Urban & Community Forestry Assistance Program

5 TECHNOLOGY BULLETIN

JUNE 1998 FORESTRY REPORT R8-FR 63
USDA FOREST SERVICE / SOUTHERN REGION
1720 PEACHTREE RD., NW ATLANTA, GA 30367
SOUTHERN RESEARCH STATION
320 GREEN STREET, ATHENS, GA 30602

How to Protect Tree Roots While Replacing Sidewalks and Curbs

HOW TO PROTECT TREE ROOTS WHILE REPLACING SIDEWALKS AND CURBS

New innovations in repairing or replacing sidewalks and curbs can reduce damage to street trees by accommodating, rather than ignoring, tree roots. Construction techniques to repair or replace sidewalks and curbs usually involve cutting or severing tree roots. Research suggests that injury to the buttress roots of a tree could predispose that tree to decline (Hamilton 1988; 1984; Kessler 1992) or possible windthrow (Hamilton 1988; 1984; Helliwell 1989; Smiley and Fraedrich 1991). In 1990, a triple fatality in Toledo, Ohio, was associated with a falling tree whose roots were cut during sidewalk reconstruction. This bulletin describes different techniques that may be used when repairing or replacing sidewalks and curbs to minimize the amount of damage to the tree.

SIDEWALK REPAIR AND REPLACEMENT

Sidewalks often need to be repaired or replaced when they become cracked or displaced creating safety concerns. The presence of large, lateral support roots under and near the sidewalk in these areas highlights the need to exercise caution while repairing sidewalks. Two techniques for repairing cracked or displaced sidewalks are the asphalt wedge and grinding. Landscape pavers, concrete ramp, and asphalt ramp are techniques that can be used when the sidewalk needs to be replaced.

Asphalt Wedge

This repair is usually considered temporary, but it is one of the simplest ways of repairing a displaced slab, or "stub-toe." In this repair an asphalt wedge is applied between the upper and lower slab of the walk (fig. 1). Such repairs rarely correct the prob-

Figure 1. Asphalt wedge

Patrick O' Brien
Forestry Inspector
City of Toledo, Division of Forestry and OSP
221 Elmdale Rd.
Toledo, OH 43607
(419) 936-2988

Tracy Martin
Staff Engineer
City of Toledo, Division of Water Distribution
401 S. Erie St.
Toledo, OH 43602
(419) 936-2847

Barbara Colony
Chief Construction Engineer
City of Toledo, Department of Transportation
1 Government Center, Suite 1720
Toledo, OH 43604

NORTHEASTERN AREA STATE AND PRIVATE FORESTRY
URBAN FORESTRY CENTER FOR THE MIDWESTERN STATES
845 CHICAGO AVENUE, SUITE 225 EVANSTON, ILLINOIS 60202

SOUTHERN REGION URBAN FORESTRY TECHNICAL SERVICE CENTER

lem, but they do reduce the danger to pedestrian traffic.

Grinding

Another simple, low-cost alternative for repairing a displaced sidewalk is the use of a mechanical grinder to wear down the raised edges of the slab (fig. 2). Grinding is generally limited to concrete slabs with less than 1 inch of displacement. It may be possible to grind away edges with 2-inch displacement; however, if 50 percent of the slab thickness is removed, the structural integrity of the concrete may be lost.

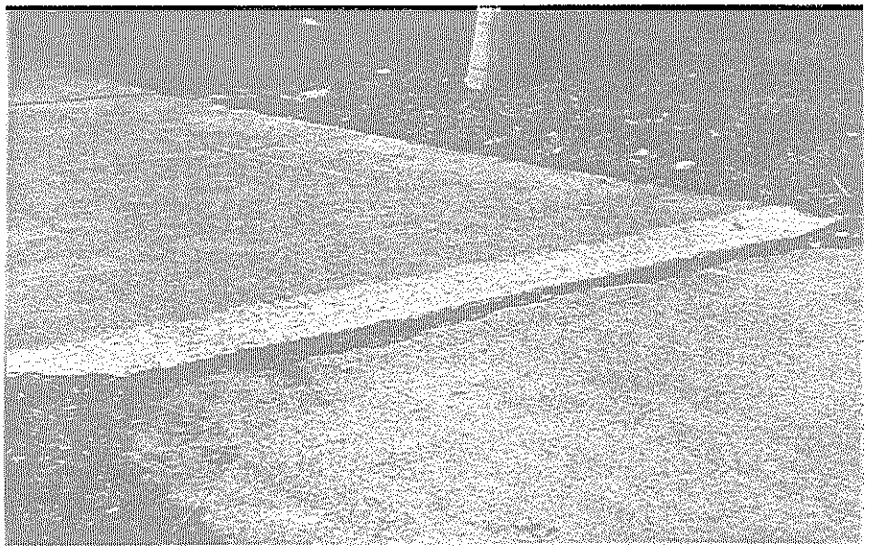

Figure 2. Mechanical grinding

Landscape Pavers

Removing the damaged sidewalk and installing landscape pavers is a very attractive option, but the high unit cost can prohibit this type of repair in most communities (fig. 3). In addition, as roots begin to expand, individual pavers could easily be displaced and would require repair.

Figure 3. Landscape pavers

Concrete Ramp

Another option is to remove the damaged sidewalk and install a concrete ramp. The concrete is then poured over the top of uncut roots to create a ramp (fig. 4). Unit cost and material durability are reasonable; however, concrete is a stiff material that can be expected to lift as individual tree roots expand.

Asphalt Ramp

This option involves removing the displaced slabs and installing asphalt over the top of exposed tree roots (fig. 5). Criticisms of this method range from questions of material durability to debris deposited by foot traffic. However, because the unit cost of asphalt is nearly half that of concrete it may be worthwhile to look at this as an option. Since asphalt is both flexible and plastic, displacement from root expansion would likely occur only in the area of the root itself rather than over the entire repaired sidewalk section. Cracks or ridges in the slab could be sealed or repaired by reapplying asphalt to extend the life of the ramp. Issues related to coloration and debris tracking could be addressed, perhaps through the application of sealers or traffic paint.

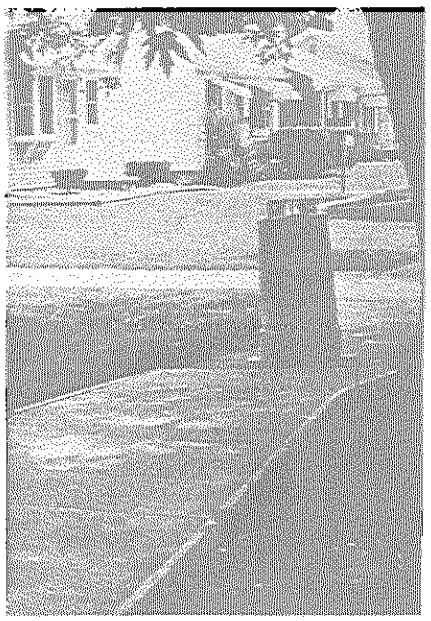

Figure 4. Concrete ramp

CURB REPLACEMENT

Curbs are often replaced during road resurfacing, especially if the curbs are cracked, leaning, or insufficient in height. For most road resurfacing projects, the height of the curb must be at least 3 inches above the asphalt. If curb height is less than 3 inches, then curb replacement is required. Since resurfacing roads usually requires the application of 2 inches of new asphalt to the roadway, curbs are often replaced. There are techniques that can be used to minimize the amount of root damage when repairing or replacing curbs.

Figure 5. Asphalt ramp

Figure 6. Small bucket

Adaptations of the Excavation Bucket

When a wide (2 to 3 foot) excavation bucket is used to remove curbing there is an unusually large amount of disturbance to the tree lawn area. In reality, only a 1- to 1.5- foot wide trench is needed behind the old curb to set forms or run a curb machine, which would reduce the amount of root damage (fig. 6). Specialized teeth or appendages can also be welded to the excavation bucket (fig. 7) and used to pry out individual sections of curb (fig. 8). Minimal root disturbance occurs with this technique, and you have an option of either pouring concrete back into the recently made mold or doing a small amount of hand digging to place a backform for the concrete. This procedure works extremely well for removing sections of sandstone curb.

Replacement of Curbing Outside Tree Root Area

If the existing curb is sound and the height is at least 3 inches, then it is possible to establish a protective zone around the tree, which leaves the curb near the trunk undisturbed. This protective zone varies from approximately 3 feet on either side of a tree less than 12 inches in diameter at breast height, or 6 feet on either side of a tree that is more than 12 inches in diameter at breast height. New curbing on both sides of the protective zone is sloped to meet the old

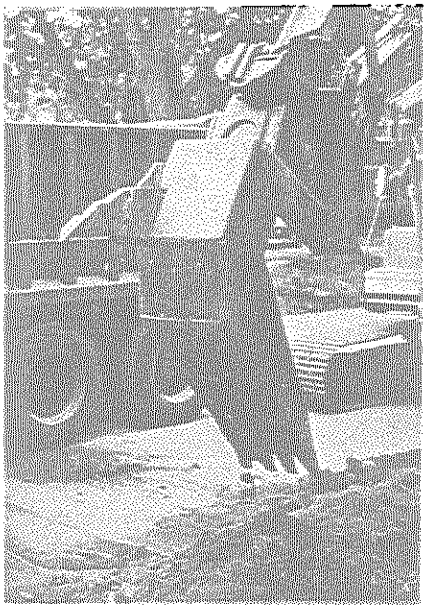

Figure 7. Bucket with appendage

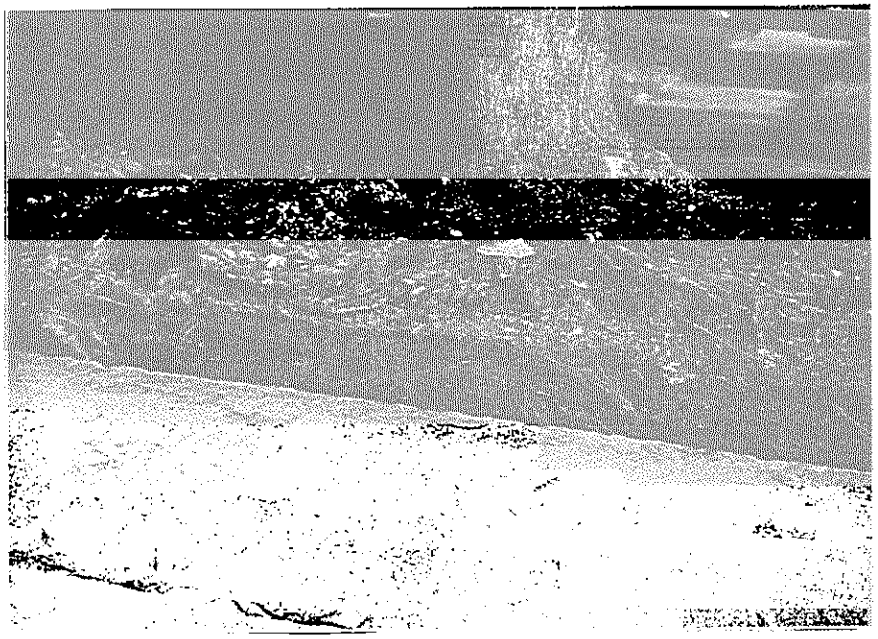

Figure 8. Removed curb

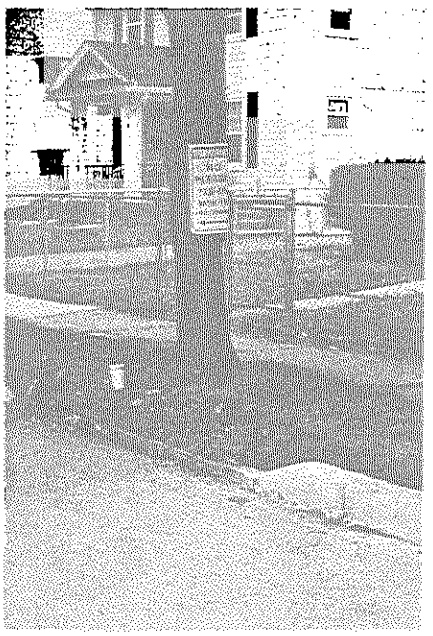

Figure 9. Sloped curb

USDA FOREST SERVICE
SOUTHERN REGION
1720 PEACHTREE RD., NW
ATLANTA, GA 30367

SOUTHERN RESEARCH STATION
320 GREEN STREET
ATHENS, GA 30602

Figure 10. Removed asphalt

curbing (fig. 9). Some critics suggest that streets with this type of curbing lack the uniformity of streets where 100 percent of the curbing has been replaced. Also, a concern may be the movement of water over these low curb areas from the tree lawn into the street, creating a possible erosion problem. However, removing all trees from a street in order to accommodate such uniform curbing may negatively impact the continuity and the value of the properties in the neighborhood.

Road Cut

Another curb replacement technique, the road cut, can greatly reduce root damage to a tree. This technique involves cutting a narrow section of pavement adjacent to the curb with a concrete saw and removing the curb and the pavement (fig. 10). A small amount of hand digging may be required for installing the new curb. A section of pavement measuring at least 2 by 10 feet must be removed each time this method is used in order to insure stability of the roadway.

Each of the above construction alternatives, while unique in their individual method and application, can reduce the amount of root damage during the replacement or repairing of sidewalks and curbs. All of these methods should be evaluated, both on applicability and cost (table 1) and the extent of municipal involvement in sidewalk replacement. Street trees are important to a flourishing community as well as to properly maintained streets and sidewalks. Use of the techniques presented here can help insure that residents have both "safe streets" and "healthy urban forests."

Table 1. Costs associated with construction alternatives for sidewalk and curb replacement around street trees

Type of construction	*Construction option*	*Average unit cost**	*Minimum expenditure per location*
Sidewalk removal/replacement	Asphalt wedges	$40.00/site	$40.00/site
	Grinding	$7.00/ft²	Variable
	Landscape pavers	$15.00/ft²	$600.00§
	Concrete ramp	$4.50/ft²	$180.00§
	Asphalt ramp	$2.40/ft²	$96.00§
Curb removal/replacement†	Straight curb (no tree)	$12.00/linear ft	Variable
	Pry curb	$12.00/linear ft	Variable
	Road cut	$35.00/linear ft	$350.00‡

* Figures based on construction bids received by the City of Toledo, OH in 1995 or from private solicitation.
† No additional costs are assumed by the vendee for use of a 1-foot wide excavation bucket or to leave existing curb.
‡ A minimum replacement length of 10 feet is required to stabilize pavement.
§ Replacement of 40 ft² is often required to achieve the grade restriction of 1/2 inch or rise per 1 inch of run.

REFERENCES

Barker, P.A. 1988. Proactive strategies to mediate tree-root damage to sidewalks: In: Combined Proceedings; The International Plant Propagators Society; 1987; [location unknown]; Berkeley, CA; Pacific Southwest Forest & Range Experiment Station, Forest Service, USDA. 37: 56-61.

Hamilton, W.D. 1984. Sidewalk/curb breaking tree roots, management to minimize existing pavement problems by tree roots. Arboricultural Journal. 8(3): 223-234.

Hamilton, W.D. 1988. Significance of root severance on performance of established trees. Journal of Arboriculture. 14(12): 288-292.

Helliwell, D.R. 1989. Tree roots and stability of trees. Arboricultural Journal. 13(3): 243-248.

Kessler, K.J. 1992. Basal trunk and buttress root injuries may be associated with branch dieback in Black Oak. Res. Note NC-358. Carbondale, IL: U.S. Department of Agriculture, Forest Service, North Central Forest Experiment Station. 2p.

Smiley, T.E.; Fraedrich, B.R. 1991. Hazardous tree evaluation and management. Charlotte, NC: Bartlett Tree Research Laboratories. 46p.

State of Ohio, Department of Transportation. 1987. Construction and material specifications. Columbus, OH: [publisher unknown]. 597p.

This bulletin is also available in an electronic format through State and Private Forestry on the Southern Region home page: http://www.r8web.com. Please call (706)546-3203 for more information on the Technology Bulletin Series.

Forestry Report R8-FR 63 May 1998

Printed on recycled paper