable system and found surprising results. Using ASAPs we never lost the load.

SETUP				CUT	ASAP 1				ASAP 2				SLIP			FORCES (kN)			
Test #	Mass	Tension Track	Tension reeve	CUT SIDE	ASAP 1 Height	Run Distance	Stop quality	Lanyard Deploy	ASAP 2 Height	Run Distance	Stop quality	Lanyard Deploy	Track 1	Track 2	Reeve	Track 1	Track 2	Reeve	Load
1	200kg	1.46/1.78	1.04	Long	on pulley	7cm	hold	2.5cm	on pulley	off	0	0	0	0	0	3.52	2.9	1.24	4.18
2	200kg	1.44/ 1.40	0.84	Long	37.5	3.5cm	hold	0	39cm	3.5	hold	0	0	0	0	2.12	1.86	1.2	3.08
3	200kg	1.52/1.36	0.74	Short	40	5cm	hold	0	41	2.8cm	hold	0	0	0	0	2.06	1.76	1.06	2.82
4	200kg	1.46/1.42	0.88	Short	on pulley	off	off	0	on pulley	2cm	hold	0	0	0	1cm	1.9	1.7	3.12	3.64
5	100kg	.94/1.0	0.46	Long	38.5	4.5cm	hold	0	38.5	3.5cm	hold	0	0	0	0	1.46	1.36	0.68	1.64
6	100kg	1.02/.98	0.42	short	40	5cm	hold	0	40	3cm	hold	0	0	0	0	1.4	1.32	0.64	1.56
7	100kg	.98/.96	0.46	Long	on pulley	7.5cm	hold	0	on pulley	2cm	held - almost off	0	0	0	0	2.24	2	0.98	2.66
8	100kg	.98.94	0.48	short	on pulley	5cm	hold	0	on pulley	6cm	hold	0	0	0	0	2.3	2.06	0.96	2.78
9	200kg	1.44/1.52	0.88	long	prusik	floor	off	n/a	prusik							3.32	2.94	0.9	lost

RESULTS: (CONTINUED)

1) With respect to our purpose as a proof of concept test with limited (8) samples we conclude that the concept of using ASAPs as reeve line capture devices has merit and deserves further and more robust testing. In fact, the only test (#9) where the load was dropped was when we reverted to a simulated attendant minding prusiks. This may point to greater reliability of fall arrest using the ASAP over more traditional and commonly accepted methods.

2) In test 1 the 200kg mass and both ASAP low only the short side ASAP caught and had a 2.5cm deployment of the lanyard. This is likely due to the greater fall distance caused by the slack lanyard and the larger test mass. Again in test 4 with both ASAP low did only one ASAP catch but without lanyard deployment. Based on limited testing it appears the allowing the ASAP to drift down creates greater arrest forces and less reliable ASAP actuation. All the other tests resulted in both ASAP actuating.

3) We did not find any negative effect caused by cut rope on the ability of the ASAP to catch. Contrary to our initial concerns, on test 7 we observed a success catch with the rope extending only to the midpoint of the ASAP wheel.

Complete notes, presentation, and video: info@thecrackerjackgroup.com

Thank you to:

Petzl NA, Rock Exotica, and Sterling Rope for generous equipment support.

Michel Goulet - Petzl
Brandon Lane – Rock Exotica
Steve Perry – Petzl
Matt Hunt - Sterling Rope
Mark Pfeifer – Ronin Rescue
Damian Anton – Ronin Rescue
Kevin Ristau – Ronin Rescue
Chris Meyer – Ronin Rescue –“cut man”
Katie Ristau - videography
Scott Pfeifer – photography
Ossum the Possum