Safe Griphoist Practices

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During the past several seasons, many Appalachian Trail crews have discovered how to move heavy loads along cables kept tense by Griphoist winches. Alternately described as "zip lines," "slack lines," "high lines," "high wires," or "sky lines," these systems are used to zip pails of gravel to a turnpike as well as to lift 400-pound stepstones 100 feet up a steep slope for a new staircase on the Trail. All of these various systems contain four basic components:

1. One or more Griphoist winches with wire rope.
2. Towers or trees for vertical supports.
3. Anchors--usually trees, stumps, or boulders.
4. Accessory hardware--nylon slings, snatch blocks, shackles, ***etc.***

In order for any of these "high-line" systems to work well and to prevent the failure of any of these four components, the following safe practices should be employed.

1. Only use wire rope that is in good condition and meets specifications for the Griphoist machine being used.

The wire rope provided with Griphoist machines has a breaking strength that five times the pulling ability of the winch. The maximum tension for the machine is reached when the safety shear pins in the handle stem break. It is unlikely that a Griphoist rope could be broken during routine tensioning, even if the shear pins were to let go, since the maximum 2,000 pounds winch tension is much less than the 10,000 pounds of tension needed to break the rope.

Conditions that could lead to breaking a cable would include:

- Disabling the safety shear pins in order to use a longer handle.
- Using damaged or inferior wire rope (see "Wire Rope: A Few Hints," ***The Register,*** December 1994).
- Shock loading--such as in pulling a large rock off a cliff while it was attached a tensioned skyline.

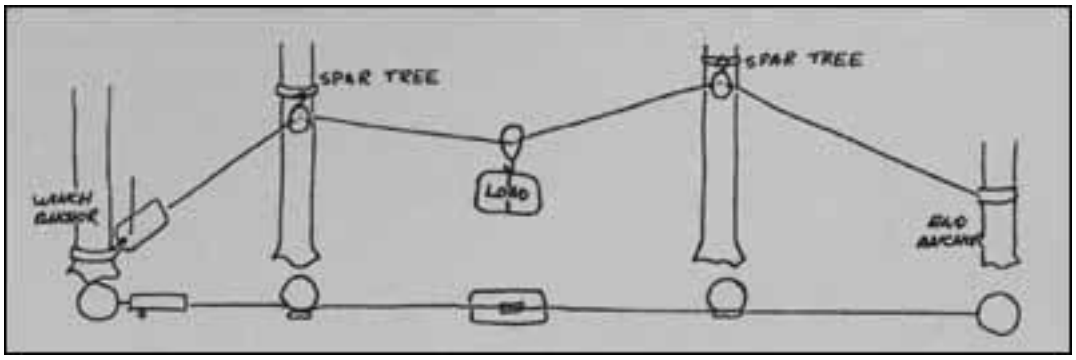
The danger of breaking a wire rope is minimized when properly maintained winches are matched with the appropriate wire rope.

2. When using trees as vertical supports, always analyze the forces being put on the tree and use appropriate guy lines to prevent toppling or breaking the tree.

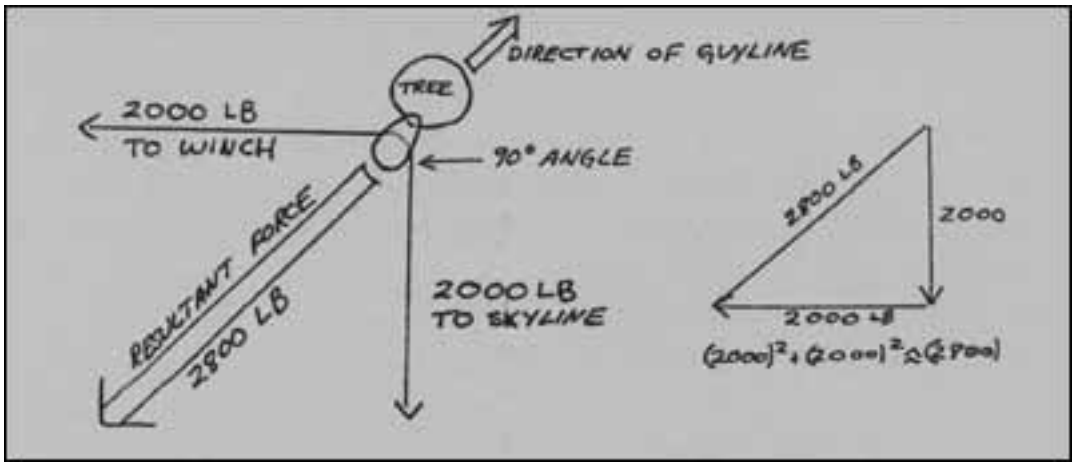
It can take 2,000 pounds of tension to lift a 300-pound load in a typical 100-foot-long slack-line system. If this horizontal force were to be applied to a tree at a point 12 to 16 feet off the ground, it could pull it over. The simplest way to prevent excessive sideways force on the "spar" tree is to lay out the system in a linear fashion, so that the winch cable itself serves as its own guy line.

With a linear arrangement, the force on the spar trees by the slack line load is matched by the

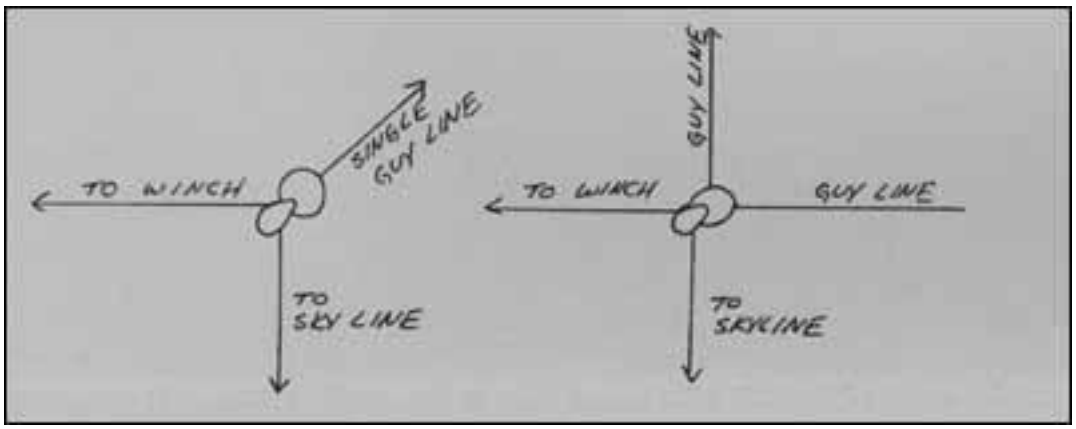
tension from the Griphoist and from the end anchor With this set-up, the spar trees only experience a downward force. In some situations, it may not be possible or desirable to set up a linear system.



When spar trees are the focus of a horizontal change in direction of the cable, the angles must be studied and a guy line or backstay must be used that will oppose the resultant force that will be applied to the tree by the angled cable.



Since an angled cable multiplies the resultant force experienced by the spar tree, at least one guy line made from lifting slings, chain, or wire rope is needed. If it is difficult to estimate the direction of the resultant force, two guy lines can be used, each one directly opposite of the two cable directions.



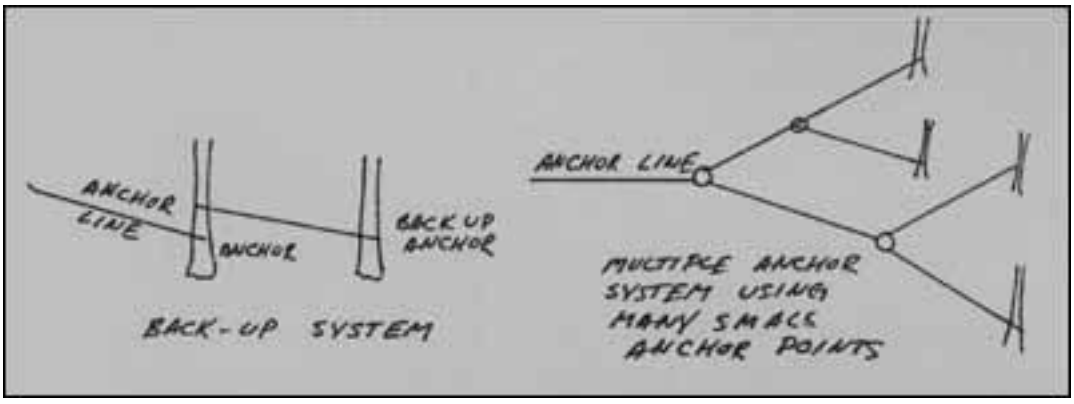
3. Pick solid anchors, and monitor them throughout the operation for changes. Use multiple anchors when in doubt.

The most common anchors are stout trees or large boulders. Even smaller trees can serve well as anchors if the anchors are attached at ground level. Nylon belts that are three-inches wide or wider are favored for their strength, high friction factor, and lightweight. They also minimize damage to anchor trees.

Things to monitor:

- Excessive tilting of trees or movement of boulders.
- Slings creeping up the anchor--provoked by too steep an angle toward a spar tree.
- Evidence of impending tree fracture, ***i.e.,*** cracking noises.
- Progressive abrasion damage or cutting of slings by rough edges on anchor.

When the available anchor points appear to be small or questionable, use multiple anchor points.



Good anchors are the foundation of these systems. It pays to do the best job possible with the anchors. Winch-anchor failure can hurt someone.

4. Maintain a safety factor of five when applying all accessories and hardware to a system.

Quite simply put, this means, "Use the right tool for the job." Only “load-rated" components should be used in these systems, and attention should be paid to avoid exceeding those limits. (Note: The "Working Load Limit" (WLL) marked on many products is 1/5 the breaking strength of the part.) The safety factor of five is standard throughout the rigging industry.

Examples: A Griphoist machine that produces 2,000 pounds of tension needs an anchoring rated at 2,000 pounds WLL (breaking strength of 10,000 pounds); 4,000-pound WLL snatch block (breaking strength of 20,000 pounds) will be fine for lifting a 500-pound boulder.

Maintaining this margin of safety is a good way to avoid dynamic failure and associated risk of injury.

Griphoist-powered rigging systems can help Trail crews move rock, wood, and other materials to work sites, up steep slopes, and across many barriers. They are powerful Trail-work tools that can empower people of many ages and abilities to do impressive things. It is important for those who work these machines to be attentive to safe work principles. It pays to learn as much as we can about safe ways to use this equipment.