

Preventing Construction Damage to Trees

Trees are a valuable asset in home landscapes. Their shade makes summer living more pleasant and can significantly reduce air conditioning costs. In winter, they shield against wind and snow, reducing heating costs. Leaves act as air cleaners, filtering dust and removing airborne pollutants. Trees shelter wildlife, slow rainfall runoff, muffle noise and provide privacy. But perhaps the main reason people value trees highly is simply the beauty and grace they add to a community.

Because a tree takes many years to grow to maturity, wooded building sites command premium prices. All too frequently, however, the trees that make the site attractive are damaged during construction. Trees may decline and die soon after construction work is finished. The homeowner then faces the cost of tree removal in addition to the expense and time needed to grow replacement trees.

Trees around older, established homes also suffer from construction damage. Remodeling projects, sidewalk replacement, landscaping projects or utility work can cause injury to trees.

Types of construction damage

Damage to trees occurs directly from physical wounding or indirectly through change of environment around the tree.

Physical wounds

Careless movement of construction equipment causes wounds to tree trunks and root collars, the area of the tree at ground line where the roots begin to spread out. A healthy tree is capable of sealing off small wounds, localizing injury. However, large wounds and those on stressed trees will not readily seal off, allowing decay to begin.

Improper pruning to create clearance for construction equipment and tree-removal techniques are other

sources of physical injury to branches and trunks. As trees are removed for placement of a new building or driveway, they may scrape bark off trunks or break branches of trees that are to be saved, creating wounds that serve as entry points for diseases. Improper pruning leaves branch stubs that die and begin to decay. To prune properly, make clean cuts with a sharp pruning saw just outside the swollen branch collar. (For more information on pruning, see MU Extension publication G6866, *Pruning and Care of Shade Trees*.)

Below ground, root damage is common from excavation and grade changes. Roots may be torn by improper excavation, opening wounds for disease organisms to enter. Fine, absorbing roots are lost by topsoil removal, putting the tree under stress. Structural support is lost by trenching too close to major roots, creating a potential hazard. Bruising or crushing of roots by heavy equipment may not be apparent from above ground.

Environmental changes

Soil compaction is a serious problem on many construction sites. Even when care is taken to avoid trunk and branch injury from equipment, trees may be damaged by equipment driving over root systems. The weight of the equipment compacts soil, reducing air space in the root zone. Limited oxygen availability to roots is also a problem when soil is stockpiled at the base of trees or paving is put over existing roots.

Excessive thinning of tree stands or removal of underbrush causes increased exposure to sun, wind and heat. Sunscald may develop on trees previously acclimated to shade. Increased wind and heat exposure increases moisture stress.

Also, moisture stress may develop from grade changes that lower the water table or divert drainage patterns away from the site. Excess soil moisture may develop from grade changes, as well. A rise in the water table, puddling from improper grading, or an increase in water flow through the area will decrease the amount of oxygen in the root zone and lead to tree decline.

Adding fill soil or cutting away excess soil alters the environment around tree roots. Hauling in fill reduces oxygen to the roots. Adding as little as 1 or 2 inches of

Credits

Reviewed by **Christopher J. Starbuck**, Associate Professor and State Woody Ornamentals Extension Specialist, Division of Plant Sciences

Original author: **Denny Schrock**, Department of Horticulture

heavy clay soil on top of the existing grade may damage sensitive trees such as oaks. The soil profile and soil pH are also altered. Topsoil is often more acidic than excavated subsoils spread on the surface. Trees adapted to growing in acidic topsoil will be stressed when forced to develop new roots in soil of a different pH and texture. The ability of roots to take up many micronutrients is reduced in high pH soils, leading to decreased growth rate and yellowing leaves. Construction material buried on-site also often raises soil pH.

Symptoms of damage

Symptoms of construction damage to trees appear over a period of several months to several years after the damage occurs. Because of the delay in development of symptoms, the relationship between the earlier injury and the current symptoms is often difficult for people to understand.

The first symptom to develop may be a slight wilting or shedding of a few leaves at the time of construction. Fall coloration often develops early, and leaves drop prematurely. In later years, leaf size and shoot growth may be reduced. Twigs and branches die, and in the case of conifers, excessive needle drop occurs. General growth of the tree is slowed, and resistance to diseases and insects is weakened.

Diagnosing compaction or root-smothering damage can be difficult because symptoms may take five to seven years to appear. The speed and severity of symptom development depends on the amount of damage, the species of tree and soil type.

Deciding which trees to save

The first step in deciding which trees to save is to accurately mark out placement of proposed buildings, driveways, parking areas and utility routes. Then, stand back to look over the site. Slightly shifting the position of a building, changing a driveway location, or altering the proposed utility line could make the difference between saving or cutting a valuable tree.

After deciding on building placement, prioritize trees for saving. Mark for removal trees that are directly in the way of construction; undesirable, weedy tree species; trees already in a state of decline; and structurally hazardous trees. If in doubt, consult a trained arborist, horticulturist, forester or nursery person to determine tree condition.

Next, determine which trees can be saved with little or no protection. Desirable trees located away from construction or traffic areas will survive if reasonable care is taken.

Finally, examine trees that might survive construction if proper measures are taken. Examine them more closely to determine if one of the techniques described below will effectively minimize damage. If severe damage is likely, removing the tree will be less expensive before construction begins than afterward.

Preventing damage

Control traffic around trees

Tree roots are not mirror images of the treetop. Roots are concentrated in the top 12 to 18 inches of soil and spread two to three times the width of branches. Protecting roots within the drip line of the tree is most critical, but damage to roots outside the drip line on only one side of the tree may remove one-third or more of the tree's roots (Figure 1).

Erect a fence at the drip line or farther out, if possible, to prevent damage from excavation, soil compaction or stockpiling of soil over roots. It is easier to save groups of trees than individual ones. Build a fence around the drip line of the outside trees to keep construction machinery away from the grove. Remove protective fences only after all construction work is done, including final grading and smoothing of the site.

Carefully remove unwanted trees

Be careful removing unwanted trees. A tree being removed might fall on and injure a tree you plan to save. If possible, remove unwanted trees when none of the trees have leaves. When trees are in full leaf, sudden removal of nearby trees is a shock and can cause sunburn to other trees.

Make clean cuts

Clean cuts to roots seal off quickly and help prevent entry of disease-causing organisms. Ragged, rough wounds from dull or improper equipment allow decay to progress to the rest of the tree. Sharply cut ends promote a flush of new roots, helping the tree recover from injury. Bulldozers tend to tear roots apart, leaving wounds that will not seal readily. Trenchers and backhoes make cleaner cuts through the soil. When cutting

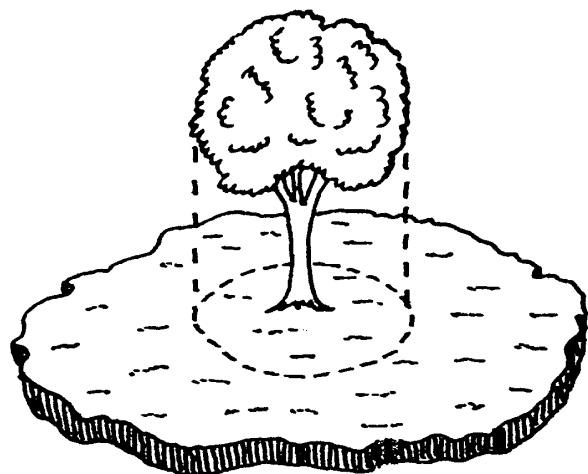


Figure 1. Roots typically spread out from two to three times the width of the branches. However, the essential roots are usually considered to be within the drip line, which is the area underneath the tree's branches.

roots larger than 2 inches in diameter, use a pruning saw to make a smooth cut.

Do not automatically prune the top of a tree that has been root pruned. As long as moisture is not limiting, leaves in the crown of the tree manufacture food to help roots grow and recover from being cut. Prune out only weak or dead branches.

Tunnel rather than trench

Trenching near a tree kills a large portion of the tree's roots. Tunneling under the tree does virtually no damage. Because most roots live in the top 18 inches of soil, a tunnel 2 feet underground often does little damage. However, placing the tunnel 3 to 4 feet deep is safer.

It is best to tunnel at least 1 to 2 feet away from the tree's center to avoid a taproot (Figure 2). For trees less than 6 inches in diameter at breast height, trenching should come no closer than the drip line of the tree. See Table 1 for larger trees.

Prevent soil compaction

Where fencing out construction traffic is not possible, use temporary wood chip mulch, gravel mulch or bridges to prevent soil compaction around tree roots. Place wood chips or gravel mulch 6 to 12 inches deep on top of a geotextile landscape fabric placed over the root zone of the trees to be protected.

Table 1. Minimum distance to trench trees.

Tree diameter at breast height	Minimum distance from tree to start tunneling
less than 6 inches	drip line of tree
6–9 inches	5 feet
10–14 inches	10 feet
15–19 inches	12 feet
more than 19 inches	15 feet

Adapted from Municipal Foresters of Northeastern Illinois guidelines.

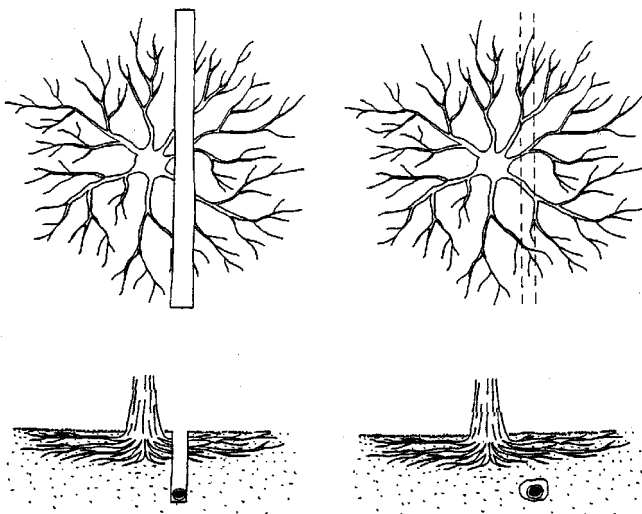


Figure 2. Trenching near a tree can kill almost half its roots. A tunnel in the same place will do virtually no damage to the tree.

Air spaces in the mulch cushion the impact of machinery or foot traffic and disperse the weight over a larger area. The landscape fabric makes cleanup easy. Temporary bridges built from steel plates placed on railroad ties distribute the weight of equipment over larger areas. What compaction does occur will be limited to areas directly below the railroad ties (Figure 3).

Handle grade changes

Cutting away soil from a tree removes a portion of the root system and changes the soil moisture level. For reasonable survival a tree, make no cuts within its drip line. To preserve the tree's roots, construct a retaining wall at the drip line or farther out (Figures 4 and 5).

Filling around trees smothers roots. Build a retaining wall at the drip line to keep soil from burying roots within the drip line. It is possible to completely cover the roots by using expensive drainage and venting techniques that require professional design and installation. It is easier, cheaper and more practical to alter grading plans than it is to protect a tree from fill over the entire root zone.

Tree care after construction

With proper care, trees moderately affected by construction damage will recover. Homeowners can help trees recover by practicing annual tree care as outlined below.

- **Aerate the soil.** Pull out cores of soil 12 to 18 inches deep to aid movement of oxygen and moisture into soil and help combat compaction. Place fertilizer in the holes, if needed. Backfill the holes with compost. New roots quickly fill in the cores.
- **Water deeply.** During dry periods, moisten the root zone of stressed trees. Let the water soak in 12 to 18 inches deep by applying a slow trickle throughout the spread of the tree's roots.

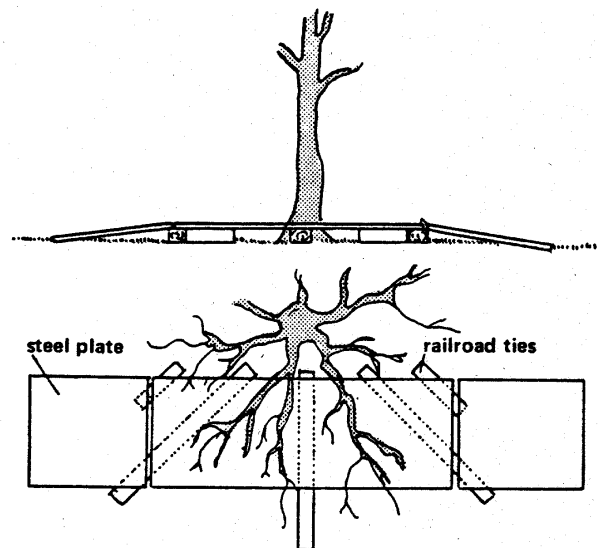


Figure 3. Use of bridges to protect tree roots.

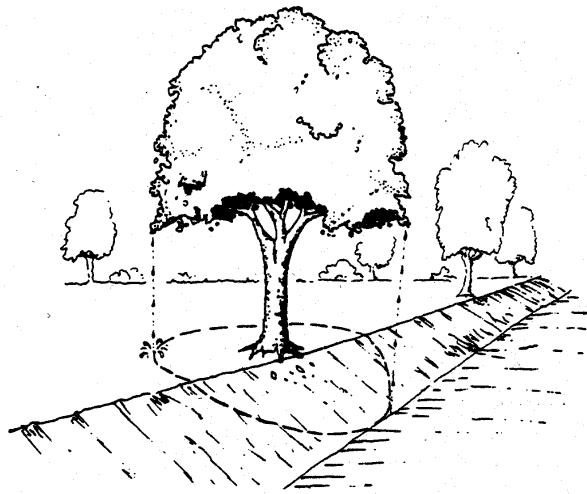


Figure 4. This change in grade has killed half the tree's roots. Most trees will die from this extent of injury.

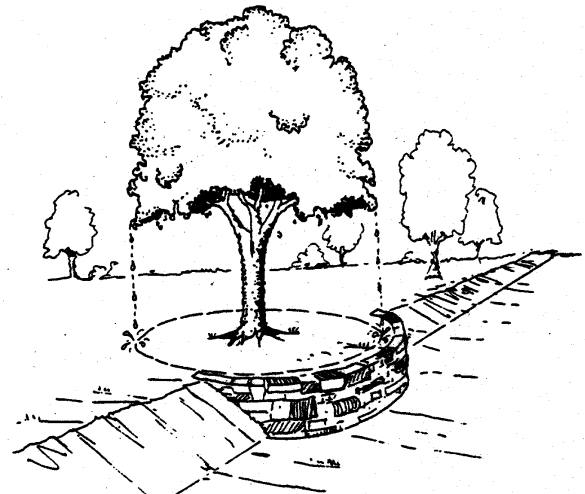


Figure 5. The tree on this cut has been protected by a curved retaining wall at the drip line. The tree should recover nicely.

- **Inspect the tree for damage.** Stressed trees are more susceptible to disease and insect attack. Check stressed trees frequently to catch pest problems before they become severe. Treat with a pesticide, if necessary. Prune out any dieback that develops.
- **Mulch.** A 2- to 4-inch layer of mulch around the base of trees helps prevent soil compaction, reduces weed competition and conserves soil moisture. Keep the mulch away from the tree trunk to prevent collar rot from developing.
- **Fertilize.** Severely stressed trees should not be fertilized until they become reestablished a year or two later. Young, rapidly growing trees should be fertilized annually. Mature trees may be fertilized every two or three years. Using a complete fertilizer, apply 2 pounds of actual nitrogen per thousand square feet. Fertilizer may be spread over the soil surface or distributed among aeration holes punched 12 inches deep every 2 feet under the tree's canopy.

Tolerance of trees to root damage

Tree species are not equally sensitive to soil-related construction injury (Table 2). Some can generate new roots quickly when conditions become unfavorable for the old roots. This adaptation occurs primarily in species that grow in river bottom flood plains. Tree species native to upland sites are less likely to adapt to soil grade changes or construction damage.

Trees are a valuable asset in the landscape and should be protected during construction. With careful planning and forethought, desirable trees can be saved and the disappointment of delayed tree decline prevented.

Table 2. Tree tolerance to root damage, by species.

Very sensitive	Moderately sensitive	Fairly tolerant
Oaks	Sugar maple	Silver maple
Hickories	Ash	Basswood
Honeylocust	Walnut	Cottonwood
Kentucky coffeetree	Sycamore	Poplar
Horse chestnut	Hackberry	Willow
All conifers	Red maple	River birch
Redbud	Hawthorn	
Serviceberry	Ironwood	

Also from MU Extension Publications

G1630 *Soil Compaction: The Silent Thief*
G6960 *Mulches*

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