

Protection Natures Structures – Trees!



E. Thomas Smiley, Ph.D.
Bartlett Tree Research Laboratories
Charlotte, NC



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
Lighting kills 90 deaths per year

Injury occurs at:

- 1) Home
- 2) Outdoor Recreation areas
- 3) Under Trees
- 4) On or near Water



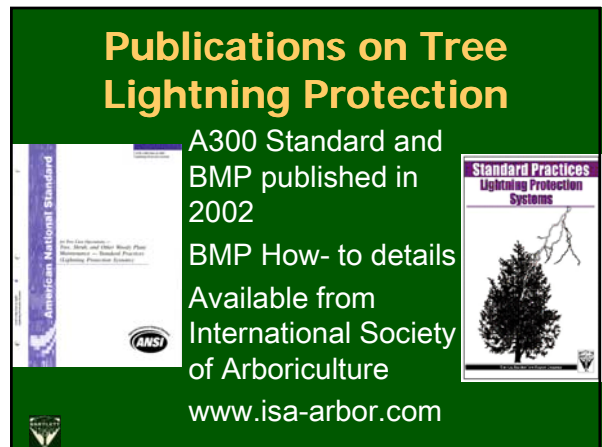
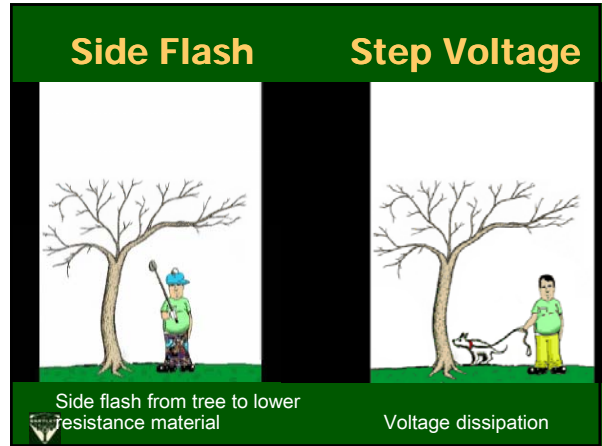
Why Protect Trees?

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



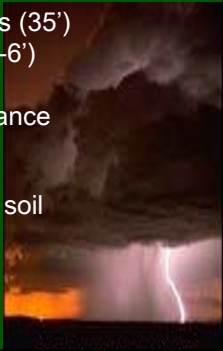
Tree Damage





2002 ANSI A300 Changes

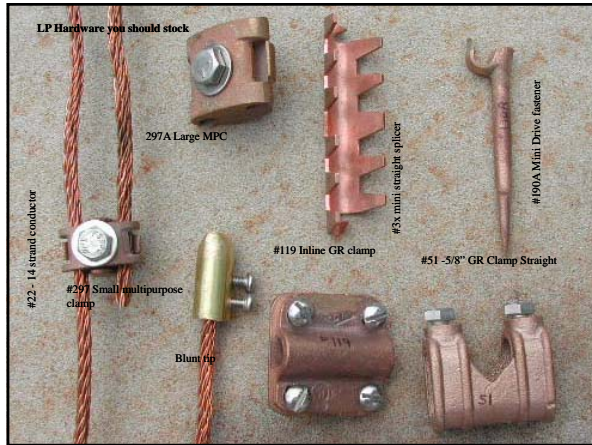
- Conductor size – 14 Strand Mini
- Spacing of branch conductors (35')
- Spacing of drive fasteners (3-6')
- Blunt tips or no tips
- Client notification of maintenance
- No 36" DBH rule for dual conductors
- Ground terminal depends on soil depth and texture.
- Ground Rod 10' from trunk
- 8" Ground conductor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



Should All Tree Protection Standards be Consistent?

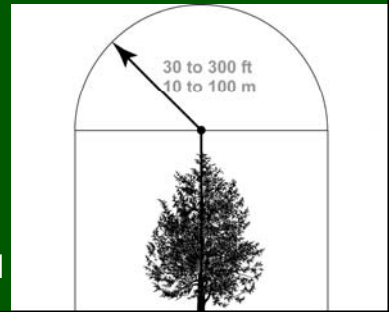


The Arboriculture Industry would like to work with you to achieve this goal.

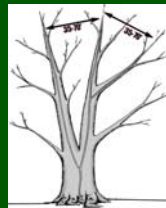


Air Terminal Spacing

Streamer and stepped leader connect between 30 to 300 feet of the air terminal



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



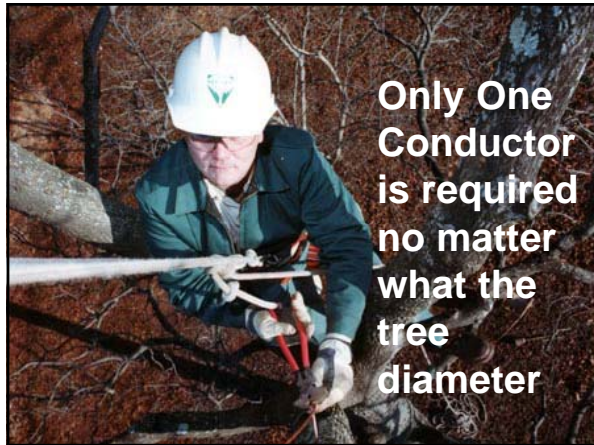
Air Terminal near the top of the tree -2.5" Diameter or smaller branches



Climbing spikes (spurs) should not be used to install LP systems in trees



Conductor is installed as directly as possible to the ground system



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 of 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

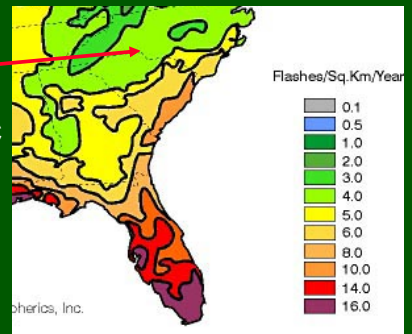
Locate ground rod at least 10' from trunk
Can install closer if tree is surrounded by pavement or rock, but expect root/tree damage.

Locate all ground terminals away from foundations (>2'), underground utilities (>10') if possible.



Tree Lightning Protection Research at Bartlett

Bartlett Tree Research Lab
Charlotte NC
4 flashes/sq km/yr = 4 flashes/250 acres/yr



ometrics, Inc.



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



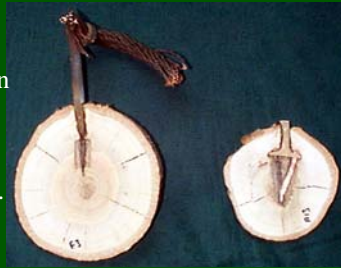
Attempts to Attract Lightning



Is there damage from copper fasteners?

No copper toxicity- due to compartmentalization within the wood

Minor amounts of discoloration / decay.



Ground conductors are often installed very close to important roots



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



Lightning Conductor Size

Product	Diameter		Area	Comments	
	AWG	inch			mm
Steel cable	10	.12	3	3	Steel melts when struck
Copper Wire	8	.13	3.3	8	Recommended for FL boats
Solid wire- house ground	6	.16	4	12	Will conduct
Miniature Conductor					Will conduct w/o heating
Standard Main					Previously Required for Trees



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

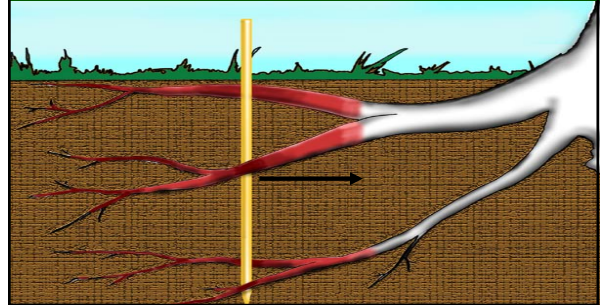
Extensive root damage close to the ground rod.



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 Clients 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

Air Terminal (too low)

Fastener and Conductor Overgrowth

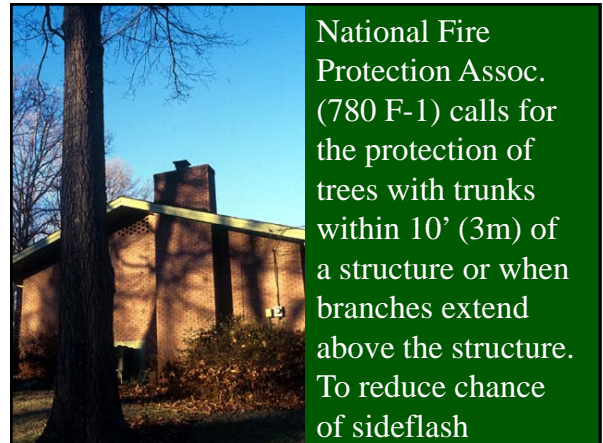


Conductor are often cut near the base of the tree

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

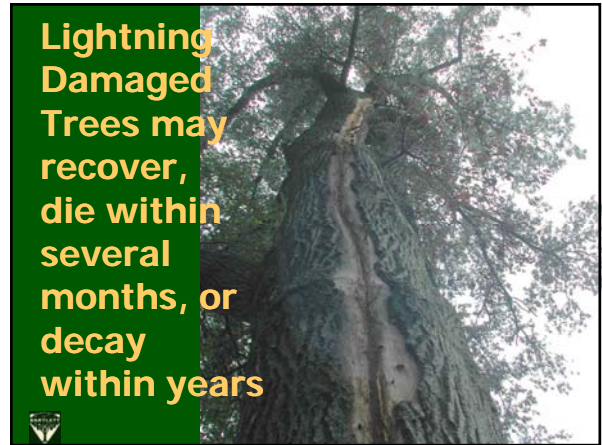


Which Trees Should be Protected?

Recreation area trees where people may take refuge in a thunderstorm.

Especially if water is nearby





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

Board Certified Master Arborists –Highest level
 For Consulting Arborists: American Society of Consulting Arborists www.asca-consultants.org
 Check for Insurance and Check References




Questions?




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



Lightning and Trees

