



Getting to the Root of Tree Stability and Construction

By Scott Jamieson

We've all seen it: A homeowner wants to build a new family room or deck near a prized tree. Or it's time to widen the driveway – near a tree that family members planted as a seedling when they moved into the house. Or a long-dreamed-of swimming pool is finally in the works, but the arborvitae screening out the neighbor's yard are nearby. When there's a construction project, trees are often in the vicinity and are likely to be impacted by the construction.

Much of the concern pertains to tree roots. Roots extend at least as far as the dripline; sometimes they even reach as far out as two to three times the height of the tree. As well as taking up water and nutrients, they are central to hormone production, and they store energy.

Roots are also critical to tree stability. Cut them too close, and a tree may be apt to fail, possibly putting people and property at risk.

Types of tree root systems

There are three types of tree root systems. One that commonly comes to mind, though it actually represents very few landscape trees, is the tap root – consisting primarily of a large, downward growing root. Trees with taproots can most tolerate root cutting from a tree-stability perspective, unless of course you cut the taproot.

Another type is the lateral root system, in which roots grow outward horizontally. These roots tend to be shallow, in the top 18 inches of soil, so they are very susceptible to construction damage, especially from trenching. Cutting many of them can cause a tree to quickly become unstable and unhealthy.



Photo courtesy of: Bartlett Tree Research Laboratories

Root-pruning machines, like this one, cleanly cut tree roots, helping to prevent damage and promoting root regeneration. This pruning is taking place outside of fencing erected to protect trees slated for preservation.

The third type of root system is oblique. While it includes lateral roots, it also has some that grow deeper in the soil near the trunk. Because of these deeper-growing roots, trees with oblique root systems are more tolerant of root cutting.

The challenge is that it's hard to say which root type a tree might have. Certainly species has a bearing, but environmental conditions play a role, too. For instance, if the soil is saturated with water within a few feet of the surface or if there is a hard or compacted layer at the surface, then even if a tree that, by species type, would be expected to produce a taproot – like a pine or a nut tree – it is less likely to be able to grow one. Another factor is tree age. As trees age and root decay becomes more prevalent, they tend to lose deeper growing roots and rely more on the horizontal roots for stability. All of this means it's hard to determine what type of root system a tree has, and it is safest to assume that the roots are far-reaching from the tree. The best action for safety and tree health is to change the plans in a way that moves the construction further from the tree. If that isn't possible, the tree might have to be removed. But how do you know if a tree can stay? There are many factors, like tree and soil health, age, and cultural conditions.

(continued on page 36)

(continued from page 35)

The distance of excavation from the tree is key, too. The critical question is, how close to the trunk can you cut the roots and still be confident that the tree will remain stable?

Research: Root cutting and tree stability

Scientists at the Bartlett Tree Research Laboratories in Charlotte, NC, have been looking into this issue for the past several years. They've begun by looking at young red maples and willow oaks.

The procedure is fairly simple. They attach a digital level to the lower stem of a tree and install a rope in the upper crown. They pull the tree with a winch to a trunk angle of one degree. They record the force put on the tree and then allow the tree to spring back to its original angle.

After measuring the force necessary to move the stem one degree, they cut the roots in straight lines perpendicular to normal root growth. Once the trench is cut, they remeasure the force needed to pull the tree to one degree again. They then make a second root cut closer to the trunk. They repeat the procedure until they shave the buttress – or large, structural – roots off the tree at the trunk.

What they have found on the study trees is that there is a measurable change in tree stability when cuts are made closer to the trunk than three times the trunk diameter. So, for a six-inch diameter tree, when the root cuts are closer than 18 inches from the trunk, the tree is less stable. If the soil is relatively dry, it does not make any

difference if the researchers pull the tree from the side of the root cut or on the opposite side of the tree. However, if the soil is saturated with water, the tree is much less stable when pulled toward the cut roots. The researchers caution that it is important to be more conservative when applying these study results to larger trees. As trees age, root decay becomes more common, so older trees may initially be less stable. Mature trees are also more prone to root decay following injury to the root system.



Photo courtesy of: The Morton Arboretum

For oaks and most other trees, roots extend out from the trunk at least as far as the dripline. As a result, trenching through roots is almost a given on any construction project that has trees in the vicinity. Tree stability and health are always an issue. So is ensuring that roots are cleanly cut.

Cutting roots at a distance of five times the trunk diameter is better, from a stability standpoint, than cutting closer. This distance should also minimize infection by root decay fungi.

The best place to cut tree roots is outside the dripline of the tree. At this distance, there are many fine roots needed for water and nutrient uptake, but fewer roots needed for stability.

When you must cut

Whether it's to trench for an irrigation line or utilities, excavate for a new swimming pool, or make way for a

building addition, the reality is that tree roots will likely need to be cut. Armed with this research, you can gauge how close you can cut without impacting tree stability. But how you cut tree roots is also important.

Key to cutting roots is using the right equipment. Backhoes are intended for digging, not cutting roots. Don't make the mistake of assuming that, by excavating, you can simply cut the roots by breaking them with the backhoe. A backhoe rips roots and can tear them all the way back to the trunk, even pulling

the trunk apart.

Chainsaws, root-pruning machines, and specially adapted trenching equipment can make a good, clean cut. This helps prevent root damage and aids in root regeneration.

Mapping root zones

Well before excavation begins, everyone involved in the project should know where tree roots are. This can and should be done during the tree-inventory phase at the beginning of the project. Then planners can map out not only tree-trunk locations but also critical root zones, which makes the inventory

much more valuable for preserving trees. In overlaying a critical root zone map on a construction document, it is possible to see where changes in elevation, paths or trenches will come into contact with roots. A map depicting critical root zones provides so much more information than the traditional plan that simply uses dots to mark locations of tree trunks.

The inventory method we have developed at Bartlett uses Global Positioning Systems (GPS) and Geographical Information Systems (GIS) to collect information, map locations and help with planning. The



Researchers at the Bartlett Tree Research Laboratories have been investigating how closely to the trunk tree roots can be cut without compromising tree stability. Here, the first round of cutting is under way. The scientists found a measurable change in tree stability when cuts are made closer to the trunk than three times the trunk diameter.

program can integrate pre-existing infrastructure information, such as additional GIS data, CAD plans and aerial images.

By incorporating data such as buildings, roads and underground utilities, a more complete picture of the landscape is possible and can aid in decision-making – especially as it relates to critical root zones and preserving trees. And having the flexibility to integrate with CAD plans means planners can adjust for trees more easily.

So much of a tree's health and stability depends on its roots. Especially when construction is involved, everything you can do to protect the roots – including knowing how much you can safely cut them – will help ensure a successful project and happy client. 🌿

Scott Jamieson is vice president of same corporate partnerships and national recruiting for Bartlett Tree Experts (www.bartlett.com). Local offices are in Chicago, Northbrook, Woodridge and Lake Barrington.