Nylon and Polyester Prusik Testing

Presented by:

Brandon Kharns

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Prusiks are a big part of the caver and rigger's arsenal. With the rise of polyester rope use, it's important to understand the change in behaviors of prusiks. This test explores the behaviors of prusiks when all combinations of polyester and nylon ropes are used.

About the Presenter

Brandon Kharns: Brandon is relatively new to the technical rope world. Brandon's rope background involves vertical caving, rope tech, SPRAT, and ropes courses. He graduated from Southern Adventist University in May 2008 and is currently seeking employment in the rope industry.

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This is a preliminary test to explore the behaviors pertaining to the rate and slippage tension points as well as the breaking points and modes of Prusiks when Polyester and Nylon ropes are used. 8mm Prusiks were used with 11mm ropes utilizing all four combinations of Polyester and Nylon. The 11 mm rope will be referred to as the mainline, and will be listed first. The 8mm Prusik rope will be listed second when Nylon/Polyester notation is used.

Testing Procedures

-Rope, Knots, and Hitches -

-Each 11mm rope, or mainline, was cut to a length of 10 feet. There was a Figure Eight tied at the end of each length with a tail of 2-3 inches. That comes to a total of approximately 36 inches, or 3 feet, (give or take 2 inches) of rope used for the Figure Eight knot, leaving 7 feet of standing line.

-Prusiks were placed one foot from the Figure Eight knot, leaving 6 feet of standing line

-Each 8mm rope was cut to a length of 5 feet, then tied using two double overhand bends with tails of 1-2 inches. The total amount of rope used for the double over hand bend was 18-20 inches, and added approximately 2 inches to the total size of the Prusik loop from the size of the knot itself, resulting in a 22-23 inch Prusik loop. When the Prusik was tied, 9 inches was used for the Prusik hitch, resulting in a remaining 13-14 inch loop.

-There was no significant change (greater than 10%) in the diameters of the 11mm rope above the starting Prusik connection point, or the 8mm Prusik rope in the non-contact areas.

-So as to avoid arriving at incorrect conclusions, the elongation of the ropes was not measured. This was due to many unknown variables, such as “jumping”, or uneven slippage of the Prusik, as well as the compression of the Prusik hitch when put under extreme pressure.

-All knots and hitches were tied by the author, and re-checked by both the author and Clem Akins for proper dressing, and uniformity. All knots and hitches were pretensioned by hand by the author.

-Every effort was taken to keep the rope in optimal condition. All ropes were new and unused in any capacity prior to the test. They were all stored in a controlled environment, and kept in plastic bags. They never came in contact with liquid substances. When in question, hands were always washed before handling of the ropes.

-Rope types- (as listed by manufacturer)

-Sterling 7/16 inch HTP, Polyester 32 carrier construction

-Sterling 8mm Nylon core, Polyester sheath

-PMI 11mm Sport EZ bend Nylon 16 carrier sheath

-PMI 8mm, all Nylon

-Testing Mechanism-

- For an anchor, a wrap 3 pull 2 with 12 mm rope around a large tree. Then a steel delta rapide, next a mechanical dynamometer, steel carabiner clipped in to the fig.8 knot of the 11 mm mainline.

-Triple-wrap Prusiks were used and were placed one foot from the Figure Eight Knot. Prusiks were tightened as much as possible and were given a light tug to make sure they were set, and gripped correctly.

-A winch was used for the slow pull mechanism

-The Prusiks were pulled until complete failure occurred.

Results and Data

As a preliminary analysis, only the physical results will be considered because they are the most solid initial data available. Below is a rough description of the method of final failure of all tests.

The final results, considering final failure point, were fairly consistent. Whenever two Prusiks were used of a similar kind, such as Polyester-Polyester, or Nylon-Nylon, almost always resulted in the cutting of the mainline without much slippage. When mixed systems were used, such as Nylon-Polyester and Polyester-Nylon, there was a consistent breakage of the Prusik after considerable slipping occurred. The Nylon-Nylon combination had one or two major slippages then gripped until breakage of the mainline occurred. The Polyester-Polyester reacted with a little more leniency while the mantle was bunching up, but not soon after, the same final result, being mainline breakage, occurred. The mixed systems seemed to offer a continuous grab and release until the Prusik became worn and broke.

Due to several anomalies that provided possibilities for flawed test results; this test points out the need for more in-depth testing of mixed systems. This tests suggests that mixed systems could be a more desirable alternative to a Nylon/Nylon system when great forces are being applied, such as a highline. The greatest possible determining factor, which is yet to be concluded, it that the Prusiks in a mixed system will most likely slip at a lower pressure at approximately 6kN and also possibly a lower failure point.

NOTES