Tree Root And Infrastructure Damage

Tree Case Management specializes in tree root and infrastructure damage. We have been involved specifically with tree root and infrastructure damage over the last two decades and have a wealth of experience in root pruning and tree retention. Our goal is to preserve the tree, if at all possible, while repairing, or replacing, the damaged infrastructure (sidewalks, driveways, house foundations, swimming pools, gates, etc.).

The conflict between tree roots and infrastructure is pervasive in urban areas. The increase in urban consolidation linked to the need and desire to have trees in our landscapes will invariably lead to conflicts. Understanding of the various causes of infrastructure damage will allow the most appropriate actions to be developed to minimize the risk of damage reoccurring. This is the main objective of Tree Case Management.

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As many homeowners and property managers have learned, the problem seems to escalate after the first 10 years as the trees begin to mature and their root systems expand and try to grow out of the much-too-small space where their planted.

It would be better to plant trees in larger spaces such as the front yard away from the infrastructure. But it is too late for many of us who buy a home in a development that has already planted large-maturing trees in a narrow planting site adjacent to infrastructure. This is a landscape design flaw, in my opinion, that is creating significant maintenance costs for homeowners and property managers.

Because the removal of trees planted close to the infrastructure is at times not practical, sometimes not allowed by local ordinance, and would remove an important environmental amenity from the streetscape, I will primarily discuss options to accommodate roots on existing large trees known as infrastructure-based strategies. The goal of Tree Case Management is to adapt the infrastructure to accommodate the tree to reduce the damage and increase the interval between repairs.

Tree Case Management Uses An Air-Spade

The Air-Spade is a durable, hand-held tool that digs soil using a "laser-like," jet of air pressurized by a compressor. It is harmless to items like plant roots, buried pipes or cables. This technique has been used by arborists, landscapers, and tree companies for root collar excavations, aeration, radial trenching, vertical mulching, root examinations, soil compaction reduction, plant disease treatments, digging trees for bare root transplanting, and eliminating girdling roots.

Root Inspections

While tree roots compartmentalize decay very well, decay sometimes extends from the buttress roots into the trunk. Decay can be measured in roots with the same tools used to measure decay in stems. The most practical tools are resistographs, penetrometers or battery-powered drills. To inspect for decay in the lower trunk and buttress areas, one should drill in between buttress roots. Since tree roots generally grow with an elliptical shape, one must drill from the top, into the root more than the width of the root.

It is important to realize that tree roots generally decay from the root tips back to the buttress roots. Furthermore, roots generally decay from the bottom of the root upwards. If decay is detected in the top half of the root, it is safe to assume that the remainder of the root is compromised below and beyond where the decay was found.

<u>Checklist for inspecting trunk flares & root zone</u>

- Presence/absence of trunk flare
- Dead or loose bark
- Recent landscaping or paving
- Construction damage to trunk
- Soil compaction
- Trenching nearby
- Underground irrigation systems
- Size of crown in proportion to available root space
- Limited root space – curbs, walks, and planters
- Saturated or high-water table soils
- Exposed or windy sites
- Leaning tree – especially with soil mounding and cracks in the soil
- Roots causing soil or pavement upheaval
- Root disease and decay
- Fungal fruiting bodies – on trunk, roots, or growing in the soil
- Cracks in the soil near trunk flares

Over the years I have observed trees lifting sidewalks usually at the seam or expansion joint. The lifting can occur anywhere between the slabs next to the trunk to as far away from the tree as the third concrete slab that is about 20 feet from the trunk. Once the slab lifts over ½ inch, there is a serious potential liability issue -a trip and fall hazard.

In addition to the lifting pressure caused by roots, the tree root flare of trees will slowly expand outward and upward putting additional pressure on the sidewalk or infrastructure. Often the root flare begins to become a problem with nearby infrastructure when trees reach a diameter of around 20 inches.

The proper inspection of trees for hazards should take place at regular,scheduled intervals.In most urban,suburban,and park-like settings,tree inspections should be done at a minimum of once a year.Tree Case Management is trained in the process of inspecting the whole tree, from roots to crown,for hazards that could cause a serious problem.

Options for Sidewalk Repair Around Existing Trees

There are several options to consider when repairing lifted sidewalks or other infrastructure damage. These include options that sometimes can be combined with others. Tree Case Management uses the following infrastructure-based strategies on various job sites:

Shaving lifted concrete: Once roots lift a slab, it can be shaved down several times until the thickness of the sidewalk is too small to support the weight of pedestrians and golf carts using the sidewalk. This relatively inexpensive technique and could be used at first to even out lifted sidewalks. Another version of shaving is the use of asphalt to level the sidewalk slabs where they have lifted. Asphalt on a concrete sidewalk is not a very esthetic alternative.

Slabjacking: This is a process where concrete is injected under high pressure beneath the low side of a lifted slab causing the slab to lift upward to match the lifted section of the adjacent slab. This process has been around for several years but I have yet to speak with anyone who has had the slapjacking done.

Meandering sidewalk: Move the repaired sidewalk out away from the tree by several feet preferably outside the main root plate, which may be the distance from the tree that is three times the tree diameter

Excavate beneath offending roots: Instead of cutting the offending roots that have lifted the sidewalk, leave the root intact and use an air excavation tool like an Air Spade or Air Knife to remove soil beneath the root. This void can be left open beneath the root or filled with clean pea gravel that will move out of the way as the root expands downward. Because the concrete sidewalk is being replaced above the root, the root should expand downward filling the void. This technique should be combined with reinforced sidewalks and possibly thicker sidewalks.

Bridge or ramping over roots: Sometimes the roots are too large to cut and have expanded above the natural grade. In these cases the root(s) can be bridged or ramped possibly creating a slight rise in the sidewalk where it passes over the root.

Use reinforced concrete: Use rebar or wire mesh when re-pouring concrete sidewalk slabs. This will make the sidewalk stronger. It is important to connect the slabs together with rebar to avoid the lifting of a single slab. In that way the root will be pushing against two or three slabs rather than a single slab.

Use thicker concrete: Increasing the concrete thickness from 4 inches to 6 inches will make the sidewalk less likely to break or lift. This technique should be used with the reinforced concrete technique above for best results.

Place sidewalk over a geogrid and gravel base: Recent research into roots and sidewalks has demonstrated that a geogrid mesh base placed on top of roots will spread the force of the upward pressure of the roots over a wide area. Then if we cover the geogrid with clean #57 stone for at least a depth of 3 to 4 inches, the concrete sidewalk can be poured on top of the stone. The stone should be covered with a geotextile fabric to help keep the sand and soil from filtering into the stones, which provide a partially flexible buffer to diffuse the force of lifting roots on the concrete sidewalk slabs above. This arrangement may cause the sidewalk to be higher than the original sidewalk.

Place clean gravel beneath sidewalk: Recent research has demonstrated that simply placing clean gravel beneath a sidewalk slab will cause roots to grow below the gravel not directly below the concrete slab. The large air spaces in the gravel cause any roots to grow below both the concrete sidewalk and the gravel layer. Consequently, the sidewalk is less likely to get pushed upward by the roots.

Rubber Sidewalks and Pavers: Rubber sidewalks, other flexible materials and brick pavers allow for reduced repair costs to lift out a root-damaged sidewalk section and replace it. However, often the repair involves cutting the offending root that is lifting the sidewalk. These materials do not solve the problem of what to do with an existing large root that is increasing in diameter. Other methods may be needed to accommodate the large roots rather than cutting them.

Pervious pavement: This type of pavement will allow moisture to percolate through the concrete directly to the soil and roots below. But pervious concrete is not as strong as regular concrete so a thicker layer of pervious concrete may be needed. And allowing moisture to percolate through the concrete may increase root growth beneath the concrete. Pervious concrete is a good product to use in a parking lot or area where root growth is to be encouraged and stimulated. Stimulating root growth under a sidewalk is not helping the situation, in my opinion.

Other Repair Methods
We will employ a variety of design strategies and construction techniques to repair sidewalks around trees. Each solution will seek to optimize the pedestrian experience while minimizing damage to tree roots. Repair strategies include:

Tree Pit Expansion
This technique involves the removal of damaged concrete sidewalk from the area around the tree and expansion of the size of the tree pit around the tree. This practice also increases the level of permeable surfacing reducing the storm water runoff.

Ramping
The grade of the sidewalk is gradually raised to ramp large roots while assuring a smooth, even sidewalk surface.

Strengthening
The sidewalk is reinforced with steel or fiberglass plastic rebar or wire mesh to reduce uneven joint lift due to tree roots as well as the likelihood of random cracking in the future.

Curving
A curving pathway around tree roots increasing the room for trees and providing a unique aesthetic value. This design approach is particularly advantageous in some cases as root pruning is prohibited.

Root Control Barriers: Root barriers can be useful on well-drained soils on new plantings if the root barriers are properly installed. The installation of Root Control Barriers where roots of some trees have been cut has shown to be very beneficial. The top of the root barrier must be slightly above, or at, grade or roots will grow over the top of the barrier. Proper installation by an experienced arborist is very important.

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Good Resources for Dealing with Sidewalk-Tree Root Problems:

1 Dr. L.R. Costello and Dr. K.S. Jones, ***Reducing Infrastructure Damage by Tree Roots: A compendium of Strategies***, Western Chapter of the International Society of Arboriculture, Cohasset, Ca., 2003.

2 John Roberts, Nick Jackson and Mark Smith, ***Tree Roots in the Built Environment***, Centre for Ecology & Hydrology, Natural Environment Research Council, London, 2006.

3 Dr. Ed Gilman's website http://hort.ufl.edu/woody/urbansidewalk.shtml (as of June 29, 2011).

4 Dr. Ed Gilman, ***Trees for Urban and Suburban Landscape***, Delmar Publisher, New York, 1996.

5 Smiley, Thomas, Bruce Fraedrich, Neil Hendrickson, Ph.D.'s, ***Tree Risk Management***, Bartlett Tree Research Laboratories), Charlotte, NC, 2002.