

# Climbing and Working in Trees

## Chapter 16: Arborists' Certification Study Guide

<https://youtu.be/sZoghIsJCp0>

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*Special thanks to Daniel Cottier of Preservation Tree Service for his contributions in making this presentation*

# Introduction

Before getting started

- Tree climbing is very physical and potentially hazardous
- Be familiar with safety standards and procedures
- Inspect safety equipment and tree
- Be aware of potential hazards
- Plan ahead to save energy and prevent accidents

\*This is an introductory tool and not a replacement for a comprehensive training program

# American National Standards Institute

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- ANSI Z133- Safety standards for tree care operations
- ANSI Z 89.1- Requirements for head protection
- ANSI Z 87.1- Requirements for eye and face protection

“Shall” denotes a mandatory requirement

“Should” denotes an advisory recommendation

# Personal Protective Equipment

3.3.1 Personal protective equipment (PPE), as outlined in this section, shall be required when there is a reasonable probability of injury or illness that can be prevented by such protection.

Shall:

- Head protection
- Eye protection
- Foot protection
- Hearing protection (for clarification see 3.3.5)

Other considerations:

- Face Protection
  - Etc.
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# Personal Protective Equipment (PPE)

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Hard hat shall be worn by workers engaged in tree operations.

- UV light can reduce protection
- Never paint or clean with solvents
- Do not store with fuel or oil
- Impacts can reduce protection.
- Inspect daily and replace when damaged



Safety glasses.

- Requirements are outlined in ANSI Z87.1
- Many styles of glasses available
- Impact resistant with side protection
- Can fit over eyeglasses and anti-fog
- Minimize scratching and clean according to manufacturer's recommendations.



# Work boots

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New styles available designed for tree climbing:

- No metal eyelets
- Hardened, synthetic toe-cap
- Lightweight
- Flat sole for rope climbing



# Inspecting Equipment

ANSI 3.1.1-3.1.3 Tools and equipment used in arboricultural operations shall comply with applicable OSHA regulations and/or ANSI standards...manufacturers' recommendations should be followed

Inspect equipment according to manufacturer's' guidelines:

- Climbing saddles for excessive wear/stitching and rivets intact
- Snaps are self-closing/ locking
- Carabiners self-closing and auto-locking with minimum tensile strength\* of 5,000 pounds (23 kN)

\*Tensile strength-force at which a new piece of equipment or rope in testing fails in tension under a static load.

<https://youtu.be/GkMJnh9HZww>

# Inspection Cont.

8.1.3 Arborists shall inspect climbing lines, worklines, work-positioning lanyards, and other climbing equipment for damage, cuts abrasion, and/or deterioration before each use and shall remove them from service, per manufacturers' guidelines if applicable, if signs of excessive wear or damage are found.

- Work positioning lanyards
- Prusik loops
- Split-tails



# Climbing Lines

- Must be identified by the manufacturer as suitable for tree climbing
- Requires to be ½” minimum diameter with a minimum breaking strength of 5,400 pounds (24.02 kN) with the exception of:
  - 7/16” minimum diameter may be used provided the employer can demonstrate it does not create a safety hazard
- Inspect for cuts, puffs, abrasions, pulled or herniated fibers, changes in diameter, discoloration, or glazing (melting) of the fibers.
- Be sure rope ends are sealed by taping or whipping.
- Routinely move snaps to the opposite end of the line to encourage even wear

< Inspection Checklist ☰

## CUT STRANDS

*DOUBLE BRAID:  
REPAIR OR RETIRE  
CORE-DEPENDENT:  
MAY NOT AFFECT STRENGTH*

**WHAT**

- Three or more cut strands in proximity

**CAUSE**

- Abrasion
- Sharp edges and surfaces

**CORRECTIVE ACTION**  
*possible, remove affected section and re-splice with a standard end-for-end splice. If re-splicing is not possible, retire the rope.*



## PULLED STRANDS

*REPAIR*

**WHAT**

- Cover strand(s) pulled away from the rest of the rope
- Is not cut or otherwise damaged

**CAUSE**

- Snagging on equipment or surfaces

**CORRECTIVE ACTION**  
*Work back into the rope.*



# Types of Rope

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**3-Strand:** relatively low strength and high elongation, relatively inexpensive, used natural crotch or through block for both climbing and rigging.

**16-Strand:** braided arborist lines with large cover strands for strength and abrasion resistance, parallel core to keep the rope round and firm under load, the core does not carry the load, strength is in the cover strands.

**24-Strand:** climbing lines that are typically spliceable double braids (rope inside a rope that balance and share load equally among cover and core), many are 7/16" making them lightweight yet strong.

# Types of Rope Cont.

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**12-Strand:** braided rope without a core, tightly woven, solid-braid, polyester-blend  
12 strand lines are a popular choice for natural-crotch rigging

**Hollow -Braid:** loosely woven polyester 12-strand rope is often used for rigging slings but would not be appropriate as a climbing or rigging line.

# Variations in Climbing Rope

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# Design and Limitations (Key Terms)

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*Understanding the design and limitations of each piece of equipment employed is an important part of setting up a safe and efficient climbing or rigging system.*

**Cycles to failure:** number of times a rope or other piece of equipment can be used with a given load before mechanical failure

**Working -load limit (WLL):** tensile strength divided by design factor. Maximum load that should not be exceeded in a piece of equipment, rope or rope assembly when performing its normal working function

**Design factor:** factor by which the rated or minimum breaking strength of a rope or piece of equipment is divided by in determining its working load limit

# Parts of a line

- Bight: A bight is an uncrossed curve or arc in the active part of a rope between the working end and the standing part.
- Loop: A crossed bight is called a loop.
- Turn: A loop around an object is called a turn.
- Round turn: Two loops around an object is a round turn.

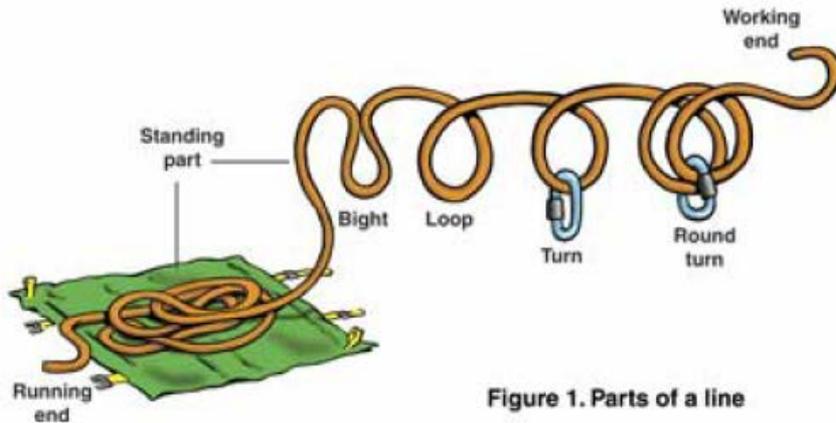


Figure 1. Parts of a line

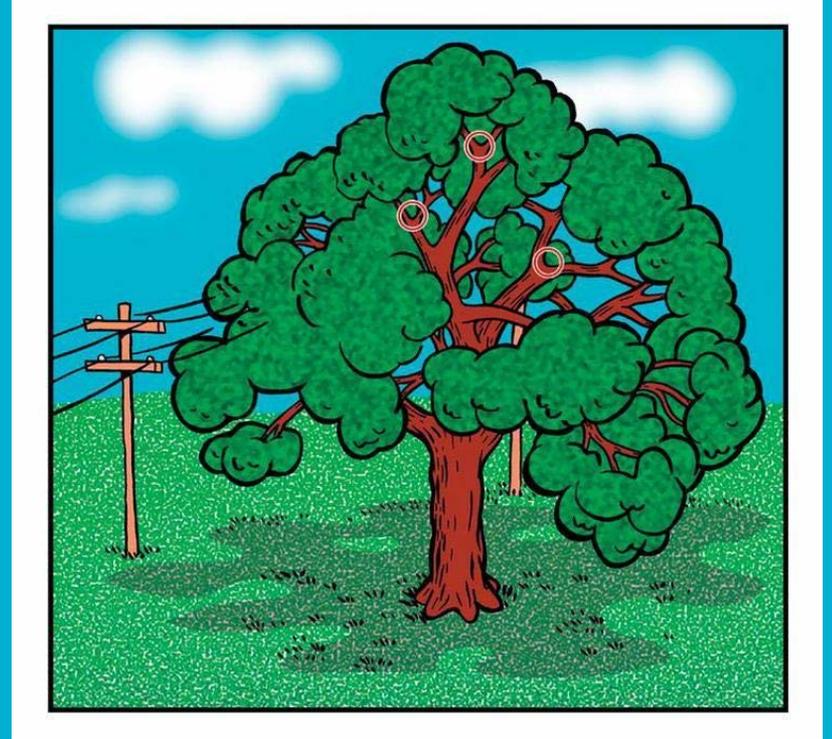
# Common Knots

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- [Knots at Work](#) by Jeff Jepson
- [Rigging Knots](#) by Saron Lilly, Ken Palmer and Rip Tompkins



# Pre-Climb Tree Risk Assessment



# Job Briefing

3.1.4 Shall be performed by the qualified arborist in charge before the start of each job.

Date	Crew Leader	Job Location
Type of job		
<b>HAZARD</b>		<b>DISCUSS</b>
<input type="checkbox"/> day of the week/time of day		Accidents can be dependent on how jobs are scheduled. They are more likely just before lunch, just before and just after holidays and vacation days
<input type="checkbox"/> extreme weather conditions		frost bite, heat exhaustion, effect on driving
<input type="checkbox"/> inexperienced personnel		their ability to detect hazardous conditions
<input type="checkbox"/> improper use of PPE		head, eye, hearing, foot, hand, leg injuries
<input type="checkbox"/> distance to electrical conductors		direct and/or indirect contact
<input type="checkbox"/> terrain		slips, trips, and falls
<input type="checkbox"/> noise levels		necessity of hand signals
<input type="checkbox"/> new equipment		proper use and maintenance
<input type="checkbox"/> obstacles		overhead and/or ground level
<input type="checkbox"/> traffic control		being struck, protection of the work area, cones & signs
<input type="checkbox"/> moving/lifting heavy objects		proper techniques and/or equipment
<input type="checkbox"/> chemicals		contact with or exposure to
<input type="checkbox"/> Others		
<b>Crew members' signatures:</b>		
1.		2.
3.		4.

# Electrical Hazards

4.1.2 The employer shall train each employee that all overhead and underground electrical conductors, guy wires, pole grounds, and communication wires and cables shall be considered energized with potentially fatal voltages.

- Leading killer in tree care
- Trees are conductive
- Always inspect first
- Storms increase risk
- Insulated equipment has limits
- “Step potential is a killer”
- See Z133 Section 4.1

<http://www.elcosh.org/document/1624/888/d000543/section2.html>

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# TCIA 2017 Accident Briefs Summary



## TCIA Accident Briefs Summary 2017

**78.5%\***

of all incidents where a company was identified were **not** TCIA members.

**43**

average age of the victim's experiencing the accidents.

**April**

most dangerous month by incident occurrence (15 reported incidents)

**December**

safest month by incident occurrence (6 reported incidents)



\*\*There was a successful rescue with no reported injury

## What Happened?

The incidents that have occurred with as much specificity as we can provide from the media accounts. Incidents are broken down in the broad categories of contact, exposure, fall, transportation and workplace violence.

### Contact

#### Caught in/under - 10

- Brush chipper - 2
- Palm fronds - 2
- Ropes/rigging - 2
- Firewood processor - 1
- Tree - 1
- Crane cab (tip-over) - 1
- Unknown - 1

#### Struck by/against - 43

- Tree (felling) - 18
- Tree section - 18
- Chain saw - 4
- Spring pole - 1
- Equipment - 1
- Log - 1

### Fall

#### Tree - 22

- Tree/tie-in point failure - 4
- Equipment failure - 3
- Unsecured - 2
- Cut climbing line - 1
- Unknown - 12

#### Aerial lift - 12

#### Height, unspecified - 5

#### Ladder - 2

#### Work vehicle - 1

### Exposure

#### Electric shock/burn - 19

- Indirect contact - 12
- Conductive tools - 11
- Tree limb - 1
- Direct contact - 3
- Unknown - 4

#### Insect bite/sting - 3

Additionally, there were 5 incidents involving transportation: 3 were motor vehicle accidents, while the remaining 2 were struck by motorists in work zone. There was another incident involving workplace violence, and 2 more occurred under unknown circumstances. Finally, there was one recorded instance of a successful aerial rescue in which no injuries were sustained.

# 138 Occupational incidents:

81 fatalities

45 serious injuries

11 minor injuries

1 successful rescue with no reported injuries

# Develop communication

8.3.2 Communications among arborists aloft and other workers on the ground shall be established before cutting and dropping limbs.

- “Stand clear”
- “All clear”
- “Headache”
- Etc.

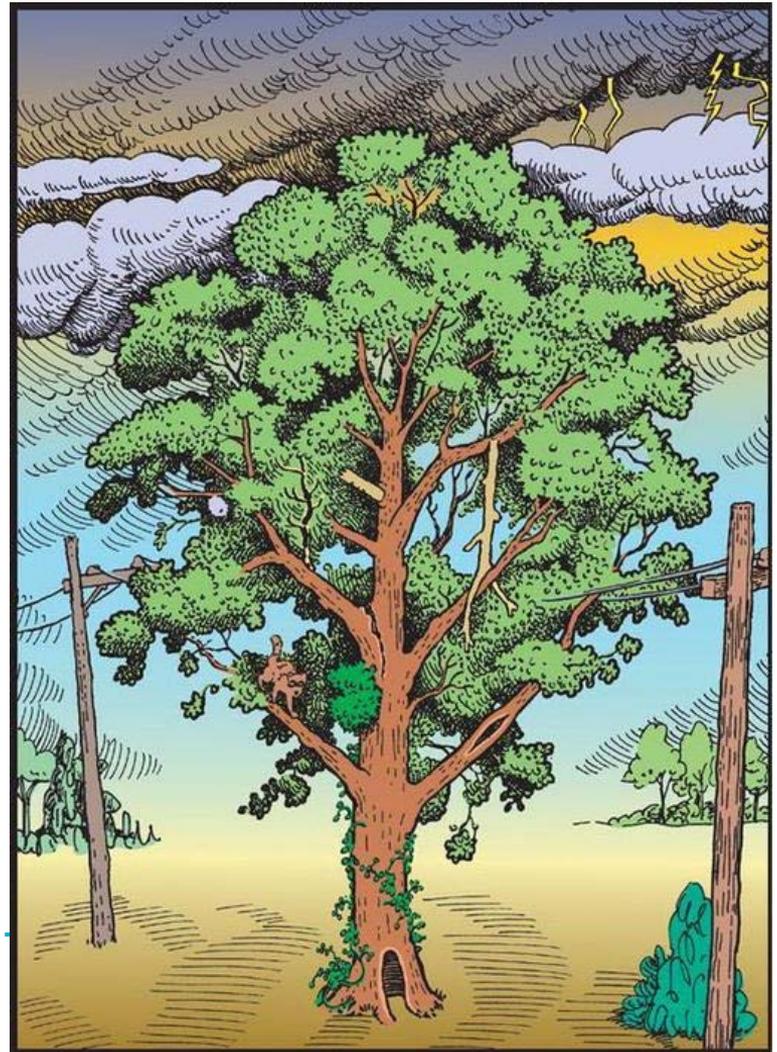
Whistles are also commonly used in noisy environments

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# Whats wrong here?

3.4.8 A qualified arborist shall visually inspect the tree, including the root collar and the area immediately surrounding the tree, for hazards before anyone climbs, otherwise enters, or performs any work on the tree.

International Society of Arboriculture, International Society of  
Arboriculture, Bugwood.org



# Tree Defects Handout

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<https://www.forestryimages.org/browse/bareas.cfm?domain=23>

# Climbing Techniques and Procedures

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- Climbing Spurs
  - Throw Ball
  - Body Thrust
  - Footlocking
  - Single Rope Technique

