BARTLETT TREE RESEARCH LABORATORIES
CHARLOTTE, NC
Technical Report

Preventing Construction Damage to Trees

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The presence of trees surrounding a residence contributes greatly to both the aesthetic and monetary value of the home site. Studies have shown the presence of established trees usually increases the value of a building lot by 10% and sometimes as much as 25% over a similar lot that lacks trees.

Most homeowners recognize that trees provide many benefits including beautifying a residence, providing shade and privacy, reducing home energy costs, and providing a barrier to noise. Most progressive homebuilders also recognize the value of trees and usually leave as many as possible on newly constructed home sites. Unfortunately, trees often are damaged so severely during home construction that many die within one or two years after the house is completed.

The loss of the trees not only reduces the value of the house but also may add from several hundred to several thousand dollars onto the purchase price due to tree removal costs. Healthy trees can be successfully left on home sites if the trees to remain are carefully selected and some basic precautions are undertaken to prevent damage during construction.

TYPES OF CONSTRUCTION DAMAGE

Tree decline and mortality, around newly constructed homes, is a result primarily from damage to the root system. During construction, roots are frequently cut when installing foundations, water and sewer lines or other utilities, driveways, curbs, sidewalks, etc. Many roots are also lost when soil is removed during grading.

Fine roots occur primarily within the top six to eight inches of soil, and removing just a few inches of soil during grading can result in the elimination of much of these roots. Loss of fine roots will reduce the water and nutrient absorption capability, which can eventually lead to decline. Cutting large roots increases the possibility of windthrow especially during storms.

Compaction of the soil or placing fill over a tree root system during grading is equally as destructive as cutting and removing roots. All plant cells, including those in the roots, require oxygen to survive. Root cells obtain oxygen from pores within the soil. When the soil over the root system of a tree is compacted or fill is added during grading, the amount of soil air is greatly reduced. At the same time, gases toxic to plant roots tend to accumulate in the soil. These adverse factors result in root mortality and tree decline.

Mechanical injuries to the stem and limbs also contribute to tree decline. Bark injuries inhibit transport of water and nutrients to the crown and allow entrance of decay and other disease organisms.

TREE SELECTION

The initial selection of trees that should remain on a building lot is the most important consideration for ensuring tree survival. A certified arborist together with the builder and/or architect should evaluate trees for preservation. Each tree should be considered individually before a decision is made to save it or not. Factors to consider in evaluating a tree are: Location, species, age and condition.

Location - Trees to be saved should allow adequate access to the lot for construction equipment and should fit into the landscape design after the house is built. Trees should not remain very close to the house, because severe root damage usually occurs when digging the foundation and because the tree may become a nuisance after the house is completed. Deciduous trees should be left on the south-southwest side of the house whenever possible. This will reduce energy costs by shading the house from hot, summer sun but will allow rays to penetrate in autumn and winter after the leaves have fallen. Trees also should be left where they screen the house from winds, noise pollution or objectionable views.

Species – Certain tree species including oak, hickory and ash withstand site changes better than other species such as dogwood, hemlock, white pine and sugar maple. Select only those species with strong wood and good branching habits when leaving trees close to the house. Favor species that do not have any acute insect or disease problems. Elm, for example, is a beautiful shade tree that tolerates extreme site changes, however, the species is subject to a lethal vascular disease, which limits its usefulness as a landscape tree. A varied species mix also should be left whenever possible.

Age and Condition - There is a tendency to save the largest and oldest trees on a site because these are most prominent and attractive to the homebuyer. However, mature trees are much less adaptable to site changes occurring during construction. Young, vigorously growing trees should be favored. Choose only healthy trees that are not suppressed or that show evidence of trunk decay, severe injuries, disease or insect damage.

PREVENTING CONSTRUCTION DAMAGE

Root Damage - Protecting against root damage is the key to preventing tree decline during building construction. Physical barriers such as fencing should be erected around trees to prevent encroachment by construction equipment. This will minimize soil compaction and also prevent fill and other debris from being placed over the root system. Barriers preferably should be placed at least midway between the trunk and the drip line.

If construction equipment must pass close to the tree, a bridge can be constructed over the root system. This is done by placing a steel plate over railroad ties, which are placed at intervals along the ground as supports.

Grade Changes - Grade changes around trees should be avoided whenever possible. If fill must be placed over the root system of a tree, a well must be installed. If the grade must be cut, this should be done outside the tree's root system. Methods for cutting the grade near trees are described in the aforementioned technical report.

Pruning - Prior to the initiation of construction, interfering lower limbs on trees to be saved should be pruned to allow access for construction equipment. Dead, dying and broken branches also should be removed at this time in order to eliminate a possible safety hazard to construction workers.

Mulch and Irrigation - Prior to construction, mulch should be added to the tree protection zones to help prevent moisture stress. Irrigation during periods of low

rainfall also is recommended during construction.

Monitoring- Periodic inspections during the construction process are recommended to evaluate tree health and the presence of pest, to ensure proper irrigation and to ensure that construction fences remain intact.

AFTER THE CONSTRUCTION

Post Construction Tree Maintenance

Trees damaged by construction as well as new transplants generally require a high level of maintenance due to stress caused by root loss. Demands for water and mineral nutrients (fertilizer) are critical due to root loss. Pruning requirements on construction damage plants are high due to a greater likelihood of branch dieback. Stressed trees are more sensitive to certain pest problems particularly borers, bark beetles and canker disease fungi.

Tree Structure Evaluation- A thorough inspection and evaluation of tree structure should be performed before any maintenance in conducted. Careful inspection of the root zone and root flares should be undertaken to assess hazardous conditions. Branch structure, wood decay and other defects also must be evaluated.

Final Grading- Final site grading should provide drainage systems that divert ground water from tree preservation areas. Grading should be avoided in preservation areas.

Whenever possible, maintain trees under a layer of mulch in natural areas rather than grading and establishing turf or other ground cover. Trees that were once part of a natural forested area have many fine roots in the duff layer. Removal or addition of just a few inches of soil for turf establishment can cause significant root mortality that can result in tree decline and death.

Root Collar Excavation- During construction soil is frequently placed against root collars of trees due to grade changes. Ensure that root flares are visible on all trees during the initial inspection. Excavate soil to expose the root collar as necessary.

Mulching- Any organic mulch, such as wood chips, shredded bark, bark nuggets, pine straw or leaves, is suitable around trees. The benefits of mulch on plant growth include conserving soil moisture, supplying nutrients and organic matter, eliminating competition from weeds and ground cover plants and preventing erosion.

Mulches should be applied to a depth of two to four inches. Excessive mulch can encourage shallow rooting which can be detrimental during droughts. Avoid annually top dressing mulched areas where the mulch exceeds depths of four inches. Avoid placing mulches against the root collar.

Irrigation- Irrigation during periods of low rainfall during the growing season is a critical factor in preserving trees that sustained root injury. Approximately one inch of rainfall per week during the growing season is advisable on stressed trees. This is equivalent to 750 gallons of water per 1000 square feet beneath the crown of plants. The recommended quantity of water can be applied gradually using a drip system or applied in one or two applications per week. Tensiometers can be installed to monitor soil moisture and determine when irrigation is required.

Fertilization- Due to root loss during construction, nutrient absorption is reduced. Maintaining a high soil fertility level is essential in preventing nutrient deficiencies. Adjusting soil pH for the specific species is essential in ensuring nutrient availability. Research has recently shown that nitrogen fertilization stimulates fine root growth.

Fertilization and soil amendment applications should be based on soil analysis. Frequent light applications (annual treatments) may be necessary during the first three to five years following construction depending on soil conditions, plant species and condition. Where nitrogen is the only element required and trees are growing in natural areas, surface applications of fertilizers are effective. In turf areas, compacted soils or slopes, subsurface application of the fertilizer should be performed to prevent runoff or turf injury. Phosphorus and potassium are very immobile in the soil and must be installed subsurface in the root zone if these nutrients are to be immediately available. Subsurface applications can be efficiently performed by injecting suspension or solution fertilizers into the soil using conventional tree spraying equipment.

Mycorrhizae spores are now commercially available and can be applied to soils to increase root growth of certain trees.

Soil Compaction- Soils subjected to pedestrian and vehicular traffic on new construction sites are prone to compaction. Compacted soils restrict root development due to physical impedance of the soil. Compacted soils have less air space and reduced water holding capacity. This further reduces root development.

Compacted soils should be roto-tilled prior to planting. Incorporating composted organic matter during cultivation will help encourage a stable soil structure.

Around existing trees, treatments for compacted soil may involve mulching, fertilization or soil replacement techniques.

Pruning-Following construction, trees should be pruned of dead, dying interfering and objectionable branches to improve health and vigor. If crowns of trees are exceptionally dense, thinning branches should be performed to compensate for root damage. Thinning, if necessary, should be performed in such a manner to maintain branch distribution throughout the canopy. Approximately 50% of the foliage should be maintained on the lower two-thirds of the crown or leader.

Pruning of live branches should be performed judiciously especially on trees which were once growing in forested areas. Forest trees generally have thin, narrow crowns due to close spacing of the trees. Major pruning of live branches generally is unnecessary and can result in decline of the tree.

Crown reduction or “cutting back” trees should be avoided except where severe root damage has occurred or where major structural deficiencies exist. Crown reduction should utilize drop crotch pruning techniques whereby limbs are cutback to laterals that are large enough to assume dominance.

Structural Supports- Trees in forest generally have many defects and structural deficiencies including double leaders, overextended branches and decay. When stands are opened during development, the remaining trees are more exposed to storm damage. Subsequently, support cables and bracing are frequently required especially on feature trees in strategic locations.

Lightning Protection-Tall trees in exposed locations are prone to lightning strikes. Oaks, tuliptree, and pine are particularly prone to lightning injury. Lightning protection systems should be considered for trees which are prone to lightning especially high value, feature or historic trees and trees within 10-25 feet of a house or other structure.

Pest Management -Pest management on new developments should utilize an Integrated Pest Management (IPM) approach. IPM utilizes a technician who periodically inspects landscape plants for pest problems as well as other plant health

problems such as nutrient deficiencies, water stress and other environmental stresses. Since newly transplanted trees and existing plant material are usually under stress on new developments, frequent monitoring is essential in detecting plant problems before losses occur. Pests and other abnormalities are then treated on an as needed basis. IPM utilizes a combination of chemical, biological and cultural treatments to prevent pest problems and preserve plant health.