

# Slackline-Webbing in UV-Light

*Slacktivity has conducted a UV-light test in a permanent midline that was up for 7 months over summer. 5 different webbings were used in the setup. The tested webbings were not in the shade of trees but in full exposure to sun light. In average the breaking strength decreased by 8kN in the mainline and 7kN in the backup.*

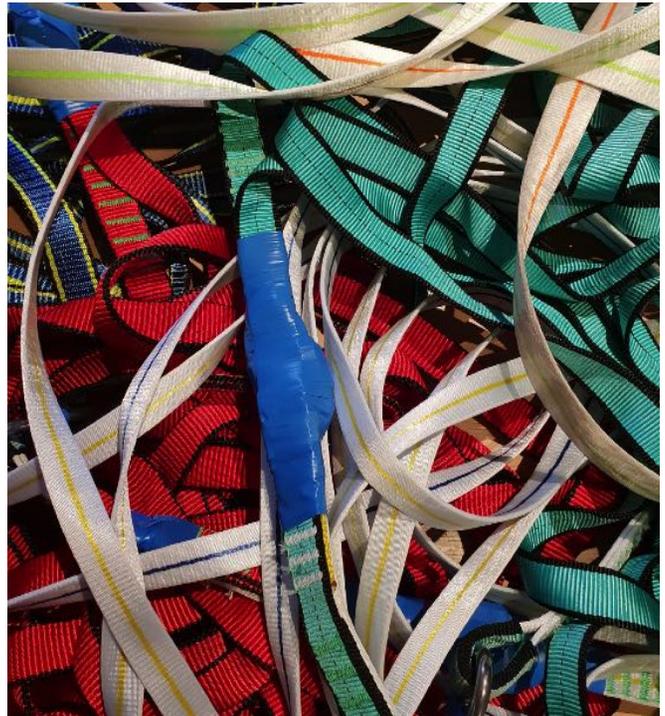
## Setup

From 13.03 – 8.10.2019 (almost 7 months) a 290m long midline has been permanently rigged and sometimes walked (about one session of 2 hours per week). In the middle of the slackline, there were 5 segments of 10m length each rigged on 5 different Slacktivity-webbings:

- ▶ Marathon (Polyester, Flat 3-layer Webbing)
- ▶ halfMarathon (Polyester, Flat 3-layer Webbing)
- ▶ pinkTube (Polyamide, Tubular Webbing)
- ▶ RedTube (Polyamide, Tubular Webbing)
- ▶ Y2K (Hybrid, Flat 3-layer Webbing, Dyneema Fibers covered by Polyester)

Mainline and Backup were rigged on the same webbing.

This 50m part was rigged in the middle of the line to avoid shade of the trees, so that the webbing was exposed to the sun as much as possible. The entire 50m-part has seen a similar amount of sunlight. The line has been hanging over summer – in winter the damage would probably have been much less. The webbing has seen about 1500 hours of sun. If it had been hanging the entire year it would have seen about 1950 hours of sun.



**Preparing the webbing for the UV-Test** Webbings have been connected with sewn Loops and 8mm quicklinks. Additionally the Main has been connected to the Backup with T-Loops

1500 hours of sun. If it had been hanging the entire

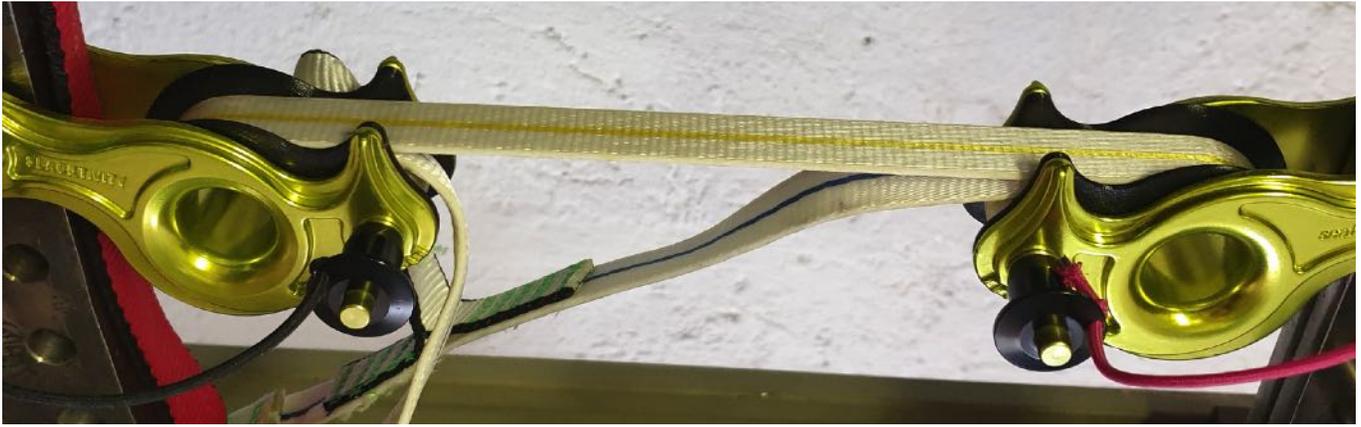


**The Location** In Bettswil there have been permanent midline rigs since 2015 - You can e.g. recognise them on Google Earth.

- ▶ Location: Bettswil, Switzerland
- ▶ Standing Tension: About 2kN – depending on temperature and humidity
- ▶ Surroundings: Above a cow-field. No traffic or city nearby. The closest city is Zurich in a distance of 25km
- ▶ Altitude: 840m above sea level

## Samples

A 30m long piece of each webbing-type has been cut into 3 pieces. A comparison piece, a Main and a Backup. This avoids differences between different webbing batches.



**Force Test** The webbing has been fixed in a seaHorse with a single wrap on both ends and pulled to failure.

## Test procedure

Each webbing has been torn apart at 5 different places. The weblock that was used to fix the webbing was a Slacktivity seaHorse on both ends. Sample length between the seaHorses was about 20cm (+/- 5cm). Pulling speed was 100mm/s.

## Results & Discussion of Breaking Strength

The Y2K-Webbing will be displayed in the table but discussed separately as the behaviour in loss of breaking strength was not comparable to the other webbings.

		Marathon	halfMara	pinkTube	redTube	Y2K
New webbing	Avg BS Comparison	34.8 kN	27.5 kN	24.2 kN	37.7 kN	31.3 kN
	MBS Comparison	33.1 kN	26.5 kN	23.5 kN	36.5 kN	30.5 kN
Used webbing	Avg BS Main	27.1 kN	19.6 kN	15.4 kN	29.6 kN	30.5 kN
	MBS Main	25.1 kN	18.4 kN	14.5 kN	26.6 kN	26.3 kN
	Avg BS Backup	27.9 kN	20.3 kN	16.4 kN	30.8 kN	26.0 kN
	MBS Backup	25.8 kN	18.2 kN	15.4 kN	27.5 kN	24.2 kN

**Breaking strength values** The MBS (Minimum Breaking Strength) was calculated by subtracting 3 standard deviations from the mean value.

An average absolute decrease in the breaking strength of about 8kN could be measured in the main line. In the backup webbing the decrease only was about 7kN.

Marathon		halfMara		pinkTube		redTube		Y2K	
Main	Backup	Main	Backup	Main	Backup	Main	Backup	Main	Backup
-7.8 kN	-7.0 kN	-7.9 kN	-7.2 kN	-8.7 kN	-7.7 kN	-8.1 kN	-6.9 kN	-0.8 kN	-5.2kN

**Loss of Breaking strength after 7 months in the sun** The displayed values are the loss of the average breaking strength.

No clear difference could be seen between Polyester and Polyamide webbings

The decrease of the MBS was slightly higher due to a higher variance and therefore higher Sigma3 in the breaking strength of the used webbings.

The relative loss in the average strength was clearly higher in the webbings with a low breaking strength. The redTube lost 21.6% and the pinkTube on the other end of the scale lost 36.1% in the main line.

## Main Line vs. Backup

In average the backup was 0.9 kN stronger than the main line. The backup was not tight. The reason for this difference is not clear. It could be:

- ▶ Difference of standing tension (0 kN vs. 2 kN)
- ▶ Slight shade that the main offers to the backup
- ▶ Traces of dirt and salt that the highliner induces to the main line

Marathon	halfMara	pinkTube	redTube
0.8 kN	0.7 kN	1.0 kN	1.2 kN

**Main Line vs. Backup** This table shows, how much weaker the Main line was compared to the Backup.

## Y2K

The Y2K-Webbing is a kern-mantel-construction with straight Dyneema-fibers in a polyester mantle. This polyester sheeth protects the Dyneema fibers from UV-light and also from abrasion. However, it also leads to a different breaking pattern compared to „normal“ webbings:

In new webbings the entire webbing will not break in a break test. Only the polyester sheeth will tear open and start sliding on the Dyneema core (Dyneema is an extremely slippery material). This tear will always happen in the area of the centre diverter of the weblock. Therefore we do not measure the actual breaking strength but rather the point at which the mantle tears open and starts sliding over the core.

In the measurements of the main line, in 4 of 5 cases the webbing really broke. In the 5 th case the same pattern as with new webbings happened. This was by far the lowest value measured, leading to a high variance of the test results. The average breaking strength only went down by 0.8kN. This can on one hand be interpreted that Y2K is a durable webbing for long-term rigs, but on the other hand we do not know how high the real breaking strength would be in a new webbing.

In the measurements of the backup webbing, the breaking pattern was comparable to the new webbing: the mantle tore open. In this breaking pattern, the breaking load was clearly lower compared to the main line. We do not know why this was the case. Possibly some new arrangement of the fibers under tension let them stick better to one another, maybe some additional dirt in the line led to this effect. Possibly it is also an unknown reason that has not yet been listed here.



**Breaking pattern of Y2K** The polyester sheeth is tearing open, but the Dyneema fibers are still intact.

## Sewn Loops

In the pinkTube, redTube and Y2K we intended to break test the sewn loop. However, none of the sewn loops of the used webbings tore apart – each of the webbings broke in the seaHorse. Only one original sewn loop per webbing type was in each webbing. So overall only 3 sewn loops had been tested. In none of the cases we found out the remaining breaking strength.

## Results & Discussion of Elongation



Prior to rigging the line, we have marked a 2m part on each webbing that we have measured again 24 hours after derigging.

In the backup basically no difference in length could be observed – possibly a slight decrease in the polyamide webbings. In the main webbings an increase of length could be observed. This increase was much more pronounced in the polyester webbings compared to polyamide webbings.

Interesting: After „massaging“ the 2m part of the pink-Tube, the increase of length changed from +6.7% to only +3.2% within 5 minutes. Also the webbing felt much less stiff after „massaging“ it.

One week later the additional length has gone down to 2.5% - from that moment on no measurable change occurred anymore. Therefore it seems like this is the amount of irreversible creep.

Marathon		halfMara		pinkTube		redTube		Y2K	
Main	Backup	Main	Backup	Main	Backup	Main	Backup	Main	Backup
0.6%	-0.1%	0.7%	-0.1%	6.7%	-0.4%	4.7%	-1.2%	2.1%	0.1%

**Change in Length** Measured 24 hours after derigging. Mainly the polyamide main lines showed an increase in length.

## Feel and colour of the Webbing



**Change of Colour** The two outer webbings are new. The two inner webbings were main lines - partly protected from UV radiation with tapes.

The backup of all webbings felt quite normal – almost not stiff. The main, however, felt different. The Marathon-webbings felt straw-like. But there was no huge difference to new webbing. Y2K showed the smallest difference between new and used. The main of the redTube and pinkTube felt really stiff after the test. With „massaging“ the webbing, most of the stiffness disappeared. Probably due to a rearrangement of the fibers when moving them to one another. The colours of the webbings have drastically faded over time - specially in the polyamide webbings. Change of colour can also be a warning sign to exchange the webbing.

## Comparison to other study

In 2018 the ISA has tested a pinkTube Type C that has permanently been used for 6-8 months for trick highlining. This webbing has been rigged in the woods and has therefore seen less sun. About 2 hours per day. At the same time that webbing has been sessioned much more and seen about 3000-5000 leashfalls.

Average breaking strength in the tests was 19.6 kN (compared to 15.4kN in this test) and the MBS has been at 17.9 kN (compared to 14.5 kN in this test). These results show that the exposure to sunlight most likely plays one of the biggest roles in the weakening of the webbings besides cuts and burns.