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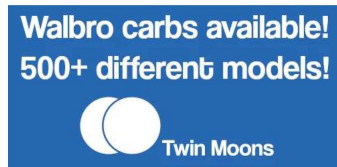
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Amsteel Blue Splicing Experiments

moray · Apr 18, 2008



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Apr 18, 2008

#1



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ArboristSite Guru

I had wanted to play with some Amsteel Blue for some time, partly because it is one of the strongest of all ropes, and partly because I thought it might make a good replacement bridge for my harness. Amsteel Blue is Samson's strongest version of high molecular weight polyethylene (HMWPE), the same stuff from which Spectra is made. It is stronger than steel, floats on water, and the 3/16 in. version is rated at 5400 pounds breaking strength.

Mine came from Redden Marine in Seattle (47 cents/foot, 20 feet, prompt delivery). It is very cool material. Here are some of the things I found from 10 days of testing:

It is **STRONG!**

It is slippery. I watched a triple fisherman's knot start unwinding under load until it got really tight; then it held.

It is very hard to cut with scissors. A very sharp pocket knife cuts it OK, but the fibers have to be held taut while cutting.

Ex. 1024
Crüzr v. Tethrd

It can take rough handling. In some of my experiments, the same piece was spliced, loaded, taken apart, respliced in some other way, loaded again, and so on. It showed much less degradation from this sort of treatment than a similar piece of polyester would have.

It is ridiculously easy to splice.

Splices are reliable. None of my splices, even ones considerably shorter than standard, ever pulled apart.

In the next post I'll describe splicing equipment, and then move on to the actual experiments.

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#2



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Materials

The wire fid is just a piece of 12 gauge electrical wire, about 18 inches long, with an eye soldered in one end. The white yarn is polyester from some old rope. (To give proper credit, the ideas here are very similar to those behind the Brion Toss Splicing Wand.)



Before inserting the fid, first lock the white snare yarn around the eye in a sort of girth hitch.



Next insert the fid where the tail is to emerge. Exit the rope where throat of the eye will be.



Loosen the snare yarn to make a loop, as in the first photo. Snare a few strands of the Amsteel Blue (AmB from now on), as shown in the last photo, pull hard on the snare yarns to tighten the captured strands of AmB hard up against the copper eye. Then pull the captured rope into itself to form the eye. Simple.



This very same wire fid, incidentally, works fine on much larger 12-strand rope, such as Tenex, but I am thinking of making a stiffer version with 2 or 3 copper wires soldered together.

Later I'll post info on the actual experiments.

[Reply](#)

Apr 18, 2008

#3

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Loop Experiment

Using AmB as a possible replacement for my saddle bridge was of some interest to me, so I needed to make something about 9 inches long, and I wanted to make it in place--no taking the saddle apart to install it. But you can't make a splice as short as you want. There is a minimum length specified by the manufacturer--Samson in this case--that is supposed to work. In the case of 3/16 AmB, the buried core consists of 8 inches of full-diameter rope terminated by a 4-inch tapered section to give a smooth transition between the thick spliced area and the undisturbed rope beyond the splice.

The absolute simplest way I could meet my spec and Samson's spec at the same time was to make a loop with a single splice, as shown below. This is the ONLY splice, in all my experiments that actually meets the manufacturer's spec.



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Unfortunately, the loop does NOT meet Samson's spec for splicing a continuous loop. This requires TWO splices. The free tail in mine should be about 12 inches long, and it should be buried in the top half of the loop in exactly the same manner as the bottom half was done. I have made plenty of loops in this manner, which are perfectly symmetrical, and they have been entirely reliable.

Nevertheless, I decided I would test my "half-spliced" loop. I rigged up the AmB loop with a 2-ton come-along stretched between two vehicles. To make the test as severe as possible, one of the pull points was attached just where the core emerged from the splice. If any pulling configuration was going to pull the splice apart, this was it. The picture below shows the loop loaded with a few hundred pounds.



This picture shows the other pulling point. Note the lower, spliced, leg is somewhat thicker at the left, but has tapered down to normal thickness before it reaches the screw link on the right. The end of the bury is probably about 1/2 inch from the screw link.



After the pictures were taken, the tension was taken up till one of the vehicles started skidding and I feared for the integrity of the come-along. I guessed the tension was at 3000 lbs or so. There was no sign when I inspected the splice later that there had been any slippage.

This was a surprise to me, as I didn't expect the unsymmetrical "half splice" to perform as well as a properly done symmetrical loop. If I were ever tempted to use the half splice, I would make sure the bury section was bent around one of the load points; this should help to lock the bury in place.

The rest of the experiments, upcoming, all involve spliced eyes, some of them very non-standard.

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Apr 18, 2008

🔊 #4



safeT1st
ArboristSite Operative

Interesting Work

Hat's off to you for your experimenting . Am I correct in understanding the splicing technique is simply pulling the line through the body of the line for the correct distance ? Please describe how you achieve the "tapered section" of splice . Would it be wise to somehow mark the line so you could tell at a glance if the splice had begun to retreat ?

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[🔗 #5](#)**moray**

ArboristSite Guru

safeT1st said: ☺

Hat's off to you for your experimenting . Am I correct in understanding the splicing technique is simply pulling the line through the body of the line for the correct distance ? Please describe how you achieve the "tapered section" of splice . Would it be wise to somehow mark the line so you could tell at a glance if the splice had begun to retreat ?

Good questions. I do mark the splices at the throat so I can see right away, after a load experiment, if anything has moved. For a finished splice meant for use, I stitch the throat more or less to manufacturer's specs. The stitching would have to unravel or stretch or break, which you could see, if the splice were starting to come apart. I have never seen it happen.

Yes, making the splice is as you describe. Once you have pulled the tail out at the insertion point, and the eye is the correct size, you smooth and stretch the cover from eye to tail so all slack is removed. Now mark the tail where it exits the rope--this will be the tip of the bury. Now pull on the tail and push the cover back towards the eye. Cut the tail off where you marked it. Unravel a few inches to make a taper (but don't disturb the main body of the bury). Say you plan to taper 3 inches. You could cut one of the 12 strands right at the 3-inch mark, another 1/4 inch longer, and so on, leaving the final strand uncut. Now go back to the eye and smooth the cover back towards the tail. The freshly tapered tail will get sucked back into the rope and you're done!

If you visit Samson's web site, there's a link there to their splicing section. Once there, pick Class II 12-strand eye splice to see the instructions (with nice diagrams) that apply to Amsteel Blue.

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[🔗 #6](#)**moray**

ArboristSite Guru

Side-by-Side Splice

In splicing short Eye and Eye slings, it is often necessary to overlap the tapered tail from one eye with the tapered tail from the other. When well done, the result is a nearly uniform rope diameter from one eye to the other. Even though I knew the 9 inches of my saddle bridge was way too short to accomodate 2 legal spliced eyes in 3/16 AmB, I thought I would go through the motions anyway. I soon discovered that AmB is roomy enough inside to hold 2 full-diameter ropes side by side! This is practically impossible with Tenex, and it offered up a new possibility for the short sling.

I made up a double-eye sling in which each buried tail extended the full length of the rope and emerged at the throat of the other eye. The distance between the eyes was about 5.5 inches, much shorter than the prescribed minimum of 8 inches. I went directly to the pull test without bothering to taper and bury the tails. My friend Jack and I hooked it up between two of his trucks and he started pulling while I took photos.



He towed his 5000-lb tree truck, brakes locked, about 5 feet down the driveway before giving up. One of the splices had slipped an inch or two before locking up, and the whole sling had become stiff. When I later massaged it back to normal pliability and pulled it apart, I encountered a surprise. The inner surface where two cores were crushed together was dead flat and mirror smooth. The cross section of each core, in other words, was a perfect semicircle. The outer surface of the semicircle was rough as a pineapple--the weave pattern of the cover had imprinted it like a waffle iron, providing, presumably, great gripping strength. The roughness can be seen in the photos below. Each photo also shows a bit of rope with a normal surface.

Ex. 1024
Crüzr v. Tethrd



Even though I was impressed that a much shorter than standard splice worked in this configuration, and even though the side-by-side splice was not hard to make, there were several things, engineering wise, that I didn't like about it, and I went on to better ideas. The next experiment was my favorite.

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Bury-in-Bury Splice

If the previous splice was a deviation from accepted practice, this one was even more so. Instead of burying 2 cores side by side, in this experiment one core is buried inside of the other.

As always, to make the tests really conservative, the splices are much shorter than manufacturer's spec. First I made an ordinary eye and left a long tail hanging out of the rope. By inserting the wire fid at the throat of the eye just formed, and running it right down the center of stuffed core, I could bring it out of the tail half an inch beyond where the tail emerged from the cover. Then the rope was pulled through to form the second eye. The pictures should make this clearer. The end result is that for the full distance between the eyes you have a rope in a rope in a rope--3 concentric layers of rope. All the strange asymmetries of the previous experiment are gone!

The load testing showed some initial adjusting as the cover and two cores stretched into some sort of equilibrium, like setting and dressing a knot, but then the splices held. This seemed like a really promising design.



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[↗](#) #8



moray

ArboristSite Guru

Bridge Test

A new example of a bury-in-bury sling was made up, this time for testing in a saddle bridge

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configuration. The first photo shows the sling being pulled by the tree truck. The sharp bend in the middle of the sling (upper part of photo) is very close to what a saddle bridge would experience.

I was sure it would not pull apart, but I wondered if some of the fibers at the outside of the bend might break. None did, but I would expect that to be the most highly stressed part of the rope. This same sling was then used in the next test.



How would this test bridge stand up to repeated flexing as the load point moved back and forth the length of the bridge? To test this, I attached a foot loop to each eye and hung the center of the sling over a suspended carabiner. By carefully adjusting the carabiner height, one foot would be resting on the ground when the carabiner had reached the throat of the opposite eye. When I would then step with the other foot, my full weight would be on the carabiner, and the sling would slide through the carabiner until the foot hit the ground and the other eye reached the carabiner. I did 400 teeter-totter steps in this manner, getting in my exercise for the day, and then examined the rope.



There were no broken fibers. The rubbed surface appeared lightly polished and slightly flattened. (The white yarns showing in the photo are loose ends from my hasty stitching.)

Intriguing as it was, the bury-in-bury splice was too hard to make to seriously consider for a bridge replacement. But I had not given up on the desire to have a simple eye of some kind to attach to the suspension rings of my saddle.

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Apr 19, 2008

#9



moray

ArboristSite Guru

Ring Splice

This next-to-last splice was an attempt to keep a simple eye for attachment to the saddle suspension ring, but add some friction that would help prevent the tail from slipping out of the short splice. The result was interesting, but the effort was misguided...



To make the splice, the rope passes around the ring, then enters the rope at the arrowhead pointing to "1st bury", then passes around the ring again, this time inside the rope. It emerges right under the black arrowhead and finally the tail is buried in the main rope at "2nd bury". After I admired it for a few moments, I realized the cover was highly distorted at the "1st bury" location, and any load would only tend to make it worse. Definitely not the first bad idea I ever had.

But this brought me to the final experiment: a hybrid of a knot and a splice. The Samson splicing specs are clearly designed to handle a worst-case scenario: an eye that is unsymmetrically loaded so the entire load is on the buried leg. That is why my very first experiment didn't pull the splice apart. But if one could guarantee the buried leg would never carry much load, then a very short bury would be sufficient to hold the tail in place. A big secure knot like a figure eight follow through or a triple fisherman's wouldn't need the tail to be buried at all. A really simple knot like an overhand would definitely require the tail to be buried, but even an overhand knot would greatly reduce the load on the tail. The idea is still to splice an eye, but the loop of the eye will now be involved in some sort of a knot around the ring.

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safeT1st

Apr 19, 2008

#10

**safeT1st**

ArboristSite Operative

Motivation

This looks like amazing rope you are working with . I think I will look at ordering a section as you did just to experience it myself . I have to ask you though ; what is motivating you to do this ? What advantage will there be to this 3/16 " bridge ? In my mind there has to be a substantial advantage to it otherwise not only are you trying to re-invent the wheel but you are treading into unknown waters .

Repectfully ,

safeT1st .

Reply

Apr 20, 2008

#11

**moray**

ArboristSite Guru

safeT1st said:

... I have to ask you though ; what is motivating you to do this ? What advantage will there be to this 3/16 " bridge ? In my mind there has to be a substantial advantage to it otherwise not only are you trying to re-invent the wheel but you are treading into unknown waters...

The short answer is: education and pleasure. No advantage, highly impractical. I could just buy a replacement bridge, like everyone else! But this way I learn lots of cool stuff, get to handle exotic materials, impress my friends with tiny little ropes that can lift a loaded truck, and so on. Most of all I like the mathematical and engineering aspects of this stuff--it's an endlessly fascinating puzzle. As to re-inventing the wheel, it is the first time I invented the wheel, and I am sure I get the same charge out of it as the first person who did it.

I hope you follow through and get yourself a few feet of AmB. I can't imagine a better rope for experimentation or for learning to splice. Good luck!

Reply

(WLL)

Apr 20, 2008

#12

**safeT1st**

ArboristSite Operative

I Agree

Yes , I agree with you describing learning new things and experiences . Seems like alot of people have little interest in broadening their horizons . I really need to get me a piece of that stuff .

Reply

Apr 20, 2008

#13

**moray**

ArboristSite Guru

The Knot

ANY knot would provide lots of friction to help secure the buried tail, but the knot configuration had to unconditionally guarantee that the whole arrangement could never become unsymmetrically loaded so that the tail was taking the brunt of the load. The girth hitch seemed perfect. Since the only point of the knot is to supply friction, and thereby remove load from the tail, how well does the girth hitch in Amsteel Blue on an aluminum ring perform?



The hammer in the photo weighs about 3 lbs. With my full weight (155 lbs.) on the other leg of the hitch, I was just barely able to raise the hammer. The next handy weight I found was a gallon of antifreeze, about 8 lbs. This I could not move at all. There is no need for great accuracy here; I conclude that the girth hitch gives a 30:1 advantage. One leg can resist a pull from the other leg with only 1/30th the force.

The final experiment is next...

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Apr 20, 2008

[🔊 #14](#)



moray

ArboristSite Guru

Testing the Hybrid

The first photo shows the "bridge" ready for testing. The other two photos show the individual eyes. They are intentionally quite different in size, just in case size was a relevant parameter. Both eyes were carefully marked where the core entered the cover.



The bridge and the come-along were rigged up between a car and a tree. This time the bridge was repeatedly loaded by backing up the car. These were dynamic loads of unknown size, but certainly in the range of 1000 lbs. and up. After 7 successive trials, the car was parked with brakes set, and a static load was applied with the come-along. At the point when the car just started to skid, the sling was left under tension for 5 or 10 minutes.

It was noted after the experiment that the sling was perhaps 1/2 in longer than before. Since there is very little stretch to HMWPE fibers, this stretch must appear as tension removes all the constructional slack in the splice. Neither of the two eyes had experienced any slippage whatsoever, and there was no apparent reason from this experiment to prefer one over the other. The small eye does have a longer bury, and that might be a reason to prefer it.

In conclusion, 3/16 Amsteel Blue turned out to be marvelous stuff--a pleasure to handle, easy to work with, and amazingly strong. I'm sure I'll find some use for the 9 feet I have left--a couple of pigtails for my ascenders, perhaps, or maybe a replacement bridge for my saddle. The most interesting thing in all this for me, though, was a better understanding of knots and splices. They are very close cousins, and a hybrid of the two, as in this last experiment, can do a job that neither could do alone.

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Apr 20, 2008

[🔊 #15](#)



ckliff

Addicted to ArboristSite

AS Supporting Member.

Correct me if im mistaken, but isnt AmB also known as True Blue? If so, the Sherrill catalog lists it as NON-spliceable. I recently purchased some 12-strand which is purportedly the only spliceable 12-strand on the market. Dont remember its name, it is white with orange & green specks.

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Apr 20, 2008

[🔊 #16](#)



moray

ArboristSite Guru

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You would think there are enough words out there that the manufacturers could come up with distinct names. True Blue and Amsteel Blue are very different. The reason True Blue isn't spliceable is because it is a solid braid. Some smart inventor could probably find a way to splice it using some interweaving technique similar to the method used with 3 strand. When the splicing gets too hard, I tie a knot.

[Reply](#)

Apr 30, 2008

#17



rbtree

Addicted to ArboristSite

AS Supporting Member

True blue can be spliced, but it isn't easy. Not by me....

moray, and anyone who wants to get great deals, contact me. My Seattle supplier gets me rope at about 60% off retail....for instance, 1/2 inch Plasma (equal of Amsteel Blue) for about \$1.80 per foot....and 1/2 inch double braid for maybe .60 coated...haven't checked lately, for the inevitable price increases.....

[Reply](#)

Apr 30, 2008

#18



Philobite

ArboristSite Member

Moray,

Thanks for your splicing pics and words.

I've been using AmSteel Blue 5/8" x 160' on a CAT D7/Hyster Winch to skid logs for over a month and so far I have to say I absolutely love the stuff. It's easy to drag out to set chokers and it's so light I can run rope off the spool by myself (almost impossible with wire rope bull line). I've already snapped two 1/2" wire rope chokers with it, so it's plenty strong.

I'll be moving the termination point soon so paying attention to splicing techniques will be helpful to me.

[Reply](#)

Apr 30, 2008

#19



pdqdl

Old enough to know better.

AS Supporting Member.

AS Supporting Member

Philobite said: ☺

...

I've already snapped two 1/2" wire rope chokers with it...

Since the rope is so light and strong, I would expect it to take the weighted end with the choker parts still attached and behave like a well aimed cannon at the back of the towing vehicle.

Isn't there a much greater tendency for the light rope to fly away under a broken load than would the heavy wire rope (away from the load, in the direction of the pull) ?

[Reply](#)

Apr 30, 2008

#20



Philobite

ArboristSite Member

pdqdl said: ☺

Since the rope is so light and strong, I would expect it to take the weighted end with the choker parts still attached and behave like a well aimed cannon at the back of the towing vehicle.

Isn't there a much greater tendency for the light rope to fly away under a broken load than would the heavy wire rope (away from the load, in the direction of the pull) ?

Actually, with the AmSteel Blue both times the wire rope chokers broke, the AmSteel rope with choker chucks and other heavy stuff at the end simply fell to the ground like a wet noodle. It jumped toward the CAT maybe two feet with 30 feet of rope out. Very safe. The rope does not store energy in the tension like wire rope bull line does. That's one of the reasons I selected it.

I've broken chokers with 5/8" steel wire bull line and the back of the CAT safety cage has the scars to show it. Very scary.

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