



## STAKING NEWLY PLANTED TREES DOESN'T ALWAYS DO THEM A FAVOR.

BY JAMES R. URBAN, FASLA

Many years ago, Henry Arnold, FASLA, described to me a row of trees near his office that all broke at the same place in a strong wind. He stopped to investigate the unusual occurrence and found the guy wires used to stake the tree embedded in the trunk of each tree at the point where they snapped off.

It's a familiar sight—a tree planted three or four years ago, still staked in place. The ties meant to keep the tree growing straight have deformed it—maybe even strangled it.

But despite the potential for catastrophic failure, most tree planting specifications automatically require contractors to stabilize newly planted trees. This may be done with traditional stakes, guy wires, or underground systems that anchor the root ball. Landscape architects will often try to design staking systems that are more secure or less visible. But we are not giving enough thought to how these systems affect the trees, the benefits of stabilizing a tree, and the potential consequences.

There is a variety of scientific research on this subject. A recent study by Kendra Labrosse and her team at the University of Guelph, published in *Arboriculture & Urban Forestry*, lists nearly 20 useful references. Over the years, studies have yielded some conflicting results, but there seems to be a consensus that stabilization may help in certain situations. But it can also harm a tree—and the negative effects become greater the longer the stabilization system remains in place.

### The Case for Stabilizing Trees

Some research has suggested that stabilizing a tree helps it to recover from the shock of being transplanted. The Labrosse paper, published in 2011, examined 488 trees in Guelph, Ontario. "In most cases, it was found that [tree stabilization systems] were associated with improved health

during a short period (1–3 years) after transplant," notes the study. The researchers found that trees with stabilization systems showed fewer symptoms of poor health owing to pests and diseases and were less likely to suffer from stunted growth than trees that did not use support systems or where the support systems had been removed.

These results are similar to those of a study of red maples by Virginia Tech's Bonnie Appleton published in the Southern Nursery Association 2006 Research Conference Proceedings. She found that stabilized trees measured 30 inches above the ground increased one to three millimeters in trunk diameter more than unstabilized trees when compared after one growing season. The traditional system of two stakes connected to the tree showed the greatest increase over other approaches tested, while the majority of the trees with belowground stabilization systems grew less than the unstabilized control.

Probably the most common argument in favor of stabilization is that when you put trees with disturbed root systems in an area with high winds, they may rock out of position if they are not stabilized. When field-grown trees are transplanted, they lose most of their supporting roots. Container-grown trees can be unstable, particularly if grown in a bark potting medium. Bark potting medium is lighter than soil, so the trees have less mass to counter the force of the wind. The potential for root ball movement under wind load is increased when there are soft or saturated soils within or around the root ball. And the soil around newly transplanted trees is often heavily saturated from frequent watering. Conversations with people and my own observations over the years have led me to believe that trees with poor-quality root balls that are loose or undersized, most container trees, and some bare-root trees may benefit from stabilization.



**BELOW**  
Cables left in place for four years cause severe damage. The tree is sprouting below the guy wires in an effort to survive.



## The Case Against Stabilizing Trees

But stabilization systems may not always make sense. Researchers including Appleton; Larry Costello at the University of California, Davis; and Gary Johnson at the University of Minnesota have found that the advantages of stabilizing a well-grown and harvested or field-grown tree are countered by some significant disadvantages.

The worst damage occurs when stabilization systems are left on too long or never removed, which happens more often than one might hope. Ties and wires can cause abrasions to the bark or trunk girdling. Even wires covered with rubber hoses can slip into positions where tree bark damage occurs.

Below-grade stabilization systems can be even worse than aboveground systems, as they are hidden from view and damage may not be observed until it is too late to save the tree. Below-grade systems are often designed such that the wires form a loop around the trunk that will eventually cut into the tops of critical support roots or girdle the trunk if it is not removed.

Damage from stabilization systems that aren't removed properly is common and has been observed in all areas of the country and in projects of all scales and complexity. For example, in her study, Labrosse observed significantly more girdled trunks, swelling, and wilting among stabilized trees without good follow-up maintenance. Appleton's 2006 study showed that by the second growing season, trees that had the stabilization left in place were beginning to show signs of damage.

Another argument against stabilization is that stabilized trees may, ironically, be less resilient when faced with high winds once the system is removed. In a 1984 article in the *Journal of Environmental Horticulture*, Richard W. Harris relays the story of a large landscape in Davis, California, where nearly all the sycamores that were staked were blown down during a storm, and all those that weren't staked survived.

Tree trunks are naturally tapered; they add more wood at their base in response to the forces of wind and gravity on the tree. This additional wood is critical to tree stability. Harris, in his book *Arboriculture*, summarizes his many research projects on stabilization that have shown stabilized trees do not develop as large a trunk taper as trees that are not stabilized. He recommends only limited stabilization that, when applied, should be lower to the base of the tree to allow the canopy to move in the wind, which promotes faster trunk growth.

And that isn't the only way that stabilization may affect a tree's ability to withstand wind. Andrew Leiser and colleagues' 1968 study, "A theoretical analysis of a critical height of staking landscape trees," found stabilized trees grew larger canopies than trees that were not stabilized, making them potentially more susceptible to wind throw after stabilization is removed.

While trees that are not stabilized are rarely observed to suffer declines directly related to lack of support, trees are frequently severely damaged or even killed by the stabilization treatments. That's why a few landscape architects, including me, Joe Karr, FASLA, and Jacobs/Ryan in Chicago, stopped stabilizing trees in the mid-1990s.

Since then, I've observed very few of these trees ever move out of alignment after planting. Many researchers have come to the same conclusion. A 2009 study by Alexis Alvey and others in *Arboriculture & Urban Forestry* tested a number of conventional tree stabilization systems on field-grown, balled and burlapped white ash and found that "even nonstabilized ash trees were tolerant of moderate to heavy wind loads." The greatest change observed in a tree's orientation was four degrees, "which was visually imperceptible," the authors said. More dramatic, Appleton and Beatty looked at Bradford pears that weathered a Category 2 hurricane just six months after they were planted. They observed no differences in trunk orientation among trees that were stabilized and trees that were not.

The majority of researchers and urban foresters who have written about stabilization recommend not stabilizing trees unless there is a good reason to do so. A well-grown, harvested, and planted balled and burlapped tree almost never needs to be stabilized.

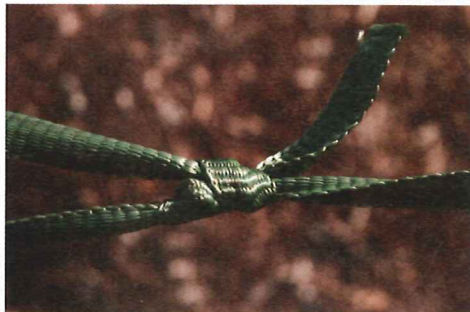
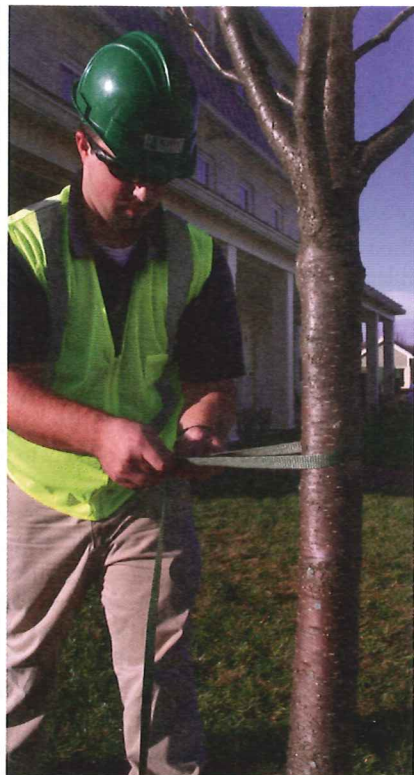
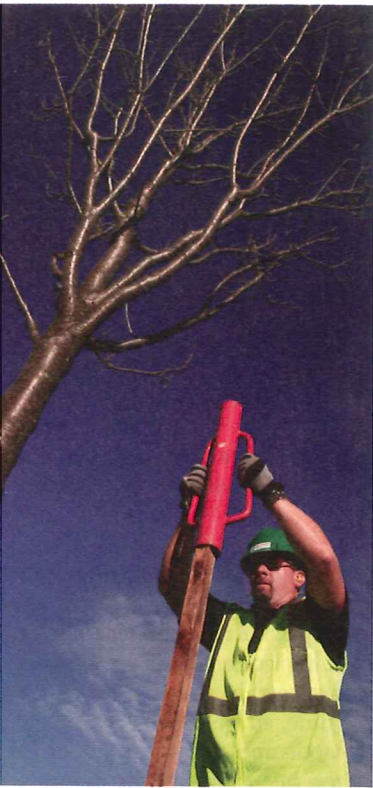
Landscape architects can modify their specifications and details so only trees that need to be stabilized are. The planting standards of many regional contractor associations require stabilization, as do most institutional master specifications, but this does not mean that these standards must be followed. Modifications to industry standards are recommended all the time as conditions and the findings of research indicate a different practice. Industry standards usually lag behind best practices, and landscape architects, as the profession in charge of specifications for projects, must be the leaders in making changes when research indicates





Left to right, top to bottom, Kevin Wetzonis of Ruppert Landscape in Laytonsville, Maryland, shows the preferred stabilization method. Wood stakes are driven securely into the soil outside the root ball. The top of the stake stands at about waist height to allow movement of the top of the tree. Webbed arbor tie tape is tied around the trunk with large loops to allow for trunk growth. An overhand slipknot is pulled against a second overhand knot tied on the line, keeping the loop diameter at least six to eight inches larger than the trunk diameter. The tape is then secured to the stake to brace the trunk snugly.







→ appropriate modifications—and the research is quite strong in this case.

Some contractors may state that they will not offer a warranty on trees if stabilization is not included. But if the contract documents are clear and the contractor has bid the project based on the specifications, then this position would not have merit.

A reasonable approach to changing the specification could read as follows: "Stabilization (staking) of trees shall only be permitted in the event that site conditions or conditions of the tree are such that the tree is anticipated to be unstable. The contractor shall submit, in writing, for approval of the landscape architect, a request to stabilize any tree. The submission shall include the type and location of each tree, the reason why stabilization is requested, and the stabilization methods to be employed."

#### **Recommended Stabilization Methods**

In those cases where stabilization does make sense, the systems should be designed to treat the specific problems anticipated and to minimize damage in the event the trees are not maintained correctly.

I tend to favor two strong posts driven just outside the root ball and connected to the tree with a web fabric tape such as Arbor Tie. Webbed tape spreads the load on the bark, and there is no chance of a hose slipping or wire cutting into the tree. But even webbed tape can girdle the trunk if the loop around the trunk is not large enough. The tape should be tied to form a figure eight twist that is never actually tied to the trunk, just attached to the post. This allows movement and trunk growth and allows several years of growth before the loop starts to interfere with the trunk expansion. With this stabilization method, the shorter the stake, the better. The point of contact should be only about halfway up the trunk to allow the top of the tree to swing over a greater arc. The greater the amount of allowed movement, the larger the trunk taper and initial roots that can be grown by the tree.

## **MOST TREES DON'T NEED TO BE STABILIZED, AND THOSE THAT DO MAY BE BEST SERVED WITH SHORT-TERM, ABOVEGROUND METHODS.**

Another traditional method is to attach a short stake to a longer guy, similar to a tent stake. With this method, the guy must be attached at the first branches of the tree to keep the guy from slipping. This method moves the support point higher in the tree. It provides greater stabilization of the trunk, however, which may not be helpful to the tree's initial trunk and root growth. As with the post method, wires and hose should be avoided; use only webbed tape tied with a large loop around the trunk.

Variations on these two approaches allow a designer's eye to refine the way the system looks, but the designer should never compromise the technical requirements of the system for an aesthetic idea that may harm the tree. For example, all the wood associated with any stabilization system, above or below the ground, should not be treated against rot. It is important that the wood decay soon enough to help the tree destroy the system, in case it is not removed, before the system damages the tree.

An in-ground stabilization system made with wood bars over the root ball attached to vertical stakes has proven to be effective in stabilizing the root ball. Two studies of this approach—one by Ryan Eckstein and Ed Gilman at Florida State and another by Cornell's Alexis Alvey and colleagues—have validated its effectiveness. Assuming that the bars are made of a soft, degradable wood, they will decay before they damage the tree and last sufficiently long enough for tree establishment.

However, in-ground systems will not solve the problem of a tree loose in its root ball, or a tree planted with loose soil below and around the bottom of the root ball. Quality nursery stock and proper planting procedures are the best solutions to these problems. An aboveground stabilization system will help with poor quality, loose balls, or

poorly planted trees, but should we be using a stabilization system as a patch to accept standard practices?

I do not recommend other types of in-ground systems, especially those that stabilize a tree using wires over the top of the root ball. They are far too likely to be left in place and damage the tree. These systems have been in wide use for only a short amount of time, so we haven't seen their effects on many landscapes yet—it may be 15 to 20 years before the tree expresses the damage. But I have already observed a few cases where their wires or web tapes remain undamaged long after they were put in place, strangling trunks and cutting into the important support roots.

Landscape architects would be better off if they understood that most trees do not need to be stabilized and accepted the short-term approach of aboveground stabilization, when needed, as part of their professional stewardship of the landscape.

Many of the problems discussed here could be eliminated if landscape architects were responsible for inspecting the site after one year and making sure all tree stabilization was removed. The most important factor is the length of time the stabilization device is left in place. Most trees do not need stabilization after the first growing season, and significant damage can be observed in some cases after the second season. But if you do not anticipate enough construction administration fees to inspect the removal of stabilization, particularly belowground stabilization systems, then it is much better not to specify them in the first place. ●

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