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UT Extension

SP659

Cabling, Bracing and Other Support Systems for Trees

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Urban trees often need some degree of supplemental, physical support to reduce the risk of structural failure of the crown or root system. Cabling, bracing, guying and staking can provide a solution for these tree failures. Tree-support systems help support the tree by limiting the movement of branches, leaders or the entire tree. They can reduce the risk of injury to humans and damage to property by providing supplemental support for structurally weak areas of the tree.

Common Structural Deficiencies in Trees

The most common risk of tree breakage is the presence of one or more codominant stems (Figure 1). Codominant stems, or "v-crotches," are structurally weak compared to a single stem. This is due to the lack of connective tissue anchoring a stem to the tree trunk and the presence of included bark between the stems. The greater the angle of the "v-crotch," the greater the risk of structural failure. The best solution for problems associated with codominant stems is to buy and plant trees with a single leader. An alternative is to remove one of the codominant stems as early as possible in a tree's life, allowing for the development of a single leader. Otherwise, bracing or cabling is required to strengthen the weak area of the tree.

Another condition that often results in structural problems is the presence of long, heavy or "overextended" limbs. These are limbs that are unusually long for the tree species or grow horizontally or downward, with most of the foliage concentrated toward the end of the branch. Breakage resulting from these conditions often occurs at the junction of the branch and stem. Alternately, the branch may crack due to the forces of tension and compression. These failures usually occur when the branch is under heavy loading such as wind, snow or ice. Installation of cables may be used to avoid making large pruning cuts. Early corrective pruning is the best course of action to prevent this condition...

A third structural problem is a weakly anchored tree. Poorly anchored trees are the result of transplanting a tree with a substandard rootball, a compromised root system with root damage or decay, or planting in shallow or compacted soils. Pruning; removal; installation of support devices such as cables, brace bolts and guys; or a combination of these techniques may be recommended.

David Vandergriff

Brace bolts in a maple tree.

Tree Support Devices

Brace rods are used when multiple leaders exist in the tree. These rods reduce the risk of the leaders spreading apart or moving sideways in relation to each other. Brace rods are also used to repair a crotch or branch that has split. Brace rods are typically accompanied by at least one cable for additional support. Brace rods are installed as either a through rod (rod is bolted with a nut on other side of tree or branch) or dead-end (rod is threaded into the tree) configuration. The appropriate configuration is dependent on tree size, whether decay is present in the tree and the

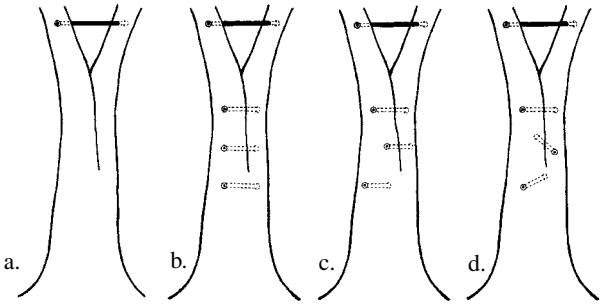

Figure 1. Bracing system types: (a) Single, (b) Parallel, (c) Alternate, and (d) Crossing
Credit: Tree Care Industry Association

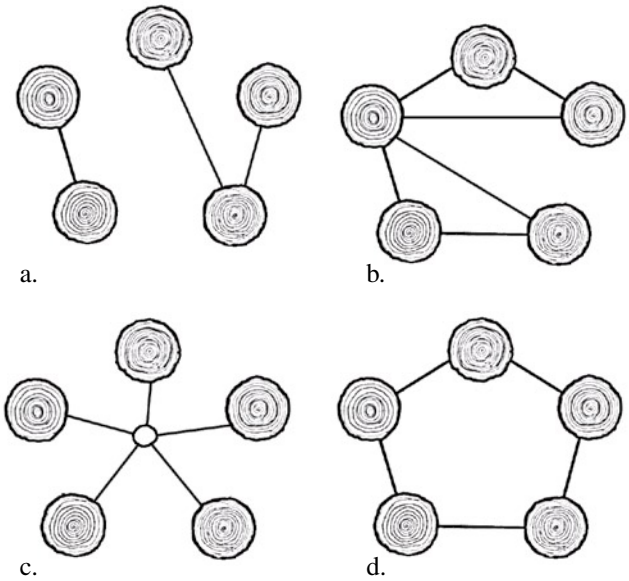

Figure 2. Cabling system types: (a) Direct, (b) Triangular, (c) Hub and Spoke, (d) Box.
Credit: Tree Care Industry Association

Direct cabling consisting of a single cable between two tree parts, e.g., two limbs, two stems or a trunk and a limb (three cables shown).

Triangular cabling consists of connecting tree parts in combinations of three. This method is preferred when maximum support is required (two triangular systems shown).

Hub and spoke cabling consists of a center attachment (hub) with spans (spokes) of cable radiating to three or more leaders. Hub and spoke cabling should only be used when other installation techniques cannot be installed.

Box cabling consists of connecting four or more tree parts in a closed series. This system should only be used when minimal support is needed.

the structural problem on the tree. Common configurations are shown in Figure 1.

Cabling restricts the distance that a branch can move in relation to the rest of the tree. Cables are installed across a weak crotch to reduce the risk a branch breaking. Cables are also installed on overextended branches to support the branch. More than one cable is often necessary in the installation and may be used in combination with brace rods. Cable systems include anchors, cables and the appropriate termination hardware for connection to the anchor. Cable anchors are installed in the tree at a point that is approximately 2/3 of the distance from the weak crotch to the ends of the branches. The exact location is determined by the location of lateral branches and the weak area of the tree being supported. There are several configurations used for multiple cable systems: direct, triangular, box, and hub and spoke (Figure 2). If a lightning protection system is installed in a tree with cables installed, the cables must be connected to the lightning protection system.

Guying is where a cable is installed between the tree and an external anchor to provide supplemental support and to reduce tree movement. Trees with root problems may be guyed to keep them upright and protect potential targets if they fail. Established trees are guyed if they have had some degree of tipping from wind throw and require some support. Two types of anchor systems are used on established trees – soil anchors or using another tree as an anchor (Figure 3).

A ground-anchored system should be installed with the anchor point as far from the trunk as the height of the attachment in the tree. The distance should not be less than 2/3 the height of the tree attachment. If a tree anchor system is installed, the anchor tree should be larger than the guyed tree, have an attachment point that is in the lower half of the trunk and is at least 7 feet from the ground. The guy should be placed at least at 1/2 of the tree height, preferably higher in the tree to be anchored. The anchor tree must be able to support the load of the guyed tree as well as itself. A qualified arborist should inspect the trees to assure the anchor tree has the structural integrity to support the guyed tree.

Tree staking is used to hold the tree upright and the rootball in place until the roots become established in the surrounding soil. Staking can also be used to straighten the trunk of a young tree or protect the lower trunk from injury. **Generally, staking is discouraged because most trees with adequate root systems do not need to be staked at planting**. Trees that are staked require constant monitoring and maintenance. Only those that are planted on steep slopes and in loose, friable soil or have top-heavy, large crowns may require staking to keep the tree upright. If stakes are installed, they should be regularly inspected and adjusted to prevent damage to the staked tree. Stakes

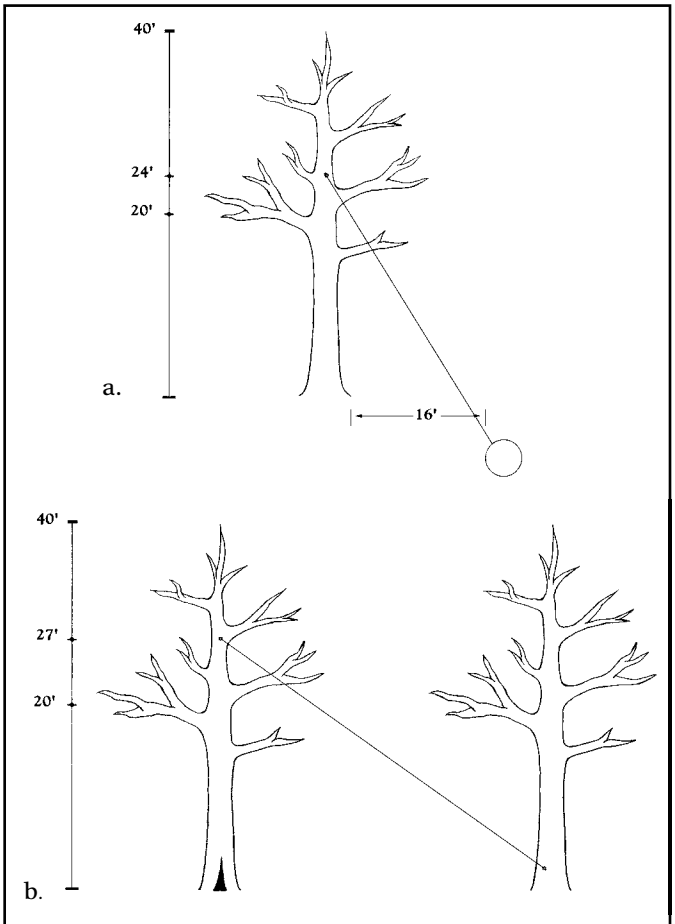

Figure 3. Guying system types: (a) Tree-to-Ground. (b) Tree-to-Tree
Credit: Tree Care Industry Association

Tree-to-Ground example – A point of attachment 24 feet up the trunk would place the anchors a minimum of 16 feet away from the base of the tree.

Tree-to-Tree example – Point of attachment is in the upper half of supported tree and lower half of anchor tree.

within a year of planting under most circumstances. Larger trees may require two or more years to establish a root system sufficient to support the tree.

Staking can have several detrimental consequences for a tree:

- Less trunk taper or reverse taper.
- Increased potential for rubbing and grinding injury from the stakes and ties.
- Uneven xylem around the trunk.
- Trunk growing or bending away from the stake.
- Reduced ability to stand on its own when the stakes are removed.

No staking is usually needed for most shrubs, evergreen trees or trees with limbs close to the ground. Protective staking can also reduce damage to the tree from mowing equipment, vehicles or vandals. A metal or wooden frame to protect the tree may encircle trees in high-traffic areas.

Trees can be staked aboveground or belowground. Aboveground staking should be installed as low in the tree as possible. The treetop should be able to move in the wind to develop taper while limiting the movement of the rootball in the soil. Trees can be supported by a single or double stake or with three short stakes. The number of stakes depends on the tree size and the planting location. The rootball can also be anchored belowground by driving metal or wooden stakes along the sides of the rootball about a foot deeper than the rootball. This eliminates the need for aboveground staking and maintenance.

Maintenance of Tree Support Systems

Tree support systems must have periodic inspection by a qualified arborist. The inspection schedule should be discussed before the installation of the support system. All support systems have a limited service life and adjustments to the hardware will be required. The service life of steel cables may range from 20–40 years depending on environmental conditions. The service life of synthetic-rope cable systems is not known, but should be inspected every 10 years. Staking and guying systems on newly planted trees should be removed within a year after planting, as soon as the tree has established a root system sufficient to anchor the tree. Mature trees may require guying systems to remain permanently. The service life of a guying system is similar to steel cables. Tree support systems should be replaced or repaired if the following conditions are found:

- The system has excessive wear, corrosion or other types of degradation of the system.
- The tree has grown over the end of the steel cables or fabric slings.
- Tree growth has resulted in the cable being too low in the canopy to be effective.
- Excessive slack is found in the cable.
- The cable is rubbing against any part of the tree.
- Anchors or terminations are either substandard due to overgrown tree growth or are no longer effective.

Safety must be the primary concern when supporting damaged trees. Support systems can fail if subjected to extreme conditions. Periodic inspection is essential. The inspection interval is determined by the tree, the supporting device and the site. Deficiencies must be corrected as soon as possible to avoid further damage to the tree and to protect people and property if tree support fails.

Seek Professional Advice

A qualified arborist should install tree support systems. These professionals can judge structural deficiencies in trees and determine whether tree support systems are required. Not all structural defects can be corrected by tree support systems. Qualified arborists are certified by the International Society of Arboriculture (ISA) and can be located on the ISA Web site at www.treesaregood.com. All tree support systems should be installed following the standards and the hardware specifications in the ANSI A300, Part 3 (National Arborist Association, 2000).

Summary

Tree support systems are a tool used by qualified arborists or landscape professionals to reduce the risk of tree failures and aid in the successful establishment of new trees. Improperly installed systems can increase the risk of tree failure, in turn increasing the potential for personal injury and property damage. Working with a qualified professional will increase your satisfaction with the services performed and protect your investment in plant materials.

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Tree support using cabling.

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Staking materials not maintained and not providing support on a planted tree.

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