Greater Bemidji Area Joint Planning Board
City of Bemidji Northern Township
317 4th Street NW Bemidji, MN 56601 Office (218) 759-3579 Fax (218) 759-3591

Protecting Trees from Construction Damage:

A Homeowner's Guide

Gary R. Johnson

Minimize the Impact of Construction Activities

In addition to protecting the PRZ, there are other ways in which you can reduce the impact of construction activities on your trees. Some of these are relatively simple; others can be extremely expensive. Carefully consider the importance of each tree to the future appearance of the site and consult a tree-care specialist before deciding whether protective measures are worth the cost.

Figure 6. *A root system bridge will help protect trees in the path of construction vehicles.*

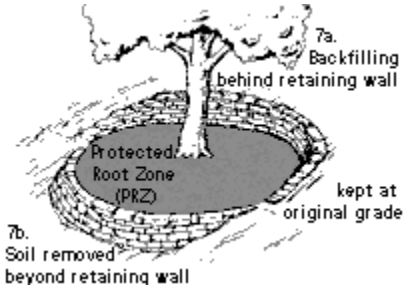

Figure 7. *If you change the grade within the root zone, use retaining walls to keep as much of the original grade as possible.* **a)** *backfilling;* **b)** *cutting.*

Site Clearing

When you remove a large number of trees, you expose the remaining plants to new conditions. Sudden increases in amounts of sunlight and wind will shock many of your trees. It is not uncommon to find scorched leaves, broken branches, and uprooted trees after a site is cleared. Although some of these problems are temporary, they may compromise tree health when coupled with additional construction damage.

You can avoid sun and wind stress by saving groups of trees rather than individuals. When possible, remove the unwanted plants in winter after the leaves have fallen. Dormant plants are

less susceptible to damage, and frozen ground helps protect roots. Bulldozers should not be used to remove trees near plants to be preserved. Heavily wooded sites should be gradually thinned over two to three years to reduce removal shock on remaining plants. This is especially important in dense pine, spruce, or fir forests.

Soil Damage

Soil compaction is the single largest killer of urban trees. Tree roots need loose soil to grow, obtain oxygen, and absorb water and nutrients. Stockpiled building materials, heavy machinery, and excessive foot traffic all damage soil structure. Lacking good soil aeration, roots suffocate and tree health declines.

Prevent soil compaction by carefully selecting storage areas and traffic routes (the future driveway is a good choice for both) and installing protective fences and signs. If you can't reroute traffic, install root system bridges with steel plates suspended over railroad ties or spread several inches (six inches or more) of wood chips on the soil within the PRZ (Figure 6). Trees that are pruned or removed during the construction process should be chipped on site and the chips used for soil preservation tactics such as this. Heavy mixing trucks can be kept off tree roots by transporting concrete from the truck through conveyor pipes.

Improper handling or disposal of materials used during construction also can harm roots. For example, wood products treated with pentachlorophenol and creosote can be deadly to tree roots; CCA-treated timber (greenish color) is a better alternative. Ask the builder about the materials to be used on the site and read product labels. Chemical spill damage can be prevented by filling gas tanks, cleaning paintbrushes and tools, and repairing mechanical equipment well outside tree PRZs. Insist that all building debris and chemical wastes be hauled away for proper disposal, and not burned or buried on the site.

Finally, avoid changes in soil pH (acidity). Increases in pH are particularly dangerous to many species (Table 1). Alkaline clays or limestones should not be used for fill or paving, and concrete should be mixed on a thick plastic tarp or outside the site. Mixing trucks should never be rinsed out on the site.

Grade Changes

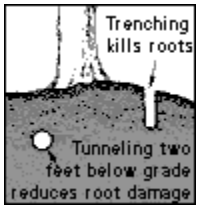

Figure 8. *Protect roots from damage when laying utility lines by tunneling rather than trenching.*

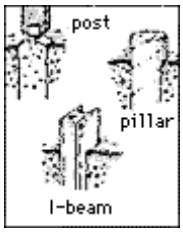

Figure 9. *You can minimize damage to trees near foundations by using posts, pillars, or I-beams rather than foundation walls.*

Moving large amounts of soil within the PRZ usually kills a tree. Except where absolutely necessary, avoid disruptions to the natural contour of the site or shift them well outside the PRZ.

Soil additions compact the soil around a tree and often raise the water table. You may be able to protect compaction-tolerant trees (Table 1) from additions of six inches or less of soil by using a porous fill within the PRZ. Porous fill can be made by mixing one part loam, one part coarse sand, and one part shredded bark.

Deeper fills require more expensive measures. A retaining wall beyond the PRZ may protect some trees (Figure 7a). These walls preserve much of the original root system and redirect excess water away from sensitive plants. Your tree-care specialist may suggest other, more elaborate measures for protecting trees that must be covered with soil close to the trunk. However, as a general rule, it is best to remove trees that would be buried by 24 inches or more of fill around the base.

Cutting the soil away from a tree removes vital feeder roots, eliminates nutrient-rich topsoil, and often lowers the water table. Damage caused by shallow cuts (less than two inches) at least three feet away from the base of the tree may be minimal, but still can be a shock to a tree's vitality (health). If possible, avoid making the cut during hot, dry weather; water the tree (undisturbed portions) before, during, and after soil removal; and allow only hand digging inside the PRZ. A shallow layer of mulch (pine needles, wood chips, or coarsely chopped twigs and bark) and clean root cuts will help wound closure and regrowth. Deeper cuts within the root zone will require construction of a retaining wall no closer than the limit of the PRZ (Figure 7b).

Excavation

As much as 40 percent of a tree's root system could be cut during the installation of a nearby utility line. This reduces water and nutrient uptake, and may compromise the stability of the tree. If it is not possible to relocate the utility line outside the tree's PRZ, you can reduce root damage by as much as 25 percent by tunneling under the tree's root system (Figure 8). When digging a trench near a tree, begin tunneling when you encounter roots larger than one inch in diameter.

Trenching for building foundations also poses a danger to nearby trees. Although not often used in Minnesota, posts, pillars, or I-beams sometimes can be substituted for foundation walls and footers on homes (Figure 9). Drilling single holes as opposed to cutting deep trenches saves many critical roots.

For all digging operations, insist that exposed roots be cut cleanly to promote quick wound closure and regeneration. Vibratory plows, chain trenchers, and hand tools do a better job at this than bulldozers and backhoes. Minimize damage by avoiding excavation during hot, dry weather; keeping the plants well watered before and after digging; and covering exposed roots with soil, mulch, or damp burlap as soon as possible.

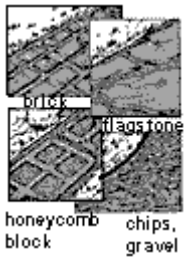

Figure 10. *Paving materials such as brick or flagstone over sand will produce less disruption than poured concrete to the roots of a nearby tree.*

Pavement

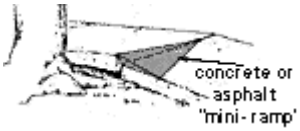

Figure 11. *A "mini-ramp" can be used to smooth the uneven surface caused by root damage to pavement.*

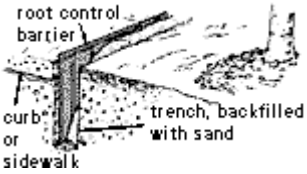

Figure 12. *A vertical underground barrier will help keep tree roots from damaging concrete as they grow.*

Sidewalks and driveways located too close to a tree endanger its health and may threaten pavement stability. Factors such as frost heaving, poor drainage, and pavement flaws give roots an opportunity to expand, gain a foothold, and cause damage. Homeowners are faced with costly repair bills and potential liability for the hazardous situation that develops.

These problems can be avoided if you consider the spatial needs of a tree and its root system when designing the layout of new sidewalks and driveways. Just how much space is required depends on a tree's sensitivity to root cutting and its future size (Table 1). It's best to locate sidewalks and driveways outside the anticipated PRZ. At a minimum, walkways should be at least three feet from the trunk of a tree; driveways may cover up to half the distance from the tree's PRZ to its trunk, as long as no excavation occurs. No tree should be boxed into an area less than eight feet by eight feet by three feet deep, with larger trees receiving at least 300 cubic feet of root/soil volume.

You can minimize disruption by using alternatives to conventional paving materials. In some communities, brick or flagstone walkways on sand foundations can be substituted for concrete (Figure 10). These materials protect soil pH and allow water and oxygen penetration. Preserve natural contouring by spanning uneven areas with wooden walkways elevated on posts. Elevated decks are excellent alternatives to concrete porches. Where additional pavement strength is needed (e.g., driveways), concrete requires less excavation than asphalt. "Structural soils" may be used under pavement to allow for both adequate pavement base strength and tree root penetration. . Structural soils are composed of 80% stone chips, 20% clay-loam soil, and a polymer binding agent. Ask your builder about raised pavement techniques near valuable trees.

There are several techniques for repairing pavement that has been damaged by protruding roots. For trees that are highly sensitive to root disturbance, consider creating a concrete or asphalt. Mini-ramp to smooth the uneven surface between two sidewalk sections (Figure 11). Local ordinances governing liability should be consulted prior to using this technique. Relocate walkways with broken concrete slabs a few feet farther from the tree. For trees that can tolerate root disturbance, a vertical underground barrier may redirect root expansion away from pavement (Figure 12).

All tree species are capable of causing root damage to sidewalks, foundations, or pipes. Species notorious for damage-causing roots are noted in Table 1.

Symptoms of Construction Damage

Conspicuous symptoms of construction damage may take years to appear. Tree decline from soil compaction, for instance, may take three to seven years to appear as obvious symptoms of distress. Because of this delay, landowners often attribute tree losses to other causes. Carefully monitor affected plants and keep written records to help you recognize the less visible signs of tree stress. Remember, the most serious damage remains hidden in the root system.

Figure 13. *Suckering is one symptom of construction damage.*

Wilted or scorched leaves and drooping branches usually are the first signs of construction damage. In deciduous plants these symptoms may be followed by early fall coloring and premature leaf drop. Damaged conifers will drop excessive amounts of inner needles. In subsequent years you may notice yellowed or dwarfed leaves, sparse leaf cover, or dead branches.

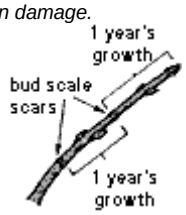

Figure 14. *Annual growth is the distance between bud scale scars on twigs. The twigs of healthy trees usually grow two to six inches longer each year.*

Other indicators might include flowering out of season, excessive water sprout formation on the trunk (Figure 13), abnormal winter dieback, or abnormally large amounts of seed. Flower and seed production and water sprout formation are defense mechanisms for ensuring species survival and commonly indicate that the plant is experiencing extreme stress.

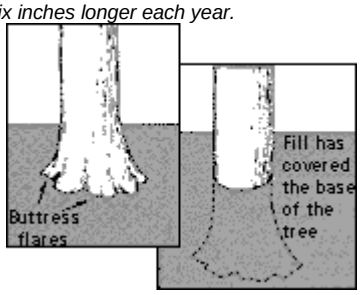

Figure 15. *To determine whether the grade has been changed around trees on a newly built site, check for the presence of* **buttress flares** *at the base of the trunk.*

In addition to observing a tree's appearance, monitor its annual growth. A slightly damaged plant will grow more slowly and be less resistant to insects, diseases, and weather-related stress. Examine the annual shoot and branch growth (Figure 14). Healthy trees generally will grow at least two to six inches at the ends of the branches each year. Photographs and records of the tree prior to construction also can help identify growth problems.

If you purchased your home following construction, you can identify deep fills around large trees by looking for buttress flares at the base of the trunk (Figure 15). Most common shade trees in Minnesota have buttress flares, and their absence usually indicates that the tree's base has been covered. It may be helpful to examine the condition of trees on other sites where your builder has worked.

In many cases you would be wise to have a tree-care specialist look for early symptoms of tree stress. Dollars invested in consultations with professionals before damage becomes obvious may be repaid in considerable savings later on.