Bartlett Tree Experts

Tree Risk Assessment

Cottonwood Tree at Lou Neff Point, Zilker Park

SUBMITTED TO
Angela Hanson, Forester
City of Austin Parks and Recreation Department
2525 South Lakeshore Blvd.
Austin TX 78741

SUBMITTED BY
Steve Kinslow, Arborist Representative
ISA Certified Arborist #TX-3634A
Bartlett Tree Experts
2403 Howard Lane
Austin TX 78728
512-310-7545

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INSPECTION TEAM & DATE OF INSPECTION

On February 22, 2012, I visited the inspection site, along with my colleague, James Dossett, who assisted me with the sound-wave and resistance-recording evaluations. Mr. Dossett has substantive experience operating the instruments involved with these advanced assessments.[1]

SITE

Lou Neff Point
Zilker Park
Austin, Texas 78704

SUBJECT TREE

65-Inch DBH Cottonwood

ASSIGNMENT

Provide a visual assessment from the ground and perform both sound-wave and confirming resistance-recording drilling of the subject tree to assess structural soundness, evaluate risk of failure, and recommend either remediation procedures or removal, based on findings.

VISUAL ASSESSMENT

Site Description

The subject tree is located two feet to the uphill (NW) side of Lady Bird Lake Trail, a recreational trail made of concrete and installed roughly five years ago. Barton Creek runs adjacent to this trail and is within the fall zone of the tree. Just in the time we visited the site, a near constant procession of joggers, bicyclists, walkers, and mothers pushing babies in strollers passed us on the trail. The creek is also frequently host to people in canoes and kayaks. Figure 1 shows the tree's close proximity to the trail. Figure 2, obviously a winter view, shows a fairly steady stream of people enjoying the trail. Presumably, this traffic would increase in spring.

[1]A note about terminology: In the new ISA Best Management Practices on Tree Risk Assessment (full reference in footnote 3), the term "Advanced Assessment" refers to more specific methods, such as use of sound-wave and resistance-recording drilling, that go beyond (and often complement) "Basic Assessment," which includes visual inspection from the ground.

FIGURE 1: The subject tree leaning over the trail and toward the creek (not shown).

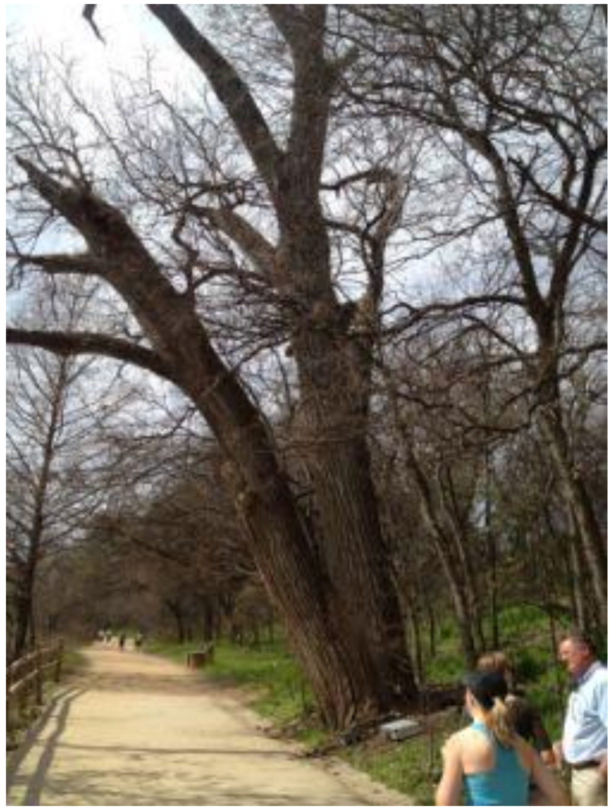

FIGURE 2: Aerial view of subject tree and site.

The Subject Tree

This cottonwood is a very mature tree and quite large at 65 inches DBH, 75 feet in height, and a canopy spread of 50 feet. Seven broken stubs appear in the canopy, indicating past limb failures. Cavities at old wounds are visible in various locations in the crown. The main **stem**[2] bifurcates at eight feet into **codominant stems** of approximately 33 inches diameter each. Some bark disturbance appears near the crotch, possibly from an old wound, and evidence of borer activity is visible in this area and elsewhere on the main stem. The tree leans 25-30 degrees over the recreational trail. A **fungal fruiting structure** is visible at the tree's base. The **root collar** is exposed. Figures 3-6 show examples of defects in this tree.

FIGURE 3: Multiple stubs show evidence of previous failures.

FIGURE 4: Example of decay cavity visible in tree.

[2] Definitions for bolded terms that appear in the main text throughout this document may be found in the Glossary in Appendix C.

FIGURE 5: Detail of crotch at codominant stem.

FIGURE 6: Fungal fruiting structure at tree base.

SOUND-WAVE EVALUATION

Research shows a high degree of accuracy in sound-wave assessment of internal wood density in trees (Gilbert and Smiley 2004). We used the ArborSonic 3D Acoustic Tomograph to evaluate wood density at nine inches above grade. The resulting image (Figure 7) represented 75% decay at that location. The ArborSonic instrument may represent some decay at the sensor points that slightly over-states the percentage of decay in a particular location, but the results should be reliable within a few percentage points. For this reason, even adjusting to 70% decay puts this tree at high risk of failure, especially taking into account the other defects and factors that add to the risk profile.[3] To provide confirming data on this result, we also performed a drilling evaluation, as detailed in the next section. (A description of how the ArborSonic works is included in the Appendix.)

[3] Interpretation of the sound-wave and resistance-recording drilling findings is based on the model provided by Smiley, E. Thomas, Bruce R. Fraedrich, and Neil Hendrickson in *Tree Risk Management*, Bartlett Tree Research Laboratories, Second Edition, 2007.

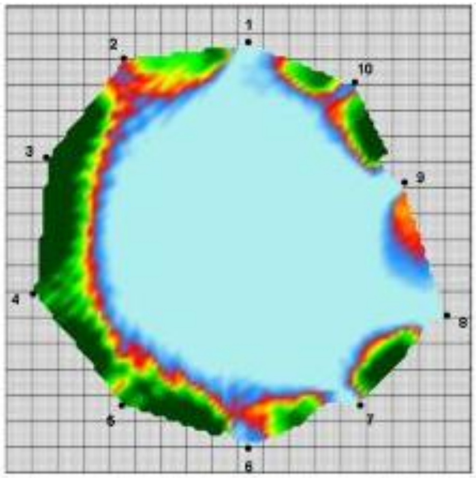

FIGURE 7: ArborSonic image at nine inches above grade, showing 70% decay.

Key: Green = Intact; Red = Decayed; Blue = Hollow

RESISTANCE-RECORDING EVALUATION

We used the IML Resistograph drilling instrument to perform this evaluation at four locations, nine inches above grade. The following table provides the results:

RESISTOGRAPH RESULTS AT NINE INCHES ABOVE GRADE		
Drill Location	**Inches of Solid Wood**	**Notes**
North	3	
East	12	Atypical Resistance
South	13	Atypical Resistance
West	9	
Average	*9.25*	

The average thickness of solid wood surrounding a decay column for a tree of this size should exceed 9.75. The subject tree does not exceed this benchmark. Additionally, Mr. Dossett noted that the drilling resistance on the east and south sides did not feel typical, i.e., steady and greater resistance as one drills into solid wood. The graphical representation backed up this impression, suggesting that the 12 and 13 inches of "solid wood" is "punky" or that much of it is in the **incipient** stages of decay. These interpretations must also be considered in the context of other factors that interact with decay to cause failure of stems and branches. These include stem lean, unbalanced crown, multiple defects, species characteristics, tree age, declining vitality, sensitive target locations, and similar concerns. As for confirming the sound-wave results, the drilling results confirmed that a significant area of decay is present at the examination location. (A description of how the IML Resistograph works is included in the Appendix.)

Although we were satisfied that both advanced assessments of the lower stem – a critical area for tree stability – provided adequate information to help us evaluate risk potential, we decided to take one more Resistograph reading at about nine feet, approximately level with the stem crotch. The result was 10.5 inches to decay, and, again, the resistance through that distance was atypical, suggesting early-stage decay. Figure 8 shows the location of that drill point and provides a better idea of tree size, lean, and location.

FIGURE 8: James Dossett takes additional resistance-recording reading at approximately nine feet above grade. This photo also provides a better view of the disturbed area at and below the crotch that showed evidence of borer activity.

DISCUSSION

Species Characteristics

As a species, the cottonwood (Populus deltoides) is a fast-growing, short-lived tree that thrives along waterways and bottomlands. These trees often have dense branch ends, and because their wood tends to be brittle and weak, their stems and branches are susceptible to failure and decay. They also have an aggressive – and often destructive - root system that is susceptible to root diseases.

The subject tree appears to fit most of these characteristics. The prevalence of branch failures greatly increases likelihood of decay, and any resulting **epicormic growth** tends to be weakly attached, which increases structural difficulties with the tree.

Tree Architecture

While codominant stems are common in trees, and more so in certain species, this structure is less desirable than one in which a central leader exists with well-spaced, appropriate-sized branches growing from it. In the case of the subject tree, each codominant stem is quite large and poses additional hazard potential, should weakness be present at the crotch, as suggested by the bark disturbance, borer evidence, and the Resistograph reading that indicated decay at 10.5 inches on the stem leaning over the trail.

Borer Activity & Tree Age

Borers are usually secondary invaders; they like to inhabit trees already stressed by primary causes, such as drought, construction damage, over-pruning, or loss of vitality. The subject tree is old, has lost its vitality, and is giving in to species susceptibility for failure and decay. Presence of borers in this tree emphasizes its poor condition.

Fungal Fruiting Structures & Root Decay

Fungal fruiting structures in the area of the root collar are positive indicators of root decay (Smiley, Matheny and Lilly 2011). In this declining tree, especially in this species, root disease would not be surprising. Furthermore, it is possible that disturbance from construction of the concrete trail within two feet of the stem might have advanced any root decay already occurring in this aging tree. Notwithstanding the presence of a fungal fruiting body at the tree's base, we did not perform additional assessment of the root collar or **root plate** because so many other factors are present to evaluate the hazard potential of this tree.

Advanced Assessment Findings

In addition to visual evidence that decay exists throughout the tree, that failures have already occurred, and that root decay is likely, the sound-wave and resistance-recording drilling confirm that a significant area of decay exists in the lower stem. This increases the risk that the tree could fail at the base.

Lean, Targets, and Conclusion

Finally, evaluating risk of failure and potential for harm must include whether **targets** are present, types of targets (e.g., a person, empty vehicle, or building), likelihood of contact in the event of tree failure, and consequences of that contact. In the case of the subject tree, it leans directly over a popular, high-use recreational trail. Taking together our findings and the subject tree's age, loss of vitality, species characteristics, history of failures, and lean, we conclude that the subject tree

- has a probable to imminent likelihood of failure,
- has a medium to high likelihood of impacting a target, and
- that the consequence of that impact would be extreme, as it would involve trail users.[4]

RECOMMENDATION

The subject tree should be removed as soon as possible.

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[4] Risk probability and target impact and consequence considerations are adapted from Smiley, E. Thomas, Nelda Matheny, and Sharon Lilly. *Tree Risk Assessment (Best Management Practices).* Champaign: International Society of Arboriculture, 2011.

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Gilbert, Elizabeth A, and E. Thomas Smiley. "PICUS sonic tomography for the quantification of decay in white oak (Quercus alba) and hickory (Carya spp.)." *Journal of Arboriculture*, 2004: 30(5).

Smiley, E. Thomas, Bruce R Fraedrich, and Neil Hendrickson. *Tree Risk Management, Second Edition.* Charlotte: Bartlett Tree Research Laboratories, 2007.

Smiley, E. Thomas, Nelda Matheny, and Sharon Lilly. *Tree Risk Assessment (Best Management Practices).* Champaign: International Society of Arboriculture, 2011.

APPENDIX

Appendix A: ArborSonic 3D Acoustic Tomograph

The Arborsonic 3D Acoustic Tomograph uses sound waves to investigate a tree's internal condition. Typically, a visual inspection reveals external evidence that provides a basis for the examination. The arborist installs a series of sensors around the tree, just through the bark in contact with the sapwood, and taps on one of them, activating the sound waves that travel to the other sensors. The software calculates the sonic velocity, which is correlated to wood density. The resulting color image provides a visual representation of how the sound waves move through the tree, which is an indication of wood density. The accompanying software compares these readings to the known density characteristics of the species and indicates where the tree is less dense than the baseline—an indication of decay.

Appendix B: IML Resistograph

We use the IML Resistograph, a precision resistance-drilling instrument that assists with detecting variations in wood density. With this instrument, mechanical electronic sensors translate into output that depicts internal conditions encountered by the drill (Dunster ND). Simply put, the less resistance encountered, the more decay that is present. This tool is especially beneficial for examining buttress roots, whose circumference would not normally be available for use with sound-wave technology (described below).

Appendix C: Glossary

Codominant Stem	Forked branches nearly the same size in diameter, arising from a common junction and lacking a normal branch union.
DBH	Diameter at Breast Height
Epicormic Growth	Shoot arising from a latent or adventitious bud.
Fungal Fruiting Structure	Also fungal fruiting body. Reproductive structure of a fungus. Presence of certain species may indicate decay in a tree.
Incipient Decay	Early stages of decay in wood.

Root Collar	Also root crown or root flare. Flared area at the tree trunk base where the roots and trunk come together.
Root Plate	Area at the tree base with a high concentration of primary lateral and support roots. This area is usually 3-5 times the DBH.
Stem	Woody structure bearing foliage and buds that gives rise to other stems (branches). In this report the “main stem” is the trunk.
Target	Life or property that could be harmed if part or all of a tree failed.