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# Sidewalks and Roots: Mitigating the Conflict

2 messages

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Brian,

Thanks for being open to hearing ideas I've found re: tree preservation on Tillinghast (and beyond). I think we agree that there's a great deal of value in preserving La Conner's street trees; the question becomes how can we do it affordably, safely, and sustainably?

I had the incredible good fortune of hearing from Gordon Mann, an ISA Certified Arborist and Municipal Specialist, PNW Certified Tree Risk Assessor, and CaUFC Certified Urban Forester. I was able to interview him and hear what solutions he's encountered in instances like this where sidewalks and trees conflict and the desired outcome is the trees' preservation while maintaining a safe sidewalk.

First, he shared with me a presentation he did to the NY Arborist's Association recently where he reviews various sidewalk materials, provides the pros and cons, and provides (in my opinion) some really outstanding analysis. I've attached it, but in summary, his ultimate recommendation comes down to sustainable modular materials.

One material he mentioned was Terrewalks, a permeable modular plastic plate made out of 100% recycled material, that have been used in Seattle recently to combat this very problem. Other case studies are here. I'd be curious to hear what you think about this. It seems like these can be removed, the roots can receive a light pruning, and then they can be placed down again. I've read the price is comparable with concrete but we'd only know that for sure if you got a quote. I wonder if there's some kind of WA state grant or something that could be used to help pay for the effort?

For what it's worth, it strikes me that some kind of modular material is the way to go; trees are dynamic, they change and shift, so any static material like bridging or concrete eventually becomes untenable. Whatever we do, it's going to break, so something that can be pieced together with replaceable parts seems to make sense.

I hope this can be the start of the conversation, that we can share ideas, and come to a solid solution for not only those five trees, but when this issue inevitably springs up in the future in other elements of town.

**Sidewalks and Roots Gordon Mann 2022 NYAA annual conference.pdf**
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**Ryan Anderson** <randersonvt@gmail.com> Tue, May 10, 2022 at 12:49 PM
To: Rick Dole <council_3@townoflaconner.org>

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## CASE STUDY: *City of Seattle, Washington*

The City of Seattle prides itself as one of the most pedestrian friendly cities in the nation. It has a well-developed and mature urban forest with more than 130,000 trees. Liz Ellis (Sidewalk Safety Repair Coordinator) is responsible for managing the sidewalk repairs adjacent to some of Seattle's various tree populations including maple, cherry, magnolia, tulip, and gum trees – all of which uplift sidewalks.

The Seattle Department of Transportation (SDOT) has installed Rubbersidewalks™ at three different locations. These locations were selected because they provided distinct conditions for evaluating the Rubbersidewalks™.

### Problem:

For Seattle it's important to repair as many priority locations as possible. Yet, sidewalk repair needs exceed available budget funds. In addition, paving costs per square foot are typically higher than the national average. Ideally, sidewalks repairs represent a lasting investment in maintaining safe sidewalks. **The Sidewalk Repair budget for 2011 is $1.7 million.**

### Solution:

Costs of tree root pruning and removal are one of the primary contributors to Seattle's high sidewalk repair costs. Seattle considered Rubbersidewalks™ because of a key feature about the pavers: they can be **removed** and **replaced**. In addition, Rubbersidewalks™ contribute to Seattle's reputation as a pedestrian-friendly city because the pavers' flexibility means they are softer and easier to walk on.

**"It's important to create sustainable projects that support healthy, long term tree growth without compromising expensive investments. Rubbersidewalks™ is to be commended for creating products that may provide a good alternative to traditional concrete sidewalks."**

*Liz Ellis, Sidewalk Safety Repair Coordinator/Certified Arborist*

**For more information, please contact:**
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# Alternative Sidewalks: Mitigating the Conflict Between Sidewalks and Roots

by Gordon Mann, Consulting Arborist, CalTLC & Mann Made Resources, Auburn, CA

*Follow up to NY Arborists Assn, 2022 Conference Presentation*

The scope of the sidewalk and tree conflict is very large. In the U.S., the cost of repairing sidewalks characterized as being damaged by trees is in the hundreds of millions of dollars. In California alone, the snapshot amount of concrete damage has been reported at $70 million by the Center for Urban Forest Research. In Redwood City, the damage was estimated at $24 Million with a 40-year plan to repair. In Los Angeles, a lawsuit settlement is supposed to provide $1.37 Billion over 30 years, expended at a rate of $31 Million per year ramping up to a rate of $63 Million per year in the final 5 years.

This handout offers an overview for municipal arborists and engineers of ways to improve the relationship and longevity of trees growing near sidewalks, streets, and driveways. Although written with the focus on the public right-of-way, the information is applicable to private property and new developments.

**The Essential Conflict**

There are two types of interactions between trees and sidewalks:

- Trunk flare damage where the actual flare of the trunk lifts the sidewalk
- Root damage where a root emanating from the tree has caused damage to the sidewalk

The sole cause of trunk flare damage is a lack of space. The sidewalk is actually in contact with and lifted or offset by the enlarging trunk. Increasing the distance between the tree and sidewalk is the optimum way to mitigate the trunk flare sidewalk damage while retaining the tree. There are no opportunities to root-prune in this situation. If the decision is to remove the tree, unless the site design is modified or a much smaller scale size-classification tree is planted, the same damage should be expected in the future.

The causes of root damage vary from shallow and surface roots to the radial growth increase of roots, both causing sidewalk displacement. Sometimes the offending shallow or surface roots may be pruned. Other times, relocating or modifying the sidewalk can reduce the need for, or amount of, root-pruning.

New construction and design can provide ample space for the two infrastructure elements (tree and sidewalk) to co-exist. However, existing retrofit sites may not have the necessary space to allow for re-design that increases the distance between the tree trunk and the sidewalk. The space around a tree can be utilized with either temporary or modular designs that can be moved away as the tree grows larger. I have used sacrificial sections of pavement adjacent to the tree, separate from the permanent pavement to limit the damage that will be caused by the tree.

**Solutions and Innovations**

In mitigating sidewalk-tree root conflicts, once the decision is made to retain the tree, managers have to weigh tree removal avoidance vs. tree preservation. With tree removal avoidance, the intent is to maintain tree stability and avoid unplanned whole tree failure. Tree decline or death, although not desirable, can be managed. Tree removal avoidance typically involves root pruning and re-grading—for instance, cutting roots more severely than accepted industry standards and best management practices.

By contrast, the tree preservation approach focuses on protecting the tree for optimum condition and longevity. The chief concern is to avoid injury or decline to the tree. An example of tree preservation is relocating the sidewalk and minimizing excavation into the root area while completing the repair.

In the relationship between trees and sidewalks, choice of sidewalk material is a major consideration. The disadvantage of a rigid material such as concrete is that one lift point pries and raises an entire section, causing the section to be offset. This can create an edge step separation or offset greater than the actual root lift. Alternative materials and designs to concrete provide the benefits of less excavation, increased porosity, and the ability to allow roots to be present in the base materials and under the walkways.

The disadvantage with materials that require an edge border for support is that the rigid edge can be raised in a fashion similar to concrete. Edge borders include the footing on tree grates and side forms on brick, interlocking pavers, decomposed granite, and rubber sidewalk panels.

The ability to repair future damage by reusing the same materials reduces the future maintenance and repair costs. Additionally, from a sustainability perspective, there is less material going to the landfill. Another advantage of repair vs. replacement is that site appearance remains more consistent over time. Also, the repairs can usually be performed faster.

The thickness of the material and how deep roots would need to be cut to install or repair is a very important consideration. Many conversations discuss roots existing in the top 12 inches of soil. Using 12 inches as an area of most of the root growth, two inches depth is $1/6^{th}$ the root depth. Eight inches is 2/3 the root depth, and four times a 2-inch material.

An important consideration I always have is how is the material maintained or replaced. Many products on the market that are poured and are not modular have to be torn up and replaced. While many products have less removal needs than concrete, removing and replacing is not as sustainable as re-using the same material. The sidewalk materials in use at the time of this presentation along with their plusses and minuses follow. All materials can be ADA compliant if designed/installed properly.

**Concrete** On the plus side, this accepted standard material is solid, doesn't need an edge treatment, and can be permeable, reinforced, tinted, textured, and shaped and formed into curves around trees. It also can be leveled by slab jacking and grinding raised edges. On the minus side, it is rigid and not reusable, is usually not very porous, and depending on soil conditions and building codes may require a 4-inch-thick compacted

base beneath 4-inch-thick sections. This often means removal of roots to eight inches depth which has an impact on tree health. Root pruning to 8 inches can impact stability.

**Asphalt** has a lot of advantages. It is low in cost, thinner than concrete, and easily paved, shaped, and repaired with saw-cutting and patching. It should not need an edge form after paving. It can be coated with a cement dust that gives a gray finish, absorbs oils, and lightens color to reduce heat absorption. It can also be stamped and tinted. Asphalt doesn't require a thick base when used for a walking surface. It can be placed over roots and can be permeable. Finally, it can be used as a ramping or topping material to alleviate a raised/offset concrete area, though ramping patches don't last long in regions that experience harsh winter with freeze and thaw cycles. On the downside, it heats up in sun and becomes soft, it has a shorter lifespan than concrete, it is not reusable, although may be recycleable, and its appearance is not always desirable.

**Tree Grates** provide space around the tree as long as the grate opening doesn't cut into the trunk or trunk flare as the trees grow in girth. The opening can be enlarged by cutting the grate by torch or saw, but many cities fail to keep up with this requirement. If an agency has a large quantity of tree grates, instead of cutting, they can be swapped out with the smaller opening being saved for the next planting and ones in stock with larger openings placed around the tree. On the downside, the grates are designed and specified sit in a concrete footing. The footing is usually a deeper concrete pour than the adjacent walkway. If the grate is 4 or 5 feet round or square, the space between the footing and trunk is inadequate, and grate frames can be lifted by roots and trunk flare growth. Also, grates and installation are one of the more expensive treatments.

**Bricks over Sand -** This common material, mid-range in cost, and offering many colors and styles can be placed over roots, shaped or curved, and is reusable. It's one of the more classic and attractive treatments. On the minus side, it requires a rigid side form (wood or concrete) to hold the bricks in place, which can be lifted by roots. Bricks don't interlock, so individual bricks can be offset and not level. It is mid-range on the thickness and price scale.

**Interlocking Pavers** The advantages of these are that they are flexible, reusable, shape-able, and decorative and can use a sand base and be installed over roots. Permeable pavers are available besides the permeability of the seams. A disadvantage is that they need a concrete or rigid edge on all sides to hold them in place and this edging can be lifted by tree roots. They are mid to upper level on the thickness scale. Also, interlocking pavers may require higher maintenance to keep them looking attractive.

**Decomposed Granite, aka Fine Rock Dust** - This material is low cost and easily maintained by adding more or by grading and compacting. A binder can be used to help keep it together. Its border can be shaped, it can be placed over roots, and it doesn't need a deep base. On the minus side, it requires an edge band on the sides to hold it in place, and this band can be lifted by roots. Also, the surface typically wears easier and needs more maintenance. The dust has the potential to be tracked into homes and businesses. It

can erode on slopes. The appearance may not be acceptable in some urban settings. This is mid to upper level on the thickness scale and once compacted is not very porous.

**Rubber Panels** - On the plus side, rubber panels come from recycled materials (usually tires) and are flexible, thin (around 2 inches), and reusable. They can be easily cut to shape around trees and can be placed directly over roots. The base material can be filled in around roots and graded prior to laying the rubber panel. Also, rubber panels may be manufactured to appear similar to concrete. On the minus side, edge treatment is needed to hold the panels together, which can be raised and cantilevered by tree roots. If the site grade undulates (as in rolling hills), the adjacent panel edges may not match perfectly. Another disadvantage is that most installations are not designed for vehicle traffic. This material is on the lower end of the thickness scale.

**Poured-in-Place Rubber** - Forms for this material may be removed after the product cures and it can be placed over roots. Other advantages are that it can be shaped or curved, can be placed in thinner sections (2 inch), it doesn't need a thick base, may be permeable, and the color of the material or the top surface may be customized for enhanced appearance. Disadvantages are that it is not reusable (it may be recyclable) and the new installation may not match the older weathered appearance. It is usually softer/more squishy than formed rubber panels (may be even softer in hot climates), and its cost or contractor availability varies greatly by location. Another disadvantage is that some installations are not designed for vehicle traffic. This material is on the lower end of the thickness scale.

**Polymer-Bonded Aggregate** - This attractive newer material consists of small aggregates of decorative stone that are glued together with a viscous polymer or resin. The glue material does not fill the pore space between the aggregate allowing water to pass through easily. The result is an attractive, fairly thin, porous walking surface. It can be mixed on site and the polymer can bring out more luster in the aggregate making it more attractive. It doesn't need rigid side forms or a thick base. It can be shaped or curved and placed over roots. On the minus side, it is rigid and could cantilever if raised by a root. The repair should be able to be made by cutting and patching closely matching aggregate, which isn't as sustainable as reusing. As a material, it hasn't been used on enough projects for long-term evaluation. This material is on the lower end of the thickness scale, although if designed for vehicle traffic, it may be made thicker.

**Root Bridging** - This approach creates a space between the sidewalk material and the existing tree roots or ramps the walkway over the roots while still meeting ADA grade standards. A slope is created using posts, piers, or arch supports, or materials placed over the aggregate; the sidewalk material is laid on the supports to leave a gap and space for the roots to grow without lifting the sidewalk. The big advantage of root bridging is that existing roots can be retained for health and stability. The bridging materials can vary, depending on height required, length of the repair area, and available budget. Common materials are wood, concrete, and composites. The main disadvantage of root bridging is that its design and construction may be expensive. If the height of the bridge is equal to a step (6 - 8 inches) above adjacent grades, a railing may be necessary for safety.

Sometimes soil can be used to match the edge of the bridge and remove the step-off potential.

**Sunnyvale's Steel Plates**

An innovative method practiced for more than 20 years in Sunnyvale, CA is to use steel plates bolted to or around the roots to limit the future growth of the root towards the concrete improvement that is placed over the steel (see photo). Steel plates of 1/8" thickness are bolted on top of the root or placed on opposite sides of the root and bolted together, sandwiching the root. Future root growth cannot push the steel apart the force does not exceed the strength of the steel — rather, the root flattens between the plates. Plates are placed under or adjacent to the sidewalk to strategically limit future radial growth. This technique is more expensive than root pruning and it takes time to perform the plate work. However, the trees are more stable and healthy, and Sunnyvale has not had to return to these sites for root conflicts. Most importantly, the trees are more stable than if they were root pruned.

**Going Forward**

Innovative methods of administering a sidewalk repair program are needed to achieve longer living trees and fewer conflicts. The approaches will require a good education component to receive better engineer and citizen acceptance.

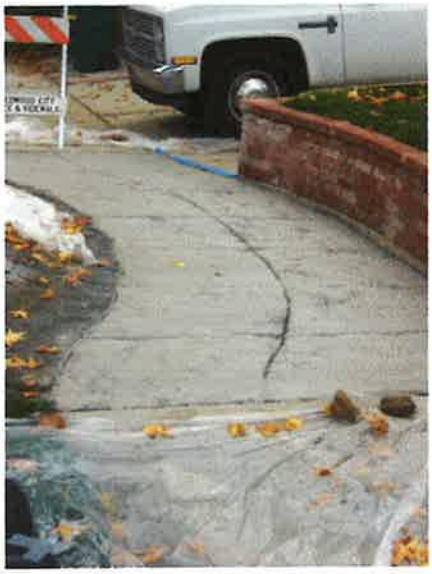
Some examples of interim and transitional approaches include:

a) Planting new trees farther from the curb than the sidewalk (not just placing the tree in the center of a narrow planting strip)
b) Relocating sidewalks farther from the tree
c) Relocating curbs farther from the tree
d) Larger tree grate systems, moving the concrete footing farther from the tree
e) Larger space around the tree/moving the permanent concrete farther away; the space between the tree and permanent concrete can be filled with many of the materials listed above
f) Removing the sidewalk on one side of a residential neighborhood street. Plant larger trees on the side with no sidewalks and smaller trees on the side with sidewalks
g) Obtaining easements to move sidewalks onto private property to provide more space for tree roots
h) Constructing more root-friendly/compatible sidewalks in lieu of the traditional 4 inches of concrete over compacted base or soil
i) Installing the Sunnyvale steel plate system to limit root growth
j) Designing new developments with larger planting space

If we continue to design the sidewalk-tree interfaces the same as we have in the past, we will see the same sidewalk-tree root conflicts. Fortunately, there are options for communities to consider and achieve a higher level of success in protecting their tree infrastructure assets while enjoying pedestrian walkways. As more communities strive to create walkable, sustainable, shaded neighborhoods, we need to work with community designers and civil engineers to modify current practices and adopt approaches that have a higher probability of long-term success. When the benefits the community trees provide

are combined with the age the tree has to grow to, at least 15 years after planting to start providing returns greater than the investment, the support for valuing trees more than traditional concrete and finding ways to retain the trees with an acceptable ADA compliant walkway are the sustainable approach to sidewalk and tree management.

**Images**



Poured in place rubber sidewalk

Rubber Panel Installation

Roots offsetting curb and gutter; note: Concrete edge band holding pavers

roots raising sidewalk