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Costs Due to Conflicts Between Street Tree Root Growth And Hardscape

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In California, there are over 30 million people of which more than 90% live in urbanized areas. Most residents appreciate the important role street trees play in enhancing quality of life. There are approximately six million street trees and 80% of all California cities have municipal tree programs (Bernhardt and Swiecki, 1993).

Although street trees provide a host of environmental, social, economic, and aesthetic benefits, the wrong tree in the wrong location can be costly. Conflicts between tree root growth and hardscape can result in repair costs, as well as other costs that have not been widely studied. For example, cities fund root pruning and installation of root barriers to alleviate conflicts, remove and replace trees that become liabilities, and pay trip and fall claims. The magnitude of these "external" costs is unknown.

This paper summarizes results of research aimed at achieving a complete accounting of annual expenditures associated with street tree root-related hardscape damage in California.

Costs Associated with Root and Hardscape Conflicts

A survey of 18 California cities indicated that approximately $70.7 million (se $11.1 million) was spent annually statewide due to conflicts between street tree root growth and sidewalks, curbs and gutters, and street pavement.

1. Repair Costs

Annual expenditures for tree-related sidewalk repair totaled $6.6 million or $0.88/capita (se $0.36). The frequency of sidewalk repair averaged 1 per 99 street trees and the average repair cost was $480 (McPherson, 2000).

Tree-related curb and gutter repair costs for 5 cities were 38% of sidewalk repair costs ($1.14/tree) (McPherson and Peper, 1995). Fifteen California cities reported a weighted mean expenditure of $0.45/capita (se $0.10) or

51% of the amount spent to repair sidewalks. The average repair cost was less for curb and gutter than for sidewalk repair ($277) and curb and gutter repairs occurred less frequently on average (1:169) (McPherson submitted).

Street surface repairs were reported to account for 5% of total tree-related infrastructure expenditures in 18 California cities ($0.32/capita, se $0.05), while 44% of total costs were for sidewalk repair, and 8% for curb and gutter work. Street repairs occurred at nearly the same frequency as curb and gutter repairs (1:151), and at nearly the same average cost ($288) (McPherson, 2000).

When repair costs are passed through to property owners, trees may be regarded as villains. In the California survey, only eight of 18 cities fully funded sidewalk repair. Property owners were required to pay all tree-related sidewalk and curb and gutter repair costs in the two largest cities, Los Angeles and San Jose. Of the total $6.6 million spent on sidewalk repair in the 18-city sample, 61% was paid with municipal funds and 39% was passed through to property owners. Property owners paid 17% of total curb and gutter repairs, while the municipalities paid for all street repairs.

2. Mitigation and Prevention Costs

Expenditures for mitigation of existing damage and prevention of future damage accounted for only 9% ($0.17/capita, se $0.08) of total costs in 18 California cities (McPherson, 2000). Fifty-six percent of mitigation/prevention expenditures were for root pruning. Root pruning occurred more frequently than sidewalk repair (rate of 1:86), and the average cost was $79. Twenty-one percent of total dollars spent on mitigation/prevention was for grinding and ramping of sidewalks to reduce displacement that might result in trip and fall accidents. Grinding was the most frequently applied mitigation measure in two cities (1:72) and averaged $44 per job. Ramping or tapering the walk with asphaltic concrete or a similar product was reported as a relatively infrequently applied measure (1:13,782) in 9 cities with an average unit cost of $31. Installation of root barriers was a common prevention measure. The use of root barriers in 12 cities accounted for 15% of total costs for mitigation/prevention, with an average unit cost of $40 and a frequency of 1:293.

3. Tree Removal and Replacement

Tree removal and replacement totaled $1.96 million ($0.26/capita, se $0.14) or 13% of total estimated expenditures for 18 cities in California (McPherson, 2000). Expenditures for removals totaled $1.6 million with an average cost of $537. Removals occurred at an average rate of 1:596 and removed trees were typically 50 to 64 cm dbh and 30 to 35 years old. Seventy-five percent of all removed trees were replaced; the average replacement cost was $154, and 92% of the total replacement expenditures were for 57-liter (15-gallon) container trees.

Benefits are foregone when a large tree is prematurely removed because of a conflict with surrounding infrastructure. The value of annual benefits produced by a large street tree in a San Joaquin Valley community can exceed $100 (McPherson et al., 1999). On the other hand, cities spend $20 to $40 per year to maintain a street tree of this size, so benefits can exceed costs by a factor of 2 or more. Replacement trees are a net cost for the first 5 to 10 years because establishment costs are greater than benefits from the relatively

small tree crown. Therefore, premature removal and replacement of large trees results in considerable payment for work performed ($691/tree on average), and a substantial loss of net benefits formerly produced by the tree (approximately $70/tree).

4. Trip and Fall Cases and Legal Staff Time

An interesting finding from the California survey was the relatively large cost for trip and fall payments and legal staff ($2 million, 14%) (McPherson, 2000). Average costs were $0.26/capita (se $0.06) for trip and fall payments and $0.12/capita (se $0.06) for staff time. Annual expenditures were variable, ranging from $1,300 in Lompoc to $1.3 million in Los Angeles. The highest single trip and fall payment reported was $120,000, and the average payment was $6,245.

5. Inspection and Repair Program Administration

Expenditures for inspectors and staff administering repair programs totaled $1 million or 7% of total costs for 18 California cities (McPherson, 2000). Inspection costs accounted for 55% of the total expenditure. The average annual inspection and administration expenditure was $0.22/capita (se $0.05).

6. Ranking of Factors Responsible for Tree-Related Damage

Respondents ranked six factors associated with sidewalk damage in order of importance. Restricted planting space was identified as the most important factor associated with hardscape damage by 56% (se 12%) of the respondents and listed as the second factor by another 33% (se 11%) of the respondents. Tree species was ranked as the number one factor by 39% (se 11%) of the respondents and as the second most important factor by 28% (se 11%). Shallow soil (i.e., soil with hardpan or other root-limiting zone) was ranked first by 6% (se 5%) and second by 17% (se 9%). Tree size (after a tree reaches a certain size it causes damage, regardless of species) and soils with restricted macropore space (e.g., fine-textured soils such as clays, compacted, sodic soils) received lower rankings. The least important factor cited by respondents was inadequate design/engineering.

Conclusions

Results from the California survey indicate that on average communities spent over $2/capita or $11/tree each year on expenses related to conflicts between tree roots and infrastructure. In 1992, California cities budgeted an average of $4.36/capita or $18.32/tree for their tree programs (Bernhardt and Swiecki, 1993). Repair costs alone accounted for 60% of total expenditures, and sidewalk repair was the single largest cost category, accounting for about 33% of total expenditures. But other costs are important. For example, Californians spent $2.26 on legal remedies for every $1 spent on mitigation and prevention.

The distribution of expenditures varied among cities, reflecting how each has chosen to deal with the problem historically, as well as each city's willingness to fund repair activities in the present. For example, in 1996, the City of Los Angeles had an estimated $375 million sidewalk repair backlog due to inadequate funds for repairs beginning in 1976 (Los Angeles Department of Public Works 1996). Only recently has funding become available to begin to alleviate

this problem. As a result, in 1996, the City spent only $0.69/capita on tree-related infrastructure issues and 51% of this amount was spent to pay claims and legal fees. The disproportionate expenditure on legal remedies reflects a long-term failure to adequately maintain the infrastructure in combination with an increasingly litigious urban population.

The City of Lompoc California, adopted a different strategy. In 1996, it spent an average of $10.67/capita on tree root-infrastructure conflict issues, the largest amount reported for the 18-city sample (McPherson, 2000). Although Lompoc spent the most for repair ($5.85/capita) and mitigation/ prevention ($2.44/capita), it had the lowest expenditure rate for trip and fall payments and legal fees ($0.01/capita). Lompoc spent $863 for repair, mitigation, and prevention for each $1 spent for trip and fall.

Conflicts between tree root growth and hardscape are costing Californians economically, environmentally, aesthetically, and socially. Not only are millions of dollars spent annually to remedy the problem, but sometimes the remedies result in the loss of other benefits that healthy, large-statured shade trees could be providing. Clearly, this is a lose-lose situation that calls for increased collaboration in the management of the gray and green infrastructure, as well as research and development of cost-effective strategies to retain benefits from a healthy street tree population while reducing costs associated with root-sidewalk conflicts.

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