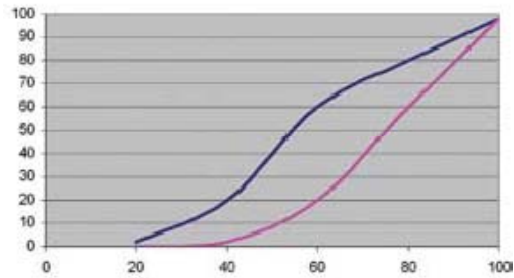


**SELECTED NOTES ON TREE PRESERVATION DURING
CONSTRUCTION**

- I. Plan**
 - a. Consult with an International Society of Arboriculture Certified Arborist**
 - b. Identify what trees can be protected and those that can't or shouldn't be protected**
- II. Protect**
 - a. Provide proper protection for trees – fencing or bridges**



A tree looks like a wine glass on a dinner plate



Tree survival depends on the amount of critical root area protected and the tolerance of a tree to damage. (Coder 1996). Right line is susceptible, left is resistant.

Generally, 3 types of construction damage

- 1. Physical damage above the ground**
- 2. Physical damage below the ground**
- 3. Soil Compaction**



The roots of a tree extend far from the trunk and are found mostly in the upper 6 to 12 inches of soil.

1

What Are Critical Roots/Critical Root Zones

There hasn't been a lot of research on what is THE critical root zone and what part of the root zone should be protected during construction. However, there are some generally agreed upon guidelines for root protection. These guidelines use a formula based on tree diameter OR based on the drip line of the tree.

Damage to tree roots and to trees from soil compaction is affected by soil type and condition, the extent of compaction, tree species, and the tree's current condition or health.

What is the Critical Roots/Critical Root Zone of a Tree?

Below is Virginia Tech Professor Susan Day's response to this email from Ingrid Sather, USDA Forest Service Forester.

Ingrid Sather: "I often get calls from communities who are writing or revising their tree ordinance and they want to incorporate a critical root zone/tree protection zone into the ordinance but are not sure what formula or criteria to use. I've been trying to track down research on this topic and I'm not finding very much. It seems like there are formulas/criteria floating around but they are not substantiated with research. Do you have any leads for me on this topic?"

Susan Day, Virginia Tech

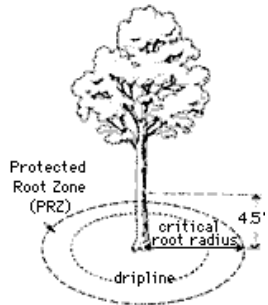
"There are formulas floating around, and they are not substantiated by research. To my knowledge there is no research that directly addresses this. There have been a few things looking at trenching on one side, two sides, etc. and there is research with that in apple orchards--but these results haven't been very informative for this issue. I think the

¹ International Society of Arboriculture: Avoiding Tree Damage During Construction;
http://www.treesaregood.org/treecare/avoiding_construction.aspx

recommendations in the latest edition of Harris' Arboriculture text book are as good as any. These say 1 foot radius per inch of dbh with some adjustments for species and age. My personal opinion is that the impact is so heavily affected by soil conditions and maintenance before and after the event that these zones are only guidelines. Also, many sites do not have enough space for these protection zones to be installed at the "recommended size". What disturbs me sometimes is when I meet with people who say that they tell clients to just give up on trees where they can't protect at least two-thirds (or another amount) of the root zone. Certainly younger trees can easily handle more damage if they have good soil conditions and proper after care. Trees in marginal conditions with no aftercare, can usually handle only very minor damage to roots. I would suggest an ordinance specify certain aftercare procedures (watering, and mulching in non-woodland cases) in addition to protection zones. Also, the timing of the installation of the protection zone is as important as the size. It needs to be installed before any kind of activity, brush clearing, etc., occurs. Hope this helps you. I often recommend the book by Nelda Matheny and Jim Clark that the ISA publishes. I don't agree 100% with everything they say, but overall it is excellent. Good luck. Susan Day"²

² Compiled by: Ingrid Sather; Southern Center for Urban Forestry
Information & Research USDA Forest Service
www.urbanforestrysouth.usda.gov

Publications surveyed contained various methods for determining the “Critical Root Zone” of a tree. Below is a sample.



“Approximate a tree’s **Protected Root Zone** by calculating the critical root radius (*crr*). First, measure the tree diameter in inches at breast height (*DBH*). Then multiply that number by 1.5 or 1.0. Express the result in feet.

Example:

dbh=8 inches

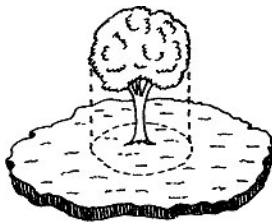
$8 \times 1.5 = 12$

crr=12 feet

Measure diameter (width)=dbh

dbh X 1.5=critical root radius for older, unhealthy, or sensitive species or dbh X 1.0=critical root radius for younger, healthy, or tolerant species”³

“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.



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

³ University of Minnesota Cooperative Extension Service; Protecting Trees from Construction Damage: A Homeowner's Guide

<http://www.extension.umn.edu/distribution/housingandclothing/dk6135.html>

Gary R. Johnson, Associate Professor, Urban and Community Forestry, University of Minnesota Extension Service, Department of Forest Resources; Publication details protection of trees during construction, symptoms of construction damage, and remediation of damage; contains a table listing several species and their relative sensitivity to damage (species are generally native to upper Midwest).

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.”⁴

“After a tree is established, any activity that changes the soil condition is extremely detrimental to its health. Construction traffic compacts soil most severely near the surface, the area where the majority of tree roots lie. Soil compaction decreases soil permeability and interferes with essential gas exchange processes as well as surface and subsurface drainage. When root growth is restricted by compacted soils, less nutrients and water are available for plant growth. These factors limit root growth, reduce tree vigor and can cause tree death. Decline and dieback may gradually appear over a period of years.

It is much easier to avoid soil compaction than to correct it. Keep construction traffic and material storage away from tree root areas. Apply a 4 to 6 inch layer of wood chips around all protected trees to help reduce compaction from vehicles that inadvertently cross the barricades.”⁵

“An effective zone encircles a radius of at least 1.25 feet of protected area for every inch of trunk diameter. A tree with a trunk diameter of 12 inches requires a protected radius of at least 15 feet and ideally 30 feet.”⁶

Tree Protection Plans

Most tree care professionals agree that some sort of preconstruction tree protection plan be created before construction begins. A tree care plan will designate trees to protect, and trees that may not be worthy of protection because of condition or species. What follows is an excerpt about tree protection plans from a North Carolina State University publication.

“A tree protection plan designates the valuable trees that must be protected during the construction process. Assemble a team to write a tree protection plan before ground is broken. The team should include the site managers as well as professionals who can

⁴ University of Missouri Cooperative Extension Service; Preventing Construction Damage to Trees; <http://extension.missouri.edu/publications/DisplayPub.aspx?P=G6885>; Denny Schrock, University of Missouri Dept. of Horticulture

⁵ Colorado State University Cooperative Extension Service; Protecting Trees During Construction <http://www.ext.colostate.edu/pubs/garden/07420.html>; C. Dennis, Colorado State Forest Service; and W.R. Jacobi, professor, bioagricultural sciences and pest management

⁶ North Carolina State University Cooperative Extension Service; Construction and Tree Protection; <http://www.ces.ncsu.edu/forestry/pdf/ag/ag685.pdf>; Robert E. Bardon, Ph.D., Forestry Extension Specialist, Mark A. Megalos, Ph.D., Forestry Outreach Associate, Amy L. Graul, Environmental Technology Undergraduate; Department of Forestry and Environment Resources

provide tree protection advice (Table 1). Do not leave anyone out who should be involved. By working together, the team can identify potential conflicts between construction needs and tree protection, and identify compromise solutions.”⁷

How to Protect Trees During Construction

Erect Barriers

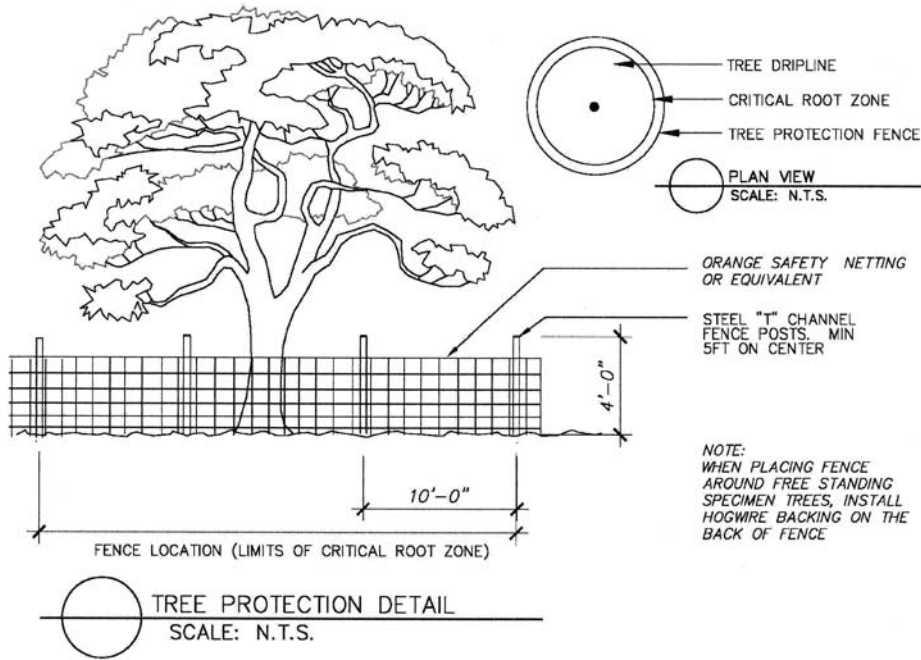
“Because our ability to repair construction damage to trees is limited, it is vital that trees be protected from injury. The single most important action you can take is to set up construction fences around all of the trees that are to remain. The fences should be placed as far out from the trunks of the trees as possible. As a general guideline, allow 1 foot of space from the trunk for each inch of trunk diameter. The intent is not merely to protect the aboveground portions of the trees but also the root systems. Remember that the root systems extend much farther than the drip lines of the trees.

Instruct construction personnel to keep the fenced area clear of building materials, waste, and excess soil. No digging, trenching, or other soil disturbance should be allowed in the fenced area.

Protective fences should be erected as far out from the trunks as possible in order to protect the root system.”⁸

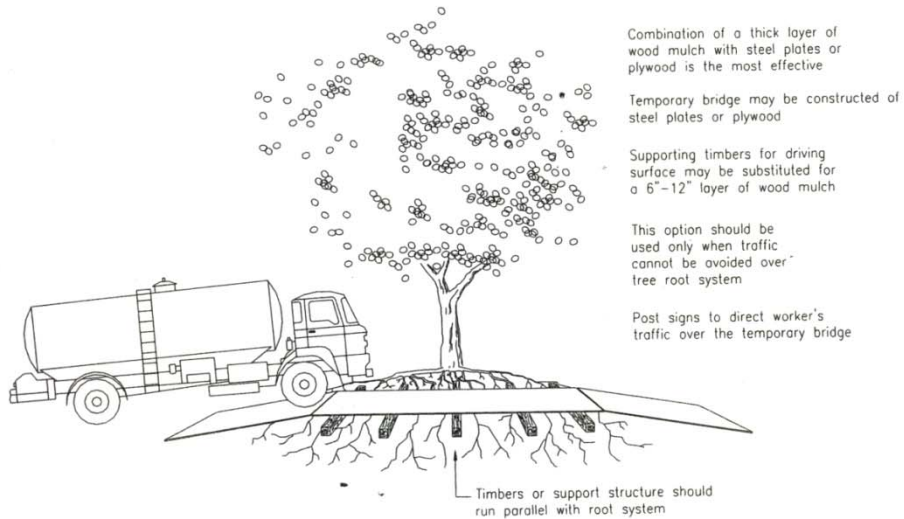
⁷ North Carolina State University Cooperative Extension Service; Construction and Tree Protection; <http://www.ces.ncsu.edu/forestry/pdf/ag/ag685.pdf>; Robert E. Bardon, Ph.D., Forestry Extension Specialist, Mark A. Megalos, Ph.D., Forestry Outreach Associate, Amy L. Graul, Environmental Technology Undergraduate; Department of Forestry and Environment Resources

⁸ International Society of Arboriculture: Avoiding Tree Damage During Construction; http://www.treesaregood.org/treecare/avoiding_construction.aspx



Tree Protection Diagram from Garden City, GA Tree Protection Ordinance

Where Critical Root Zone cannot be avoided construct a temporary bridge.



Temporary Bridge Diagram from City of Fayetteville Landscape Manual