

NEW ZEALAND ARBORICULTURAL ASSOCIATION

Best Practice Guideline



NEW ZEALAND
ARBORICULTURAL
ASSOCIATION INC.

Amenity Tree Pruning

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1. Scope

These pruning guidelines set out the requirements for the maintenance of amenity trees and gives an indication of currently accepted correct arboricultural pruning practices. The intention of this document is to encourage pruning practices and procedures that reduce the risk of hazard development, branch failure, pathogen infection or premature tree death. It is intended for use on amenity trees, including palms, and does not include practices which are specific to timber, foliage, fruit and flower production, root pruning, chemical pruning or sculptural forms such as topiary, espalier, and pleaching.

These Amenity tree pruning guidelines are intended for use by tree workers wishing to comply with NZAA promoted pruning practices and should be applied in conjunction with the ANSI A300 Standard promoted by the ISA. The guidelines will also serve to assist property owners, contractors, and those undertaking contractual arrangements which specify arboricultural pruning procedures and practices.

2. Reasons for Pruning

The first consideration when pruning, is whether cutting off and removing living branches will actually benefit the tree. It is important that the arborist undertaking the pruning has an understanding of the biology of trees and how they respond to pruning wounds and the reduction in stored energy reserves and photosynthetic ability that pruning entails.

Prior to pruning being undertaken, an inspection of the tree should be carried out to assess the tree's health, growth habit, structure, stability and soil environment. The inspection should also consider species, age, wind exposure, foliage distribution and any potential hazards. The potential impacts of the proposed pruning on the tree's biological processes, longer term health and structure, plus wound size and response should also be considered.

Objectives

The objective of pruning is to promote strong, healthy and attractive amenity trees, which enhance the environment and do not present a hazard to public safety. No tree should be pruned without first establishing clearly defined pruning objectives, which may include the following;

- Pruning for safety – Where branches:
 - Are extended with heavy end weight and poor taper.
 - Obstruct lighting, lines of sight on streets or driveways.
 - Present a hazard likely to cause injury or property damage.
 - Are growing into utility service lines.
 - Exhibit weak attachments.

- Pruning for tree health
 - Removal of dead, diseased and unthrifty branches.
 - Removal of crossing and rubbing secondary branches.
 - Removal of broken and storm damaged branches.
 - Removal of stumps and stubs to encourage wound closure.

- Pruning for aesthetics (Formative pruning)
Thinning the crown to increase air-flow and sunlight.
Thinning to encourage an open tree structure.

3. Pruning Procedures - General

All tree work should be in accordance with specifications set out in following Codes of Practice, and their subsequent revisions:

- The Approved Code of Practice for Safety and Health in Tree Work (1994)
Part 1: Arboriculture.
- The Approved Code of Practice for Safety and Health in Tree Work (1996)
Part 2: Maintenance of Trees around Powerlines.
- The Approved Code of Practice for Safety and Health in Tree Work
Part 3: Tree-work in Rivers, Streams and Waterways.
- The Approved Code of Practice in Forest Operations (April 1999)
Sections - Cable logging, Rules for Helicopters, Use of wire ropes.
- The Approved Code of Practice for Elevated Work Platforms (EWP)
- The Approved Code of Practice for Cranes (March 2001)

| | |
|------------------------|----------------------------------|
| Part 1 – General Rules | Part 2 – Duties of Controllers |
| Part 8 – Mobile cranes | Part 11 – Vehicle mounted cranes |

All pruning work should employ natural target pruning in accordance with the principles of Modern Arboriculture. Pruning work shall endeavour to maintain the natural form, structural safety and visual appearance of the tree. Where necessary, ropes should be used to lower large branches and stems. When removing branches, cut sections should be dropped or lowered in a way that will avoid damage to the bark or cambium on the remaining parts of the tree. All branches that are too large to be hand held when removing must be under cut to prevent bark tearing and damage to branch collars. All branches removed must be extracted from the canopy.

Care should be taken to avoid excessive pruning. At least one half of the foliage distribution in younger trees should be on branches that arise in the lower two-thirds of the trunk. In general pruning should employ thinning cuts. Care should be taken not to expose the inner canopy, (shade leaves) to intense sunlight by over-thinning or excessive cleaning out of the entire inner canopy (lions-tailing). All saw and pruning cuts should be made back to either collars or branch nodal junctions. Techniques other than those applied in Natural Target Pruning should only be used in specific circumstances such as Pollarding or Retrenchment.

When shortening, branches should be pruned back to a lateral which large enough to assume the terminal role. Spikes/spurs or other equipment that may damage bark on the tree must not be used unless the entire tree is being removed or an emergency situation arises.

Apical dominance

Some species with strong apical dominance with an excurrent form retain a single central leader through to maturity. Such trees should not be reduced in height unless this is necessary to address an actual hazard situation.

Epicormic shoots

The contractor should determine the cause of epicormic growth before removing it. Situations such as plant stress, previous incorrect pruning and sudden light exposure should be considered. Where restorative pruning is undertaken, selected “elite” shoots should be retained and “multiple” epicormic shoots thinned or removed.

4. Natural Target Pruning

Before the selection of a pruning class, the reason for pruning should be carefully considered. With the exception of pollarding and retrenchment pruning, all classes are based on the principles of natural target pruning. Pruning cuts should be made back to either collars or branch nodal junctions.

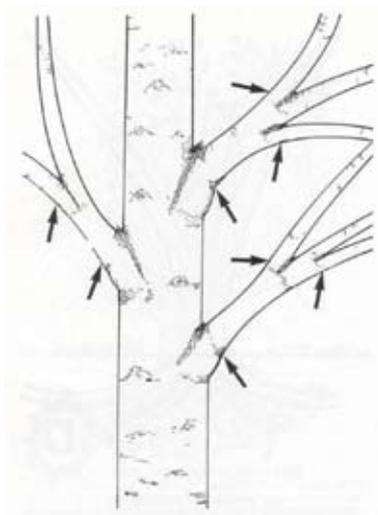


Diagram 1: Target Cuts at Branch Unions

Pruning cuts should be at branch unions [arrows in Diagram 1]. Do not make inter-nodal cuts between arrows. To avoid splitting or tearing of the branch collar or trunk, branches should be pre-cut or undercut. The remaining stub is then removed with a final cut made as close as possible to the branch collar without cutting into the branch collar or leaving a protruding stub. (See Diagram 2)

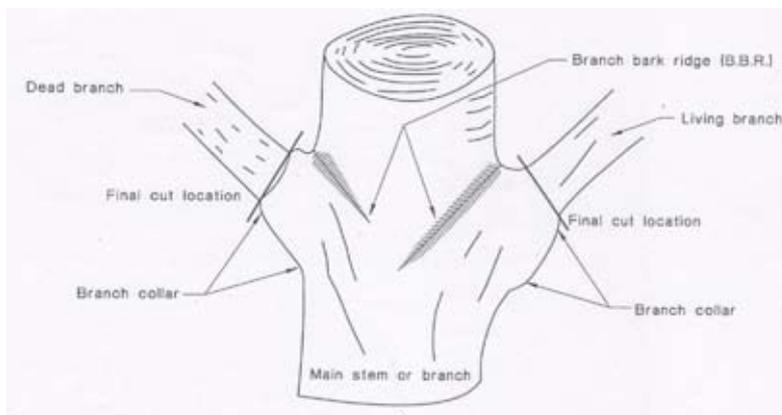


Diagram 2: Collar Pruning

The final cut should be made as close as possible to the branch collar. Do not cut into the living tissue of the collar. If a collar is not clearly visible use the branch bark ridge as a guide. In the absence of a visible collar, the branch bark ridge should be used to determine the angle of the cut when removing a branch. The aim of the cut is to prevent damage to trunk tissue and the branch bark ridge. (See Diagram 3)

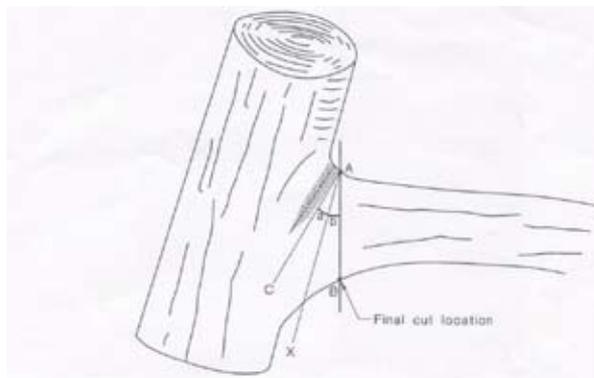


Diagram 3: Branch Bark Ridge Pruning

If living branches do not have a definite collar, the branch bark ridge can be used as a guide for the final cut. Line A-X is a line parallel to the stem or trunk occurring just outside the branch bark ridge. Line A-C indicates the angle of the branch bark ridge and line A-B represents the angle and location of the final cut. Angle 'a' should be equal to angle 'b'.

When removing a codominant stem, it may not be possible to determine a distinct branch trunk collar. Co-dominant stems may have stem bark ridges which are long or may be difficult to discern. In the absence of a clear collar, the stem bark ridge can be used to indicate the angle of the cut when removing a co-dominant stem. In removing one stem, the adjacent stem should not be damaged.

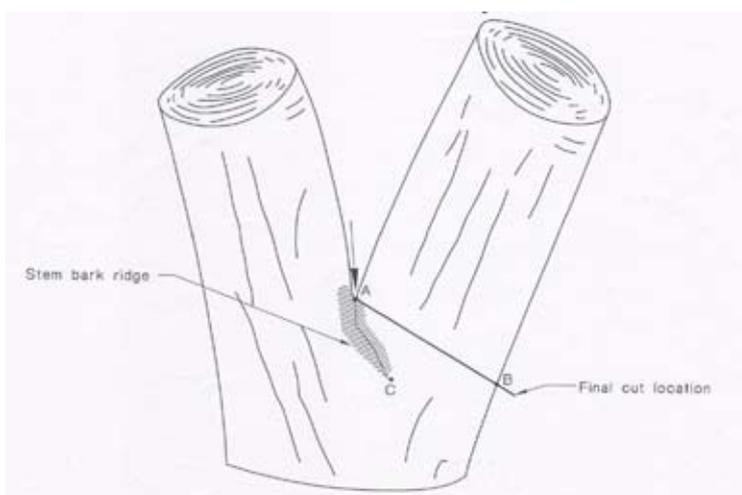


Diagram 4: Removal of Codominant Limbs With Included Bark

In Diagram 4, line A-B represents the angle and location of the final cut, point C is the bottom of the stem bark ridge. The final cut should be made without damaging the remaining limb.

Drop- Crotching / Reduction cuts

When making reduction cuts, the branch bark ridge should be used as a guide to the angle and position of the final cut (See Diagram 5 below.). When shortening branches or stems, the cut should also be made at a point where the lateral is of sufficient diameter to assume the terminal role.

Reduction pruning of the upper and outer crown area should be accomplished using drop-crotching techniques, where the final cuts in reducing branch extremities are targeted at internal secondary laterals, branch-stem junctions, or positions of previous reduction pruning.

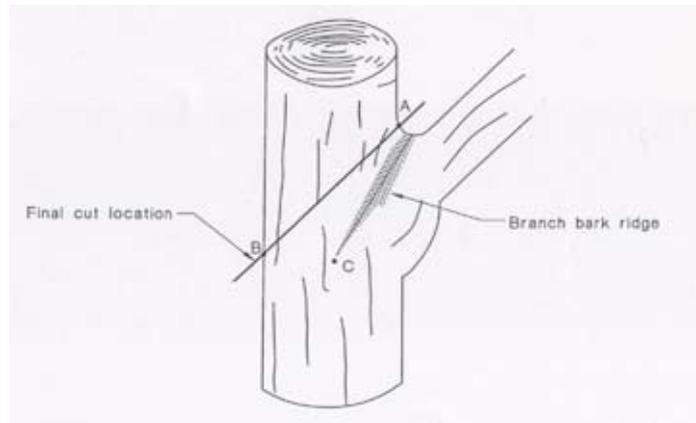


Diagram 5: Drop- Crotching

- A Top of the cut that preserves the branch bark ridge.
- B Bottom of the final cut that is opposite the bottom of the branch bark ridge
- C Bottom of branch bark ridge.

5. Pruning Types and Classes

The selection of the type and class of pruning will depend on the tree's location, form and the desired outcome.

5.1 Crown Maintenance

Crown maintenance is pruning according to the growth habit of the tree. It may include dead-wooding, crown thinning, and formative pruning. Crown maintenance pruning does not significantly reduce the area of the crown and retains the structure and size of the tree.

Crown Cleaning and Dead Wooding

Crown cleaning may be used where a tree is being maintained as a specimen within a public Reserve, street or an ornamental garden. The removal of dead, dying, diseased, detached or broken branches is undertaken to improve crown appearance and the overall tree aesthetics.

Where the deadwood has remained in the tree for a long period the collar may have extended itself along the dead branch. This collar should be left intact when deadwood is removed from the tree. It should be noted that dead wood is an essential habitat for a large number of organisms in the ecosystem in which a tree lives. The formation of dead wood within the crown of a tree is part of the natural system of tree life and removal of deadwood should not always be considered as essential to the maintenance or promotion of healthy tree growth.

Formative Pruning

The main objective of this type of pruning is to encourage the formation of good stem and branch structure, by improving the orientation, spacing, strength of attachment and ultimately the size of branches.

Formative pruning can be completed on semi-mature trees, but should be avoided on mature specimens. The main management objectives of this type of pruning are to encourage a crown form which needs less pruning when mature, and where ever possible limits the development of weak structural features which may fail in later life. The aims of formative pruning are to enhance form and improve structure, to directionally shape the young tree, and to reduce the development of structural weaknesses. (See Digram 6)

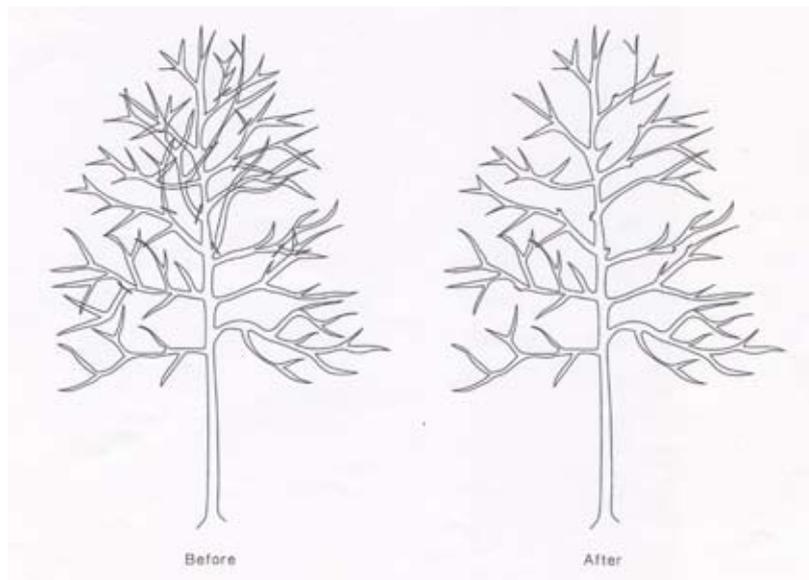


Diagram 6: Formative Pruning of Semi-mature Trees

The removal of dead and diseased limbs, crossing or rubbing branches. This type of pruning may required on developing trees to improve structure and form but should not be applied to mature trees.

Thinning

Crown thinning, is the selective removal of small, live branches throughout the entire crown, with the aim of reducing the density of the tree leaf area. There should be no external alteration to the tree's size or shape and the majority of branches should be removed from the outside third of the tree crown. The maintenance of an inner crown leaf area is essential to many tree species. Crown thinning reduces canopy density through the removal of secondary branches whilst retaining the main structural branches and established tree form.

The percentage of a crown that can be removed without having a detrimental effect on tree health and vigour is species and age specific Thinning can be used to reduce wind resistance, reduce the weight of limbs, increase light penetration and promote air movement through the tree crown. Thinning should avoid cleaning out the entire tree interior, and avoid the visual effect of "lion tailing."

5.2 Crown Modification

Crown modification is pruning that changes the structural appearance, size, form and habit of the tree. It includes reduction pruning, crown lifting, pollarding, and can also be used to reduce limb weight.

Crown Reduction (Drop Crotching)

Reduction pruning reduces the height and/or spread of the crown of a tree, by removal of branch extremities back to internal laterals or branch-stem junctions. Reduction should be accomplished using drop crotching or removal cuts not heading cuts. The use of heading cuts may spoil tree architecture and can significantly increase maintenance requirements. When a mature tree is reduced, no more than one fifth (20%) of its foliage should be removed, whereas up to one third can be removed from younger more vigorous trees without significantly reducing tree vitality.

Reduction cuts should be targeted at remaining lateral branches of sufficient diameter to assume the terminal role. At such a size, the lateral branch should be able to produce enough energy to keep the parent branch alive, and there should be enough growth regulators present to suppress excessive epicormic sprouts. This will vary with tree species, age and condition. Old, stressed or late mature trees could decline or become more stressed if too much foliage is removed. Excurrent species should not be reduced unless to address an actual hazard situation.

Crown Lifting

The selective shortening and removal of lower lateral branches to affect a vertical lift of the crown, allowing space under the tree for light, people, vehicles or buildings, while maintaining as many low branches as possible to sustain good trunk growth and taper. When pruning is complete 50% of the trees total foliage should be on branches arising from the lower two thirds of the trees height.

Crown Renewal / Restoration

The purpose of this pruning is to prolong the useful life expectancy of damaged trees and to reduce their hazard potential. This type of pruning should only be carried out on trees which have lost their natural form and structure through storm damage, topping, dieback, vandalism, or disease.

Crown renewal may be necessary where a tree has been poorly pruned or where a once regular management regime has lapsed, resulting in the formation of poorly structural re-growth. The principles are similar to those used in formative pruning on establishing trees, but is more focused upon recovery growth arisen in the region of previous damage. The technique requires the removal of a portion of the recovery growth to induce a more stable and open structure and enable those branches retained to assume the primary role.

Restoration pruning entails the training of young 'elite' epicormic shoots to form new branches and promotes the re-establishment of a new crown. This type of pruning may need to be undertaken over several consecutive seasons as a limited percentage of the tree's leaf area should be removed at any one time.

Crown Retrenchment

This type of pruning should be reserved for mature trees which have died back in the upper canopy with no mid crown or inner branches of sufficient vigour to be target pruned back to.

The procedure removes damaged, diseased or depleted branches back to undamaged or healthy tissue (live cambium), and the final cut may not necessarily be at the branch collar. The aim is to induce the production of epicormic shoots from which a new crown is intended to be established. To achieve this outcome, the successful re-growth will need to be managed by crown renewal, restoration or thinning in subsequent seasons.

Juvenile Tree Pruning

Formative pruning of juvenile trees should be species specific and may include:

- Removal of dead, broken & split branches.
- Removal of crossing and rubbing branches.
- Removal of branches and stems with “included bark”.
- Retention of branches on the lower trunk to increase taper.
- Promotion of a sound scaffold structure consistent with the species.
- Removal or shortening of competing or secondary leaders on excurrent species

The aim of formative pruning juvenile trees is to improve the tree’s structural form and reduce future maintenance requirements. The following steps are recommended;

a) Select the lowest permanent scaffold branches. Permanent branch diameter on juvenile trees should be one third to one half of the trunk diameter where the branch attaches to the trunk. Select and shorten temporary branches to be retained below the lowest scaffold.

b) Select scaffold branches to be retained as permanent branches throughout the crown of the tree. Scaffold branches should be spaced radially around the trunk, with vertical spacing between scaffolds dependant upon expected tree size.

c) Cut back or remove competing branches. Select temporary branches above the lowest permanent branch. Some or all of these branches may be shortened and retained. Temporary branches with a diameter greater than 1/3 of the diameter of the trunk at the point of attachment should be removed. (See Diagram 7)

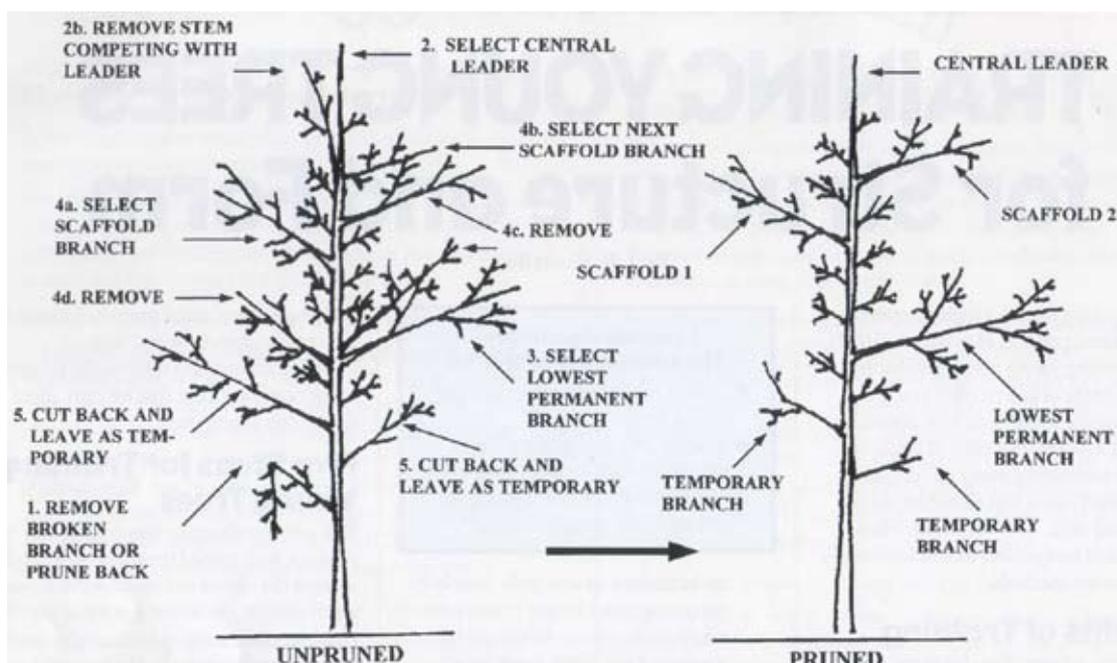


Diagram 7: Juvenile Tree Pruning

When pruning is complete 50% of the trees total foliage should be on branches arising from the lower two thirds of the trees height. This is important when selecting temporary branches in the lower canopy. No more than 20% of the trees total foliage should be removed in any one year.

Pollarding

Pollarding is a specialised pruning technique that establishes a framework of branches ending in a knuckle of buds and vigorous shoots. Trees are cut back to just above the same point every 1 to 3 years resulting in the production of multiple shoots. When removing established shoots, pollard heads should not be injured. Cuts should be made as close as possible to the swollen collars that surround each shoot or cluster. This process is suited mostly to deciduous trees that have been pruned to this form at an early age and should not be carried out on mature trees that have not been previously pollarded.

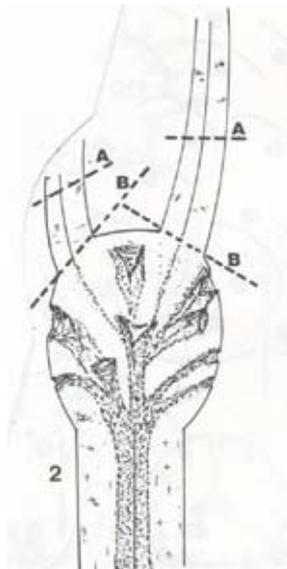


Diagram 8: Pollarding

As per Diagram 8, first remove shoots at point A, then make final cut at B. Do not cut into swollen head on remaining limbs. If there is a collar visible at point B, do not cut into this collar or knuckle region.

Palm Pruning

Palms are pruned primarily to remove old and potentially hazardous fronds and fruiting clusters. The terminal shoots should never be removed as this will kill the palm. The removal of healthy leaves should be avoided as it is generally unnecessary and may place the palm under stress. Fronds should be pre-cut to avoid tearing of trunk fibres.

Fronds should be removed as they die. Lifting can also be done, but fronds should not be lifted above a horizontal dotted line (G) shown in Diagram 9 [overleaf]. Pruning palms as in (N) in Diagram 9 injures the apical meristem, disrupts stem thickening and increases the chance of pathogen attack. Excessive crown lifting also destroys the natural form of palm trees.

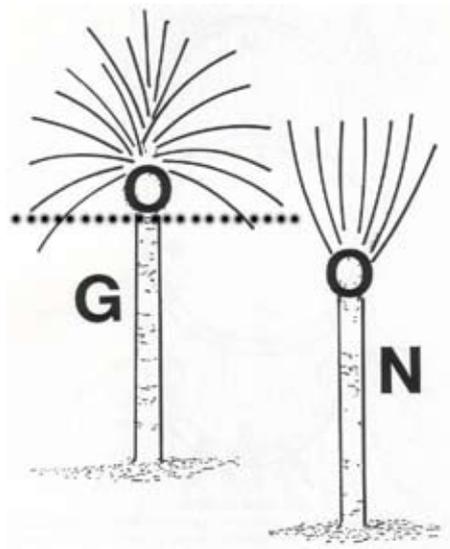


Diagram 9: Palm Pruning

6. Power Line Clearance

Line clearance is pruning to maintain clearances around overhead service lines and should involve formative pruning, crown lifting, lateral branch shortening, crown restoration and/or reduction pruning techniques.

All line clearance operations should be done in accordance with the specifications set out in: **The Approved Code of Practice for Safety and Health in Tree Work (1996); Part 2 Maintenance of Trees Around Power Lines**, and in particular the minimum approach distances for tree workers, as shown in Diagrams 10a & 10b following.

Contractors must only prune trees in close proximity to live powerlines with the clearance from the Network Operator. All statutory requirements and Industry Codes of Practice must be adhered to. Diagrams 10a & 10b indicate the minimum approach distances for tree work near power lines.

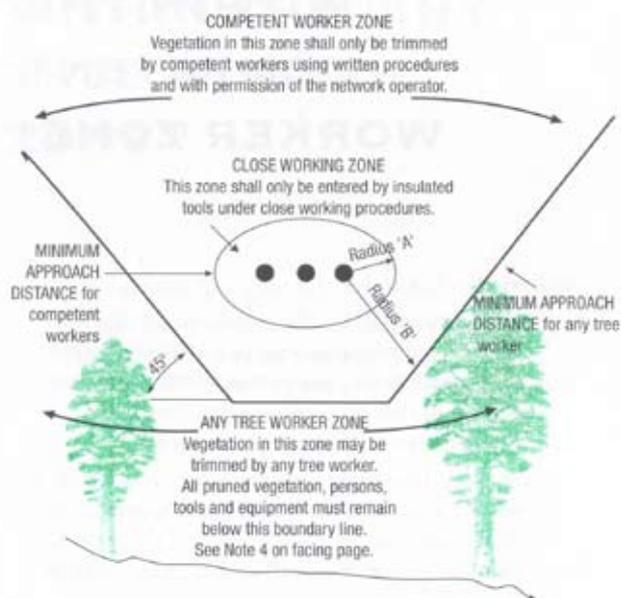


Diagram 10a: Minimum Approach Distances For Tree Workers

| | MINIMUM APPROACH DISTANCES | |
|-----------------|----------------------------|-----------------|
| | COMPETENT WORKER | ANY TREE WORKER |
| Voltage of line | Radius A' | Radius 'B' |
| 230/400V | 0.15 m | 0.5 m |
| 11,000V | 0.6 m | 1.5 m |
| 33,000V | 0.7 m | 2.5 m |
| 66,000V | 1.0 m | 3.0 m |
| 110,000V | 1.5 m | 4.0 m |
| 220,000V | 2.2 m | 6.0 m |

Diagram 10a:

For all live wire work within 4 metres of powerlines, the contractor shall notify the relevant supply authority.

7. Definitions

For the purpose of this Amenity Tree Pruning Guideline, the definitions of Arboricultural terms below apply:

Amenity trees -- Trees with an environmental, recreational, and aesthetic function or value.

Arborist – A professional with technical training and experience in the care and maintenance of amenity trees.

Branch -- A lateral arising from a main axis such as a trunk or scaffold branch.

Branch attachment – The structural linkage of branch and stem, or between scaffold and secondary branches.

Branch Bark Ridge -- Raised or furrowed bark in the branch crotch that marks where the branch wood and/or trunk wood meet. This happens at branch junctions generally and is not exclusive to where branches meet the trunk.

Branch Collar -- tissue that forms around the base of a branch between the stem and a subsidiary branch. This also happen at branch unions that have not arisen from the main stem.

Branch Order -- The first branch off a trunk is a first order branch.

A branch arising off a first order branch is a second order branch. Second and successive orders of branches may be referred to as 'lateral branches'.

Bud -- Embryonic vegetative or reproductive tissue which may be terminal, axillary or adventitious in origin. Buds are primarily unexpanded shoots or flowers.

Codominant – Stems or branches of similar size originating from the same position in the tree. Codominance with the bark ridge absent or turned inward (bark inclusion) may indicate a weaker union.

Crown / Canopy -- Portion of the tree from which branches and leaves arise, being those parts of the tree excluding the clear trunk.

Crown Cleaning – Selective removal of dead, dying, diseased, weak and unthrifty growth from the tree canopy.

Crown Lifting – removal of lower branches to provide clearance and effect a visual and physical lifting of the tree crown.

Crown Modification -- Pruning techniques that result in a changed structural appearance and habit of the tree.

Crown Thinning – Selective branch removal to increase light, air movement, reduce weight and wind-sail effects.

Crown Reduction – Reduction of height and lateral spread of the tree by shortening to suitable nodal junctions. Reduction should be by thinning and drop crotching methods.

Crown Renewal – The restoration of a natural and structurally sound form on previously damaged trees, by retaining “elite” shoots and removing superfluous regrowth.

Drop Crotching – Shortening or removing branches at lower and interior nodal junctions.

End Weight – The concentration of foliage at the distal ends of extended branches.

Epicormic – Growth which arise from adventitious or latent buds on stems and branches, resulting in singular “elites” and clustered “multiple.” shoots.

Excurrent – Tree species with a strong apical dominance that retain a single central leader form or habit through to maturity.

Final Cut -- also referred to as ‘target cut’. The final cut in reduction or removal of branches and stems. A correctly targeted final cut will reduce the risk of pathogenic ingress and encourage even wound closure.

Formative Pruning – Pruning of juvenile and semi mature trees to encourage the formation of a sound stem and branch architecture, and to reduce the development of structural weaknesses.

Hazard – Combination of the failure of a tree, (or part of) with an adjacent target.

Hazard Abatement – Reduction in the failure likelihood to result in injury or property damage.

Heading – Cutting of current or 1 year old shoots to a bud, stub, or lateral not large enough to assume the terminal role.

Included bark – Bark included in the crotch between a branch and trunk or co-dominant stems which prevents the formation of a branch bark collar. Inwardly formed bark at the junction is a structurally weaker attachment than that formed at a distinct branch collar.

Lateral Branch -- A subsidiary branch arising from another branch or stem.

Lion's Tailing (feathering) The excessive removal of branches from the interior of the crown leaving most of the foliage at the distal branch ends.

Natural Target Pruning -- The removal of branches, stems and stubs while leaving the tree's natural defence boundaries intact, by targeting the final cuts as close as possible to existing branch collars or nodes.

Over Thinning – Excessive pruning of lateral and internal branches resulting in removal of large amounts of live foliage and branch tissue.

Pollarding – Pruning technique where branches are regularly headed back to a callus knob, (knuckle) of latent buds.

Pre-Cut - The making of an undercut, side cut or scarf cut to reduce the risk of a splitting or tearing. These cuts are made beyond the branch collar and precede the final cut.

Retrenchment Pruning – where terminal branch die-back leaves no live internal branches for drop-crotching, The removal of damaged, diseased or depleted branches back to live cambial tissue in order to induce the production of epicormic shoots from which a new crown can be established. This is not a licence for topping and is primarily an ecological or woodland management tool.

Scaffold Limb – A primary structural limb being part of the permanent structure of a decurrent tree. These are large branches that form the main structure of the canopy that will remain on the tree throughout its life and constitute much of the tree's architectural framework.

Secondary Branch – A branch which arises from a scaffold limb or subsidiary. Not a primary or permanent branch.

Temporary Branches -- Branches below the lowest permanent branch or between permanent or scaffold branches that will be removed with future pruning as the tree grows in size.

Taper – Relative change in stem or branch diameter with length.

Target – People or property potentially affected by tree failure.

Terminal Role – Branch or shoot which assumes the dominant vertical or horizontal growth position.

Thinning – Removal of lateral branches at the point of origin, or the shortening of a branch or stem back to a lateral large enough to assume the terminal role. Thinning should avoid cleaning out the entire tree interior, and avoid the effect of "lion tailing."

Topping – Method of height reduction which entails indiscriminate inter-nodal branch truncation.

Wood Decay -- Degradation by the breakdown of plant tissue including cellulose and lignin as a result of pathogenic and micro-organism activity.

Wound -- An opening that exposes inner tree tissue when the protective bark is cut, removed or injured. Pruning a live branch always creates a wound, even when the cut is properly made.

8. References / Acknowledgements

Compiled in 2008 from industry correspondence, arborist forums and internet research, with particular thanks to;

- North Shore City Council
- The International Society of Arboriculture
- The Waikato Institute of Technology who supplied the initial format as a Draft.
- NZ Occupational Safety & Health Service, 1996
- Principles, Practice and Specification for Tree Pruning. Andrew Cowan N.D.Arb, Standards Australia. Pruning of amenity trees draft, May 2006
- Shigo and Associates Modern Arboriculture, 1991