Protection Natures Structures – Trees!

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Our Goals are the Same!
Protecting our clients and their property from the damage

Topics
Trees and Lightning
Materials for Trees
Tree Standards
LP Research at the Bartlett Tree Experts Laboratory
Which trees Should be Protected

Trees are Good, but they can pose a threat
Tree Failures kill about 50 people per year in the USA
Lightning kills 90 deaths per year
Injury occurs at:
1) Home
2) Outdoor Recreation areas
3) Under Trees
4) On or near Water

Why Protect Trees?
1. To protect the tree from lightning damage
2. To draw lightning locally protecting nearby people and structures
3. To reduce the risk of sideflash
Extreme Damage

Classic Damage

Side Flash
Step Voltage

Side flash from tree to lower resistance material
Voltage dissipation

Protecting Houses and Buildings from Lightning!

Tree Protection is no substitute for house protection, but it may help out!

How do we protect trees?
Similar to the ways you protect building

Publications on Tree Lightning Protection

A300 Standard and BMP published in 2002
BMP How- to details Available from International Society of Arboriculture
www.isa-arbor.com
2002 ANSI A300 Changes

- Conductor size – 14 Strand Mini
- Spacing of branch conductors (35’)
- Spacing of drive fasteners (3-6’)
- Blunt tips or no tips
- Client notification of maintenance
- No 36” DBH rule for dual conductors
- Ground terminal depends on soil depth and texture.
- Ground Rod 10’ from trunk
- 8” Ground conductor trench

Should All Tree Protection Standards be Consistent?

The Arboriculture Industry would like to work with you to achieve this goal.

Air Terminal Spacing

Streamers and stepped leaders connect between 30 to 300 feet of the air terminal.

Branch Conductors on Major Upright Leader that terminate more than 35’ apart

Air Terminal near the top of the tree - 2.5” Diameter or smaller branches
Climbing spikes (spurs) should not be used to install LP systems in trees.

Conductor is installed as directly as possible to the ground system.

Only One Conductor is required no matter what the tree diameter.

Tree Support Cables and Galvanic Corrosion
When two dissimilar metals touch, corrosion is accelerated in one of them.

Connecting Support Cables and LP Systems
When connecting LP and Cable systems, use the Multipurpose clamps, do not hand wrap.

Drive Fasteners to Keep the conductor off the bark.
Ground Terminals

Ground conductor, ground rod or plate, clamps

Ground terminal design depend on soil depth and texture.

Sand, sandy loam and gravel soils require better grounding system (2 rods)

Ground Terminal Installation

Locate ground rod at least 10' from trunk
Can install closer if tree is surrounded by pavement or rock, but expect root/tree damage.
Locate all ground terminals away from foundations (>2'), underground utilities (>10') if possible.

Tree Lightning Protection

Research at Bartlett

4 flashes/sq km/yr = 4 flashes/250 acres/yr

Bartlett Tree Research Lab
Charlotte NC
80 LP Systems on the BTRL property
350 acres
Should capture 5 or 6 strikes per year

System Fuses or Counters
Making Lightning Fuses

An inexpensive way to confirm strikes

Attempts to Attract Lightning

Is there damage from copper fasteners?
No copper toxicity- due to compartmentalization within the wood
Minor amounts of discoloration / decay.

Does Root Damage occur near the Ground Conductor?
Work in Marshall, VA
Excavated roots near conductors that were struck
5 trees and 10 root examined
No root damage found

Ground conductors are often installed very close to important roots

Lightning Conductor Size

<table>
<thead>
<tr>
<th>Product</th>
<th>AWG</th>
<th>Diameter (inch)</th>
<th>Area (mm²)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Steel cable</td>
<td>10</td>
<td>.12</td>
<td>3</td>
<td>Steel melts when struck</td>
</tr>
<tr>
<td>Copper Wire</td>
<td>8</td>
<td>.13</td>
<td>3.3</td>
<td>Recommended for FL boats</td>
</tr>
<tr>
<td>Solid wire - house ground</td>
<td>6</td>
<td>.16</td>
<td>4.13</td>
<td>Will conduct</td>
</tr>
<tr>
<td>miniature conductor Cu</td>
<td>4</td>
<td>.24</td>
<td>6.24</td>
<td>Will conduct w/o heating</td>
</tr>
<tr>
<td>Standard Main Ground</td>
<td>3</td>
<td>.43</td>
<td>11.76</td>
<td>Previously Required for Trees</td>
</tr>
</tbody>
</table>
Ground Rods and Root Damage
Systems installed with a ½ length rod (4', 1.2m) Close to the trunk (1-2', .5m) Have had one strike in 2001, 2 in 2007 Roots were excavated and examined for damage

Roots Killed Around Ground Terminal
Strike exited from end of the ground rod Extensive root damage close to the ground rod.

Root Damage from Lighting Strike

Conclusion: Roots within 16 inches (40 cm) of a Ground Rod are at High Risk of being Killed

Blunt Rods
More receptive tips may have a larger zone of protection Comparisons of rods by Prof. C.B. Moore and Dr. Bill Rison at New Mexico IMT:
Blunt rods (1/2 to 1”, 13 to 25 mm dia) are struck more (more attractive) than sharp rods or ESE

Will Blunt Tips Work on Trees and Will they Improve Strike Reception?
Research on a Client's Property near Annapolis, MD
Compared Sharp (Franklin) point, Frayed conductors and Blunt tips.

Bartlett Blunt Tip as Air Terminal
Used on all our tree installations

Maintaining Tree Lightning Protections Systems

Trees Grow!
Growth occurs in two directions:
1) Radially – outward on all stems and branches
2) Upward – trees put on height growth from the terminal buds

Tree Growth

If Air Terminal is not relocated as the tree grows, there will be damage to the tree
Fastener and Conductor Overgrowth

Conductor are often cut near the base of the tree. What happens when the main conductor is cut?

Which Trees Should be Protected

National Fire Protection Assoc. (780 F-1) calls for the protection of trees with trunks within 10’ (3m) of a structure or when branches extend above the structure. To reduce chance of sideflash.

How Lightning Works near a LP System

Recreation area trees where people may take refuge in a thunderstorm. Especially if water is nearby.
Most golf course superintendents are aware of the need for lightning protection. Some courses have all major trees protected.

**Historic Trees**

**Treating Lightning Damaged Trees**
1) Prune broken branches
2) Protect from Pests
3) Water and mulch as needed
4) Wait
5) Further treatments

**Lightning Damaged Trees** may recover, die within several months, or decay within years.

**Hiring an Arborist**

The quality of arboricultural services is highly variable. There is no certification for Tree lightning protection installers. At a Minimum Arborists should be Certified by the International Society of Arboriculture. Certification can be verified at [www.isa-arbor.com](http://www.isa-arbor.com).


Check for Insurance and Check References

**Questions?**

Thank you from the Bartlett Tree Expert Company and Research Lab! tsmiley@bartlett.com
Lightning and Trees