

RIGGING FOR REMOVAL¹

by Donald F. Blair

The intent of this paper is to briefly detail principles and concepts of rigging for tree and tree limb removal. This paper is intended as a reference tool for tree workers already skilled in tree removal techniques. It is in no way a substitute for hands-on instruction by skilled professional arborists. Rigging becomes necessary when free-falling is not possible because: a) a structure is in the way, b) sensitive landscaping would be damaged, or c) energized conductors or some other obstacle present a hazard.

Rigging

Rigging becomes desirable when:

A. Roping large pieces provide better control and greater efficiency than chunking down smaller pieces, ie: piecing back a limb on a hillside backyard. If you don't rope it, you might have to chase a piece through two or three yards and fish it out of a swimming pool.

B. Large pieces may produce an option in a more useable by-product than firewood. Sometimes taking down a tree in saw-log lengths provides saleable lumber. Black walnut, redwood and fir come to mind in the S.F. Bay Area, but you must have a known ready market. An lot of sawlogs have collected borers for several years waiting for a buyer before it has ended up as cordwood anyway.

C. Margin of worker safety is increased. In my opinion and philosophy, rigging's primary function is to decrease worker exposure to hazard. Consider this situation: you are faced with a long horizontal limb. You can chunk it down if you make 20 small cuts, hold on to them and throw them out 10' to clear an obstacle. It will take you 15 minutes to rig a tip tie and a tag line, but then you can take it in one cut. One cut means you have reduced your exposure by a factor of 20 to 1. Those are excellent odds. Also, even though those 15 minutes of rigging might seem like a long time of doing nothing with a crew, when done pro-

perly, the time invested works out to be less than the time needed to physically chunk out 20 pieces.

Rope

Rope design and construction for tree work has seen a revolutionary change since 1970. We used to do everything with 3 and 4-strand manila. Now, we use synthetic braids and 3 strands. Although the ropes of today are much stronger than the manila of yesterday, there are some specific rules for the safe use and handling of rope.

Selection. As noted, synthetic rope is much stronger, but Navy regulations require a 1 to 1 replacement ratio. A ¾" manila shall be replaced by a ¾" synthetic. Tree Work, being less restricted by regulation than the Navy might well consider down-sizing by no more than one increment as a reasonable down-sizing by no more than one increment as a reasonable standard. Example: ¾" manila could safely be replaced by a 5/8" synthetic. When down-sizing from a 3-strand manila (or even 3-strand synthetic) I would personally recommend down-sizing to a braided type construction. You'll get more strength and less stretch than you will from a 3-strand synthetic.

Braid. Highest strength to weight ratio, less stretch, easier handling, highest cost, greater abrasion resistance by 1 ½ to 2 times.

3-Strand. Durable, more stretch than braid, lower cost, heavier weight.

Personal Favorites. Stick with ropes designed, manufactured and warranted by the manufacturer for tree work. There are several good brands out, I like Arbor-Plex braid and New England's Multi-line for a 3-strand. Rope type? I prefer braided rope. Originally designed as winch lines, they work best on the lowering device.

Note. I'll say it again, don't judge a rope by it's tensile strength (that's when it breaks). One-half inch dacron (6400 lb) is stronger than 3/4" manila

1. Presented at the annual conference of the International Society of Arboriculture in Vancouver, B.C. in August of 1988.

(4,200 lb), but I stay close to a 1 to 1 on sizing. I will say that the 5/8" arbor-plex is a super rope for general use. We also use a lot of 7/8". We've never had a rope fail because it was overloaded. When in doubt, use a bigger rope.

Special Considerations. When doing critical rigging involving the use of two load-sharing lines on the same piece, be sure to use "SAME SIZE/SAME TYPE" lines. Don't mix a braid with a 3-strand. Reason: they stretch at different rates, so they won't share the load equally or as intended. In general, 3-strands stretch more. In practice, under maximum loading, the braid will do all of the work. When it breaks the 3-strand is all alone and it will fail too. Believe me, it's happened just that way. Two braids or two 3-strands is ok, just be consistent.

Load Lines. The work horses. Be careful not to slam-dunk weight into them. Five hundred pounds freefalling 5 feet will hit the rope with a real impact shock load of 3000 lbs.

Balance Points:

A. In the middle: hardest to judge, not recommended for the bigger stuff. It's too hard to get it right. Always practice new techniques on smaller non-critical branches and trees. Turning a medium-sized tree in an open area into a rigging exercise can be a good investment in time for when you really need to make the experience count. When rigging to the middle, be wary of heavy endweights of foliage.

B. Butt Hitch (only): tied near point of severance, tip will drop down. Climber has to be wary of getting hit.

C. Tip-tie (only): given the load line is crotched directly above the hitch point, butt will fall away and down.

D. Double Hitch: combining a Tip Tie with a Butt Hitch gives the most control and security. It is also the hardest and most time-consuming to rig. You also have to be mindful of the direction of swing on the Butt Hitch. If the crotch on the Butt Hitch is back of the point of severance, the limb can come at the climber like a battering ram.

Tag Lines. These are the reins to control the work horses. While load lines carry the weight, proper use and placement of Tag Lines will control swing. Without them, a log in motion can become a potent battering ram.

KNOTS: Good knots to know are:

1. Bowline
2. Running Bowline
3. Running Bowline with a half-hitch
4. Clove Hitch
5. Clove Hitch with 2 half hitches
6. Clove Hitch with 2 half-hitches and a Figure Eight in the tail. Use this combination on heavy rigging. The Figure Eight will jam the half-hitches and help prevent slip-through.
7. Timber Hitch. I only recommend this knot for cinching up a block rope. Do not use it for lowering limbs or skidding logs.
8. Truckers Hitch
9. Figure Eight
10. Sheet Bend

You can do a lot of work with combinations of these knots. Remember: In general, a knot will weaken a rope by 50%. Bowlines even more. A good Rule of Thumb for calculating PRACTICAL, SAFE WORKING LOADS is to:

A. use only 10% of the published tensile strength, and

B. cut that figure in half to allow for the use of a knot(s).

Crotch

Natural. They're great when they are strong enough and in the right position. When selecting a crotch, make sure it is "U-shaped" enough to keep from binding and strong enough to handle the job. On a removal (only) it is a good idea to cut the bark out of the crotch so the rope will run on sapwood. Otherwise, you may find that the rope will cut a groove into the bark and jam solid. Also, the extra heat generated can fuse the rope into something that looks like a brown candle at best and cause a melt-through failure at worst.

Rigged (False). Now we are rigging. False crotching gives you the option of hanging your ropes where you need them. Classic False Crotches were always of rope. With synthetic line, rope to rope contact generates too much friction/heat and can lead to premature aging of both rope and climber. False Crotches consist of the following components: block (pulley) and slings.

a. *Block (pulley).* They come in all sizes and shapes. Be sure to select one that is rated well

above the ropes you will be using with it. Learn to use, rely upon and love blocks. They will save you money on rope, make you money on your job, and give you a measure of precision control and security that you wouldn't think possible without using them.

B. *Slings*. You've got to hang the block to the tree with something. Sewn slings come in sizes from 1" to 3" and larger. Working strength can range from 500 lbs as a choker to more than 5000 lbs. You can also rig a sling out of eye-spliced rope. Use a rope that is larger and stronger than your bullrope. **SAFETY NOTE:** If you're using a rigging rope fashioned out of an eye-spliced 3-strand to hang a block with a timber hitch, be careful not to take wraps into the spliced section of rope. A sudden jolt can cause the splice to pop apart and fail.

When selecting a sling, keep shock-loading stress in mind and specify one that can handle the unexpected. I recommend that all rigging components exceed the rating of the strongest rope employed. If your weakest link in design is the rope, then you can be more assured of dealing with a known factor of performance.

Control

We've got the rope selected, we've rigged a false crotch in the right place with a sling, next we have to control the weight. A human body check jammed in a crotch works, but its messy and painful.

Wraps. There is a better way, that way is called wraps. Human flesh doesn't hold much weight. It has a tendency to burn and bleed, making the rope slick and even harder to hold on to. Take a wrap or two or three around a tree trunk or truck bumper made of pipe. A round object to take wraps against is called a bollard in Naval terms. The minimum ratio is 3 to 1. So, if you were going to take a wrap around a pipe bumper (bollard) with a 3/4" line, the minimum diameter should be 2 1/4".

Whatever you use, the key is the ability to hold and release at will and with precision.

Compared to a Lowering Device, the biggest drawback to taking tree wraps is the difficulty in taking up enough slack to avoid stretch.

Lowering device. The Lowering Device is such a remarkable tool that it has been a basic compo-

nent of many of our rigging practices. Some of our techniques are impossible without it. With the Lowering Device, you can be precise with your wraps, take up all slack and even raise a piece above an obstacle.

We've got things pretty well in hand now. We didn't have a good enough crotch so we rigged a block to a sling for a false-crotch. We've selected a bull-rope large enough to do the job and in good condition. We have double-checked to see that it is long enough. We opted to use a Lowering Device instead of taking trunk wraps. We're gaining control. Are we ready to cut yet? NO!

We've got a problem. If we butt hitch, the tip is going to hang up in some lower scaffold limbs that we still need for later work. If we tip tie, the butt is going to smash into the side of the house we're trying to avoid. We'd better add another line. Now we're Double Hitched. Ready yet? NO!

We've got the weight under control, but we don't have any control over swing. Add a tagline and take a wrap. Are we ready? Maybe!

Cut. What kind of a cut are you going to make?

A. Top Cut all the way

B. Top Cut with Undercut

C. Face Cut and Back Cut

D. Undercut all the way (with a tiny top cut for safety)

It is understood that this whole rigging scenario is dealing with a horizontal limb.

Top Cut. Creates a hinging effect that causes the tip to drop as the cut opens up. Depending upon the type of tree and whether or not it is alive, dying, dead or rotten, it is going to react in one of the following ways:

1. Break over nicely and hold on a hinge. With ash or pine, that hinge might be a bundle of splinters.

2. Break over nicely until the hinge lets go and a long barber chair tear rip along the standing section of limb. On elm, it could tear all the way to the ground.

3. Snap off without warning. dead oak. **KNOW YOUR WOOD.**

Top cut With an Undercut. The old 1-2-3. It won't tear, but it can "cock" a tremendous amount of energy if it hangs up and holds without falling free in one smooth motion. If that happens, be prepared for a pretty good jolt when it let's go.

The old tree toppers in logging used to let them hang up on purpose just so they'd have a good ride to brag about after work. Also, using an axe and a handsaw made it harder to get a clean let-off.

Face Cut with a Back Cut. Even on a horizontal limb, you can make use of a notched undercut and then a top cut. You'll gain a controlled drop into the face and a more or less predictable letoff.

Undercut. When using a crane or the Lowering Device, the Undercut Only works very well. With all slack taken up, the rigging operator lifts the piece up off and away. Done properly, there is no drop, and no pinching on the saw. You have to be extremely careful when working with a crane. Too much tension can cause the piece to barber chair off unexpectedly, fly into the air with more lift and greater force than anticipated. EASY DOES IT. A "tiny" kerf laid into the top of the limb is a good idea to insure a clean lift off.

Hardware Glossary

We've touched on the basics. Herein is a list and definition of some special tools that come in handy.

Carabiners. Oval, spring-loaded snap devices that are common in rock-climbing and mountain rescue work. They come in a range of sizes and tensile strengths. They come in locking and non-locking configuration and carry ratings all the way up to 15,000 pounds. They are handy for hanging blocks, tools and sliding down a High-Lead.

Come-Along. Handy for adjusting tension on a Speed-Line, or working as a hold-back on a leaning trunk.

Figure Eight Descender. Used in mountaineering as a rappelling brake, we use them for holding tension on a High-Lead and holding a tag line. You can also use one to ride down a bull rope.

Ground Anchor. Rig a Speed-Line to a ground anchor while on the job if nothing else is handy to tie to.

Hand Saw. Don't leave home without it.

Mesh Eye Goggles. Helps to keep saw dust out of your eyes. While you're at it, protect your head (hard hat) and ears (muffs or plugs).

Throw Line. Handy for setting a tag line or bull rope in places where wise men fear to tread.

Wedges, plastic, falling. These little plastic devils are cheap insurance. They'll unstick your saw and help to lever over a leaning trunk. When tree falling, cut the bark away where you're going to wedge. You'll maximize the advantage. Otherwise, you'll crush a lot of bark and not gain much lift.

Plywood. More cheap insurance. Use it to protect windows, cars, plants, lawns, roofs. We've even cribbed up over a flower bed. It saved a lot of clean-up.

Tires. They make a really good mat for reducing the impact of a falling tree trunk.

Old Car. The ultimate falling tree catcher. I met a Euc Man from Michigan who makes a regular practice of towing a junked car to his job site and dropping a big elm on top of it. He gets a lot of publicity and he says it works really well.

Strategy

Doing things in the proper sequence can make the difference between an "easy", efficient job and a back-breaking, no fun, asslosing proposition. In general, it's a good plan to:

A. Brush out the tree first. Be sure to leave good crotches and limbs as you go for rigging the next section. Resist the urge to knock out the easy stuff just to get a bunch of brush on the ground. If it's easy now, it'll be easy later. It also might make something else easy instead of "purt-near impossible". Keep ahead of your plan.

B. With the exception of clearing a path for a clear shot, starting in the top and working down is generally a good plan.

C. Consider using a High-Lead to facilitate brush removal. I've referenced the High-Lead several times but have not gone into rigging details. It's hard to explain without diagrammatic sketches and if you attended the seminar this manuscript was handed out at, you saw the High-Lead in action. If you didn't attend, you should contact us about doing a seminar in your area.

D. Keep up with debris disposal. Unless you need some brush for an impact cushion or camouflage, keep the site clean. Ropes catch badly in loose brush, people trip and fall, and brush with heavy wood thrown on top is hard to move.

Summary

There is no reason for a tree removal to cause damage or injury. Hazard assessment is the subject of another manuscript. All of the principles detailed herein apply to sound, predictable wood.

Keep your rigging high and directly vertical or design the swing away from the climber. Use a tag line(s) to catch and control backswing.

Know what you'll need before you get there. Bring a little extra. One less rope or one less man can mean the difference between a disaster and a good job.

For years, I didn't think that there was any money in removals. You don't get any repeat business from a removed tree. In general removals go to the lowest (dumbest?) bidder. Big wood is hard on the men and equipment. I developed this opinion twenty years ago when all we had to work with was manila rope and an occasional wood block. In 1971 I lost a night's sleep worrying about the next day's wreck down. It was a huge, heavy, creekside sycamore with about 70' of 4' diameter trunk angling directly over the

peak of the house beneath. We had no blocks, no slings, didn't know about a High-Lead, couldn't afford a crane. My saddle was an old Davey "nutsmasher". All I could see in my mind's eye all night long was a log in the living room. That morning, the tree looked just as bad as I remembered it. I couldn't risk it. I knew there had to be a good way to do it safely and efficiently, but at the time I didn't know what it could be. I walked away from the job and into a lifelong interest in design of rigging and removal.

Fifteen years later, I wouldn't thing twice about taking that job. We'd High-Lead the brush over the house into the street; Block the wood down through slings, pulleys, take our wraps on the Lowering Device. Equipment with know how and experience does make a difference. It's the true mark of a professional.

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Abstract

MITCHELL, J.H. 1988. **Your best future customer is your current customer.** Am Nurseryman 167(9): 123-127.

All marketing efforts are limited by time and resources. That's why any smart marketing plan concentrates on the smallest number of potential customers that will produce the largest amount of profitable revenue. Research has shown that the most likely potential customers are actually current customers, those who are already buying a company's services. Defining marketing as "getting new customers" is one of the most common marketing mistakes. Taking care of current customers is a key element rarely included in marketing plans. Another marketing mistake made many companies is becoming obsessed with growth for growth's sake. This obsession plagues many companies that trade class for mass. Too often, this means adopting "operation scramble" as a way of life. Customer satisfaction is, above all, the key to future success. It's the source of unlimited referrals, and, most importantly, it provides the easiest target audience for marketing efforts. The rewards are frequently immediate, and they're always cost effective.