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Appendix

Appendix A: Drafting Pruning Specifications

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Reading this document in its entirety is recommended so specifier can grasp the complexity of drafting pruning specifications that result in meeting tree owner objectives.

Instruction to the Specification Writer

This document is intended as a guide to writing project-specific specifications. Each project is unique and the specification should be developed accordingly. DO NOT USE THE FOLLOWING SPECIFICATIONS WITHOUT MAKING IMPORTANT ADJUSTMENTS to reflect local conditions, regulations, market standards, and project schedules. The following are specific items that need to be addressed.

1. General instructions for using these specifications: These instructions are intended to guide the specification writer (the specifier) through the process of editing this document into a pruning specification. Be sure to delete these instructions (i.e. all the **text in red**) before issuing the specifications.

2. General requirements, Division 01 (Construction Specification Institute) specifications and other contract elements: This specification is designed to be used in conjunction with Standard Division 01 specifications, which cover project general conditions and project-wide contract elements. THIS IS NOT A STAND-ALONE SPECIFICATION and should not be used as a contract to prune plants. Important issues of project ownership, liability, insurance, contract language, project controls, instructions to bidders, change orders and review and approval of the work are normally in the Division 01 specifications.

3. The construction team: As with any good contract there are protections for all parties; that the Owner will get the quality of project that they desire within the time limits and budget available; and the Contractor will be paid for the work satisfactorily completed. In between the initial bidding and the final completion there will be places where parts of the project do not work out as originally intended. This is normal and a good contract should allow for these changes in a manner that is equitable to both the Owner and the Contractor. To get there, a team approach and spirit must prevail. All parties must assume that each is operating in the best interest of the project goals. A clear set of objectives including a detailed description of the project results in a smooth flow during the project. The more each of the team members can trust the other members, the better the project. This should be a critical principle in approaching interpretation of the specification.

4. Other project documents: These specifications are intended to be used in conjunction with other project documents including the bid forms, the pruning contract, Division 1 specifications, other specifications directly related. It is very critical that all these documents be prepared with consistent terminology and that they be coordinated. The terms used for the parts of trees and other plants must be consistent across disciplines. A very common mistake is the use of different terms and details for the work. The terms and details must be well coordinated.

5. Reviewing and approval authority: Each specification should identify a certain entity as responsible for the review and approval of the work, project submittals, changes to the work, and acceptance of the work. The entity is normally identified in Division 1.

6. Notes to specifiers: Before issuing the document, be sure to remove all "*Notes to specifiers*" incorporated into this document in **red text** after you have read them and responded to the recommendations.

7. Specification modifications: There are locations in these sample specifications where additional information is required to reflect project region or contract or tree conditions. Please insert the requested information and make adjustments where needed.

Current vs Future Situation

Many trees are currently allowed to develop **branch architecture** with several large upright pruned branches in the first 20 years in a manner shown in Figure 1, left. Although common, this creates challenging management decisions for the FDOT described elsewhere (Gilman 2012; Gilman et al. 2013). Despite the difficulty of pruning trees with inferior branch architecture (Figure 1, left), this document includes specifications that can be used to guide the pruning of trees in this condition. However, it is difficult which means it requires structural pruning experience, skill, and well written specifications.

Why prune?

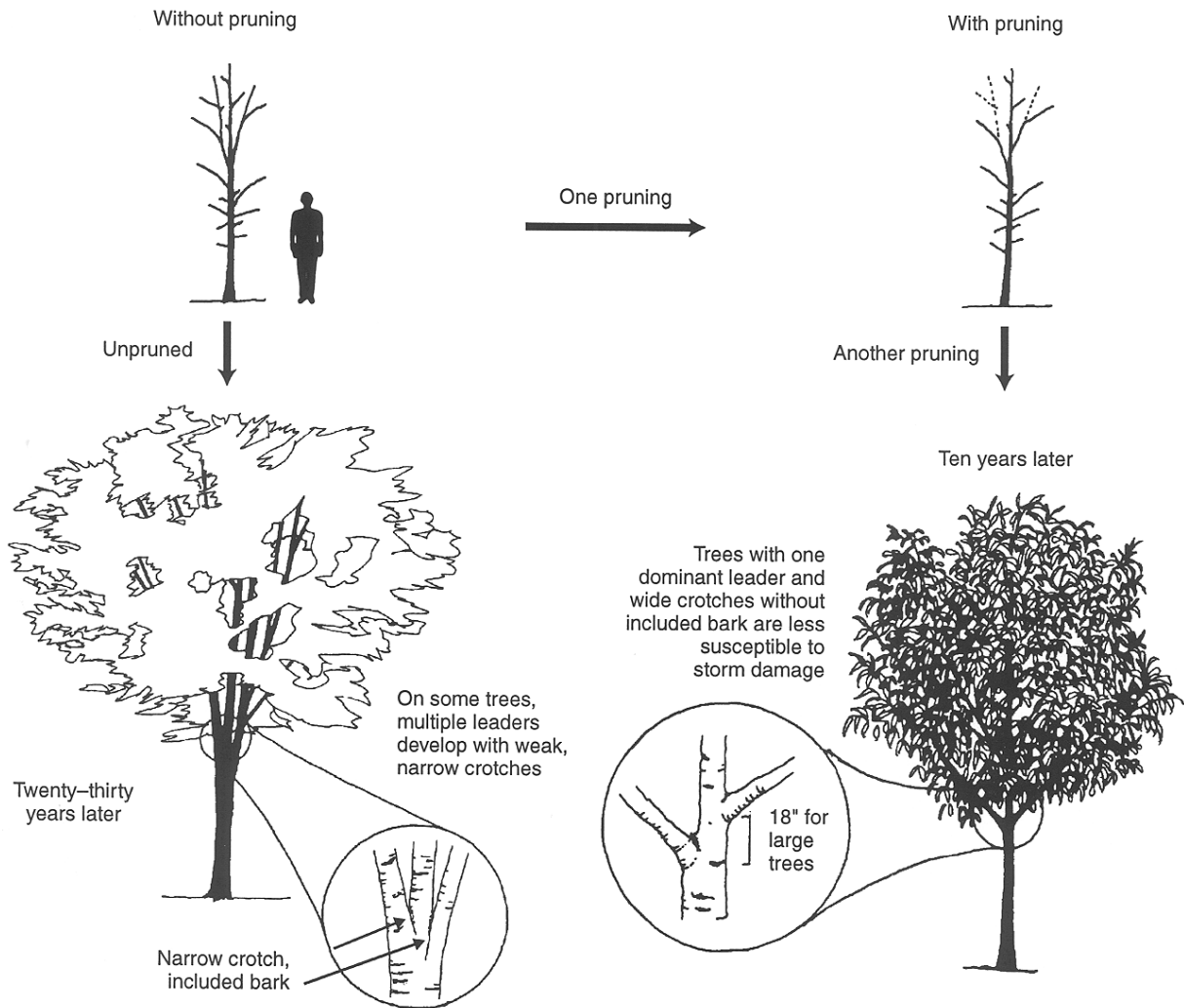


Figure 1. Many trees are left unpruned or they are pruned to encourage inferior branch architecture with several codominant stems (left). This form is weaker than the architecture that develops following pruning to encourage just one leader to dominate the tree (right)

Trees in and near rights of way can be managed in a manner that reduces risk of failure and minimizes current interference and clearance issues. This simplifies tree pruning by creating a more manageable situation (i.e. less pruning) in the future (Figure 1, right). Specifications in this document were developed to prevent the problems created by tree pruning as currently practiced. The strategy focuses on pruning trees at planting and then periodically during the next 20 to 30 years. This results in higher clearance sooner without sacrificing tree health by removing and guiding branches to position permanent branches higher off the ground.

Approach to Pruning

There are three major objectives to pruning trees in highly visible areas. These are to develop and maintain a stable structure to reduce risk of failure; provide visibility and clearance for safe passage of vehicles and pedestrians; and maintain or enhance aesthetics. Tree owners (the Florida Department of Transportation) determine objectives and contractors perform the work to meet objectives within the guidelines detailed in the specifications. Different pruning strategies are employed to accomplish each objective. For example, reduction cuts are commonly used for reducing risk and for training young trees (both these objectives are important to FDOT); whereas, branch removal cuts and reduction cuts are the choice for clearance pruning.

Urban and suburban areas - From training young trees to pruning mature ones, structural pruning manages risk by improving tree architecture and should be a primary goal each time a tree is pruned. The DOT may decide that structural pruning is particularly important for highway entrance and exit ramps, rest stops, streets, and other locations where trees or tree parts could impact travel lane, pedestrians, and structures.

A well-structured tree is aesthetically pleasing, supports the crown as it grows larger, is long-lived, and provides the greatest benefits at the lowest cost. Trees such as oaks and mahogany that become medium-sized to large at maturity (and are likely to live for decades due to their location) should be considered for structural pruning each time they are pruned. Most small-maturing trees such as crapemyrtle, ligustrum, and buttonwood remain less than 30 feet tall and DOT may decide that structural pruning is a lower priority because trees may not grow large and will cause less damage if they fail.

Pruning for structure differs than other pruning objectives because it focuses on directing growth and developing the framework (i.e., branch architecture) of the tree to enable it to withstand future wind loads. Management objectives transition to managing load once the framework is developed. Skill at structural pruning comes with experience. The primary focus is on pruning the parts of the crown that currently contribute to – or will contribute to - weakness. Rather than a one-time event, structural pruning should be thought of as a training process that improves tree structure over a period of a decade or more. It should begin the day trees are planted. A suggested 25-year management strategy can be found below.

Trees that do not receive structural pruning when young can be more problematic to maintain as they mature. Structural deficiencies that were ignored early can become significant weaknesses when trees are bigger and support larger loads (taller and longer branches). Poor tree architecture or inferior branch structure such as codominant stems (especially in the lower 15 feet of the tree), bark inclusions, over-extended branches, and leaning trees can lead to tree failure and early tree removal, eliminating the benefits that could have been provided by a mature tree. During storms, trees with poor structure are usually the first to fail, knocking out power lines, blocking traffic flow and evacuation routes, increasing the costs for clean-up, and sometimes interfering with emergency operations. Trees also can injure people sometimes resulting in fatalities.

In most cases structural pruning employs two primary strategies: 1) on young trees, develop and maintain a single, dominant trunk with smaller primary branches by removing some primary branches or pruning the

ends of the largest, most aggressive, dense, or the longest primary branches; and 2) on older trees, reduce the likelihood of tree failure caused by defects in structure and poor weight distribution by reducing load on the ends of large and/or long branches.

Structural pruning is accomplished using branch removal, reduction, and (occasionally) heading cuts (where appropriate). Removing branches from a limb slows growth on that limb which encourages other parts of the tree to grow larger. This approach is called *subordination* because it subordinates or slows growth on pruned limbs relative to other parts of the tree. By using subordination treatments, limb diameter remains small because the parent trunk continues to grow rapidly. Thus, cuts are small when the pruned limbs are removed for visual clearance in the future. This strategy makes clearance a less labor-intensive task in the future and reduces the likelihood of decay in the tree because cuts are small.

Clearance of travel lanes, buildings, sight lines to signs, and access is important in many instances. Clearance is often expressed as distance from the ground or from an object (e.g. a building) or location such as a roadway edge. Clearance includes removal of primary branches and secondary branches (using branch removal cuts), and reduction in branch length (using reduction cuts). Clearance pruning is often combined with structural pruning to meet the two objectives of creating clear site lines and reducing risk. Clearance pruning is commonly practiced on small-maturing trees for aesthetic, visibility, herbicide application, and for other reasons. Low branches that will eventually be removed from trees due to interference with buildings, vehicle or pedestrian traffic, maintenance, or blockage of sight lines should be subordinated or removed sooner than later. This prevents having to execute large pruning cuts in the future which can reduce tree vitality and shorten their life span.

Aesthetics is a reasonable objective especially in highly visible areas such as rest stops, highway interchanges, and areas where the DOT manages trees through municipal rights of way. Aesthetic pruning can include strategies such as visually balancing the tree which presents a symmetrical crown outline or thinning dense crown clusters at the crown exterior. The crown interior should not be removed under most circumstances; in other words trees should not be lion tailed.

Rural areas – In contrast to urban areas, the DOT could decide that structural pruning may not be as important in rural regions where structural integrity may be judged by DOT as less important.

Pruning Process

Pruning is accomplished using primarily branch removal cuts and reduction cuts. Heading cuts can be used along stretches of rural roadway to **reduce length** of branches near travel lanes. However, headed branches on certain species such as pines often die back to the trunk; other species sprout vigorously resulting in the need to re-prune.

Branch removal is straightforward – the branch is removed back to the parent branch or trunk which is larger in diameter than the removed branch. Reducing the length of branches is more complicated and is a key component of pruning trees. The location of the first reduction cut is toward the end of the branch in question. Beginning at the trunk and moving outward, the largest portion of the branch is visually followed at each fork until the arborist finds a place to make a reduction cut of the specified diameter. Any subsequent cuts are made on the largest lateral branches back toward the trunk (working from the branch end) until the specified number of reduction cuts are made. *(Note to specifier: The last three sentences of this paragraph are important and may be poorly understood by contractors. These can be included in specifications to clarify the desired pruning strategy.)*

Why Specifications?

Written specifications are essential for communicating what is to be accomplished by pruning. They establish tree owner objectives and describe how to meet them. Specifications guide and protect both the tree owner and the contractor by ensuring that everyone clearly understands objectives and scope of the work. Municipalities, utilities, commercial arborists, and tree owners all benefit from writing and using specifications. The language and practices contained in national standards should be used when writing pruning specifications. The United States has national standards for tree pruning that establish uniform language and practices. This document uses the American National Standards Institute (ANSI) A300, Part 1 Pruning Standard language.

Specification Overview

Pruning is complicated; therefore, specifications should be prepared by professional arborists with proven and demonstrated knowledge in drafting and implementing clearly written and accountable pruning specifications. These entities may not be easy to find. Personnel preparing specifications should comply with the language and practices contained in the latest ANSI A300 Part 1 pruning standards, and apply practices in the latest International Society of Arboriculture (ISA) Best Management Practices document. The books “Structural Pruning: A Guide to the Green Industry” and “Illustrated Guide to Pruning: Third edition” may also be referenced when writing specifications. Said arborists should also be able to show others how to conduct pruning. In cases where the FDOT will not prepare the pruning specifications, the DOT should have arborists on staff with proven knowledge of drafting pruning specifications so they are qualified to review specifications drafted by contractors. Ideally, FDOT would prepare specifications that contractors would implement. Specifications need to be clear and detailed enough so that contractors implement pruning in the same manner envisioned by the personnel preparing the specifications. FDOT and contracting arborists should receive detailed and documented training on how to draft and implement specifications from entities with experience in writing specifications. International Society of Arboriculture Certified Arborists (CAs) may or may not have the experience needed to write pruning specifications.

Individuals drafting specifications should have a working knowledge of - and experience with – modern arboricultural pruning. This includes familiarity with the applicable safety (ANSI Z133) standards, and recent advancements (research), texts, and on-the-ground hands-on experience. The most important qualification of a specification writer is an understanding of what should be accomplished with pruning (objectives) and how to describe it. This requires practice to master. Inexperienced individuals lacking knowledge of the applicable standards, and lacking experience in structural pruning might include unreasonable expectations of contractors; skip important steps or objectives; misapply terminology; recommend substandard practices; and other activities that can compromise the tree owner and the trees.

Specifications should include the location and general (or specific) description of the trees, pruning system(s), objective(s), pruning cut types(s), amount to remove, type of part to remove, and location of branches in the tree (Table 1). Specifications should also include the timeframe for completion, the plan for disposal or repurposing of debris, and a recommendation for re-inspection or re-pruning (sometimes referred to as the pruning interval or pruning cycle). The sample specifications in this document include many ways of expressing these parameters; there may be other ways to express them. However, standard language included in Z133 and A300 should be adhered to in order to avoid confusion. The language used in this document meets that in the cited Standards at the time of publication.

Table 1. A pruning specification should include the following information.

1-Trees to prune (plant name(s) - common and/or scientific)

2-Location in the landscape (street address and position in the landscape e.g., all trees lining the roadway)

3-Pruning system to be applied (e.g., natural, pollard, topiary or hedge shape); the **natural pruning system** is by far the most common and will be the only system described in this document.

4-Purpose or reason for pruning: (e.g. improve sight lines, preservation of trees, provide clearance, improve a view, prevent trees and tree parts from falling on roadway, reduce risk, increase light penetration to ground)

5-Pruning objective(s) (e.g. improve branch architecture, raise crown, reduce length or dimensions, reduce crown density, reduce risk of branches falling)

6-Type of parts to remove (e.g., live branches, dead branches, dead fronds, fruit, mistletoe)

7-Size range of branches to remove (e.g., diameter range, maximum or minimum diameter, length)

8-Location within the crown of the parts to remove (e.g., largest diameter primary branches, outer edge of entire crown, top half of the crown, over roadway, largest aspect ratio branches, branches on the travel lane side of tree, over the building,)

9-Type of pruning cuts to utilize (e.g., branch removal cut, reduction cut, heading cut)

10-Amount to remove (e.g., all dead branches over 2 inches in diameter; number of pruning cuts [of a certain diameter]; 5 to 7 feet of length; a percentage of length or height; a percentage of foliage [e.g., 25 percent of live foliage])

11-Limitations (e.g., less than 70% of cuts shall be branch removal cuts)

12-Plan for disposal of debris (e.g., remove all debris, chip brush, leave wood chips, leave firewood)

13-Time frame for completion of the work (e.g., certain date, over the winter, July)

14-Re-inspection or pruning interval (e.g., 3 years, annual, monthly during the growing season)

Additional information as needed (e.g., topiary shape, clearance distances, desired view)

(Note to specifier: For simplicity of presentation, items 6 through 10 can be combined into a “branches to be pruned” item as shown in many of the example specifications.)

Although all of the following are addressed in either the Z133 or A300 Part 1 Pruning Standards, additional emphasis can be placed on certain work practices by including them in the specification. Some examples of important statements to include are:

- All pruning cuts shall be made in accordance with the ANSI A300 Part 1 Pruning Standard.
- Work practices shall be consistent with the current ANSI A300 Part 1 Pruning Standard and the ANSI Z133 Safety Standard.
- All work shall be performed under the supervision of an ISA Board-Certified Master Arborist (BCMA).
(Note to specifier: Although there are presently (2019) no qualifications for tree pruners, the ISA’s BCMA credential may be the best substitute for a trained pruning specification writer.)
- Trees should be inspected in three *(Note to specifier: or choose an appropriate number)* years to consider re-pruning.
- Trees shall not be lion tailed or topped.

Developing Specifications

There are two ways to use this document to help develop specifications. The specifier can 1) review the list of specifications (Table 2) and illustrations (Appendix 2) to quickly locate an appropriate specification and detail(s), or 2) peruse the many specifications by reading them and then matching the appropriate specification for the trees in question. The specifier should also have a copy of the five relevant documents recommended above (also listed in the Suggested Reading section) which will help the specifier to use standard arboriculture language and understand standard practices. The specifier might want to consider including language in the specification that recommends contractors also have a copy of each on site.

Specifications Included within this Appendix

Table 2. List of example specifications included in this Appendix.

Specification example number and title.			
Example 1	Incomplete specification.	Example 18	Clearance from sidewalk, street and buildings downtown.
Example 2	Pruning specification for single tree.	Example 19	Residential street trees (young trees).
Example 3	Pruning specification for highway rest stop.	Example 20	Residential street trees (medium-aged/mature trees).
Example 4	Pruning trees at planting.	Example 21	Parking lot large-maturing young trees.
Example 5	Pruning young trees planted in the last 5 years.	Example 22	Parking lot large-maturing medium-aged trees.
Example 6	Pruning young trees.	Example 23	Parking lot small-maturing trees.
Example 7	Pruning medium-aged trees.	Example 24	Single tree.
Example 8	Pruning mature trees.	Example 25	Single tree.
Example 9a, 9b	Palms without crownshaft.	Example 26	Small grouping of trees.
Example 10	Palms with crownshaft.	Example 27	Residential shrubs and hedge.
Example 11	Pine trees.	Example 28	Reduction on a single mature tree.
Example 12	Interchange slope (shrubs).	Example 29	Reduce section of crown.
Example 13	Young trees along turnpike and interstate entrance/exit ramp. (Interchange)	Example 30	Reduce crown density on small-maturing trees.
Example 14	Medium-aged and mature trees along turnpike and interstate entrance/exit ramp.	Example 31	Reduce crown density on large mature trees
Example 15	Forest edge strip for many miles. Hedging.	Example 32	Raise crown of young large-maturing tree.
Example 16	Divided highway median.	Example 33	Raise crown of medium-aged large-maturing tree.
Example 17	Raise crown at Interstate/turnpike interchange.	Example 34	Raising crown of large mature tree.

The specifications should be based on tree owner objectives, tree species, tree condition, tree location, and size of the trees to be pruned. Sizes, lengths, fractions, percentages, number of branches, phrases and other statements are shown in this document as examples; these should be modified by the specifier to meet the objectives and the situation. These parameters should be adjusted according to the pruning cycle, tree owner's tolerance to voids in the crown, proximity to pedestrians and structures, and severity of any defects. Details (illustrations with captions, Appendix 2) should be incorporated as needed and are typically essential to communicate what is to be performed. More than one detail may be referenced and included in any specification.

Single tree specifications can be very specific detailing what is to be done on the tree; specifications written for a large grouping or population of trees have to be less specific and broader in language to reflect the

variation among trees in the population to be pruned. Broader language would include items such as specifying ranges in pruning cut sizes (e.g. 2.5 to 3.5 inch diameter) instead of a specific diameter, ranges in the number of cuts (e.g. 3 to 5 reduction cuts) instead of a specific number, and expanded ranges in branch length reduction (e.g. 6 to 12 feet) instead of a specific length or tighter range (6 to 7 feet).

It is impractical to evaluate each tree where there are many trees to be pruned. A subset of the population can be evaluated by size and species and specifications can be drawn from this subset. For example, if there were a total of 500 trees (oak and mahogany) to be pruned a 5 percent (25 trees) or 10 percent (50 trees) subset could be evaluated – the remaining trees would not be evaluated. The specifications drafted from the subset would then be applied to all 500 trees. More specifically, if an average of ten 3.5 to 4 inch diameter reduction cuts were required to meet objectives on the subset, then an average of ten 3.5 to 4 inch diameter reduction cuts would be applied to all 500 trees.

One method of calibrating a specifier is to develop a written specification on paper and go to the field and apply it to several real trees. As the arborist prunes the trees according to the specification, the specifier may realize that it requires adjustment in order to meet objectives. The specifier will become better at preparing clear specifications after some practice sessions on a variety of tree species, situations, and sizes. Items that may need adjusting include the ratio of reduction to branch removal cuts, the diameter of pruning cuts, the diameter or aspect ratio of primary branches to be pruned, the number of pruning cuts to apply to primary branches, and the location of pruning cuts.

Example Specifications: Comparing Complete and Incomplete Specifications

Short, concise, simple specifications are simple to write and allow the contractor great flexibility and leeway in executing the work. This may or may not be advisable depending on the situation. An experienced skilled contractor with a history of meeting objectives and providing quality service to your organization may execute the work exactly as you wish; whereas, a contractor new to your organization may require more detail. Detailed specifications are more time consuming and challenging to write because they describe what is to be performed to meet objectives. In the end, a detailed specification provides a more accountable system of operating and is the best way to ensure work is being performed in a manner which meets the needs of you and your customers and preserves tree health. Examples of both are discussed below.

The “*Note to specifier*” - purposely written in red throughout this instructional document - will assist the specification preparer in understanding the reasons for including certain items in a specification, and how to modify the statement for your particular application. The text in red will be removed by the specifier prior to publishing your specification.

The two examples (Example 1 and 2) below serve as models for items to include in a pruning specification. Although there are instances where these specifications could be used as is, most situations will require adjustments in the text that follows the headings in bold. The categories listed in bold should, in most cases, be included in a specification.

Example 1. Sample pruning specification for single tree. (*Note to specifier: This is a more complete approach to writing a specification compared to Example 3; compare the two to see if you can determine why Example 3 is deficient.*)

Tree to prune: Large oak (*Quercus*) in the front yard.

Pruning system: Natural.

Purpose: Preserve tree structure and health.

Objectives: Reduce the risk of live and dead branch failure; increase light penetration to the ground.

Branches to prune:

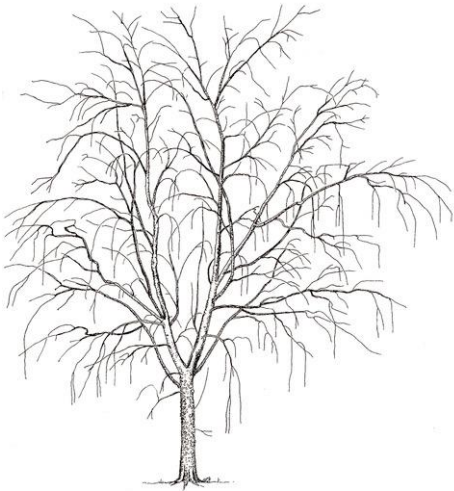
- 1) Remove dead, dying, detached, and broken branches greater than 1 inch in diameter at the point of attachment at a healthy branch (a branch with foliage) or trunk.
- 2) Reduce the live branch on the north side (~8-inch diameter) with a crack and dead twigs using two 3-inch reduction cuts.
- 3) Reduce the five largest live upright-growing primary branches using two 2.5- to 3-inch diameter reduction cuts on each branch for a total of ten reduction cuts.

Limitations: No branch removal cuts should be used to remove live branches.

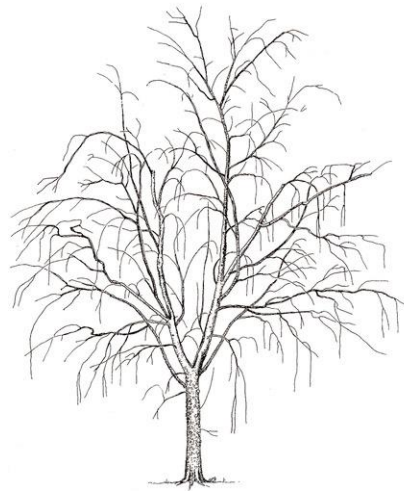
Completion date: Early spring of this year.

Re-inspection: 2 years.

Example 1 detail:

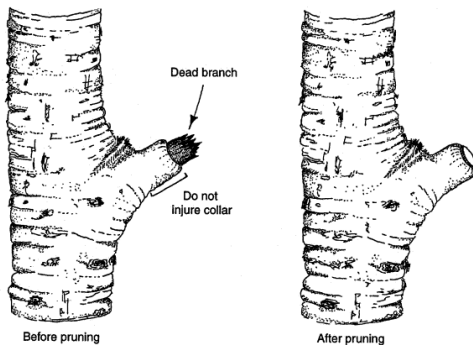


Before pruning (above): The diameter of two branches have become nearly as large as the trunk measured directly above the union.



After pruning (above): Reducing the largest primary branches (growing from trunk on lower left and middle right) using reduction cuts.

Removing a dead branch



Removing dead branches (left): Remove only the dead portion of the branch; leave the live collar intact.

Example 2. Sample pruning specification for highway rest stop. *(Note to specifier: This is a more complete approach to writing the specification shown in Example 3.)*

Location: Highway rest stop.

Trees to prune:

- 1) 115 large-maturing planted trees of various species 12 to 15 inch DBH along truck rest stop roadways, and parking lot;

- 2) 47 large-maturing planted trees of various species 12 to 15 inch DBH along automobile rest stop roadways, and parking lot;
- 3) 16 oaks 15 to 30 inches DBH located in the open lawn and landscape 40 feet or more from sidewalks and roadways.

Pruning system: Natural.

Purpose: The purpose of pruning trees at the rest stop is to minimize current and future interference with truck and other vehicle traffic; provide visible site lines across the landscape; and reduce likelihood of future tree failure.

Objectives:

- 1) Provide 18 feet clearance from ground to bottom of lowest branches at the point where the branch enters the ROW of 12 to 15 inch trees over rest stop truck roadways and parking lots. *(Note to specifier: Clearance height can be adjusted to meet site requirements and tree form. Change the height in the "Branches to prune" section below to match.)*
- 2) Provide 14 feet clearance from ground to bottom of lowest branches at the point where the branch enters the ROW of 12 to 15 inch trees over rest stop automobile roadways and parking lots. *(Note to specifier: Clearance height can be adjusted to meet site requirements and tree form. Change the height in the "Branches to prune" section below to match.)*
- 3) Provide 14 feet clearance from ground to bottom of lowest branches at the point where the branch enters the ROW under the 15 to 30 inch DBH trees located more than 40 feet from roadways. *(Note to specifier: Clearance height can be adjusted to meet site requirements and tree form. Change the height in the "Branches to prune" section below to match.)*
- 4) Reduce likelihood of tree failure in storm events on all 178 trees. *(Note to specifier: This statement was included because it is advisable to include structural pruning when clearance (crown raise) is the main objective. Implementing clearance pruning - without structural pruning - forces trees to grow taller which can accentuate and make worse existing defects in the middle and upper crown. Defects can cause trees to break.)*

Branches to prune: *(Note to specifier: Be sure each objective is met when writing this section.)*

12- to 15-inch DBH oaks (and other large-maturing) trees in truck parking area:

- 1) Where the trunk divides into two equal or nearly equal parts in the lower 10 feet, remove the one toward the parking area or roadway. Remove all primary branches – regardless of diameter or **orientation**- originating on the lower 10 feet of trunk *(Note to specifier: This distance could be as low as 8 feet depending on the upward angle of the branch segments close to the trunk. The goal is to create 18 feet of clearance between ground and the lowest branch over the pavement of the roadway and parking lots.)* so there is only one trunk vertically to 10 feet *(Note to specifier: Compared to removing only secondary branches from primary branches to create clearance – referred to as lion tailing - this approach reduces likelihood of branches and foliage growing back and blocking visibility in the future. Large pruning wounds on the trunk might be required on certain trees, but this is a good trade-off for these young trees.)* Remove secondary branches growing downward into the clearance zone from low primary branches.

On individuals where more than 50% of the foliage on the tree *(Note to specifier: Estimating the percentage of foliage removed is difficult and people often do not agree. This is a judgement call by the specifier and the contractor. Because all parties may not agree on the percentage of foliage remaining on the tree after pruning, the specifier and contractor should come to agreement by pruning three or four trees together prior to beginning the work. Other locations may have different species and branch architecture so this exercise may have to be performed in multiple locations. While this approach minimizes trunk decay from larger pruning cuts, reduced branches are likely to sprout resulting in the need for clearance again in the near future). This percentage can be adjusted downward.)* would be removed following this specification, adjust the procedure to only remove those primary branches that are less than one-half the trunk diameter originating on the lower 10 feet of trunk, and reduce those that have a larger aspect ratio. This is accomplished by using 3-to 4-inch diameter reduction cuts to a) shorten (reduce) the longest and the most upright branches and b) removing those drooping downward. About half the foliage should be removed on each reduced primary branch; do not execute step #2 below. *(Note to specifier: Specify the number of cuts to perform per branch such as 3 to 4; this section of "Branches to prune" relates to objectives 1 and 2.)*

- 2) Reduce length of the three largest diameter branches on the trunk originating above 10 feet trunk height with two 3-to 3.5-inch diameter *(Note to specifier: Number and diameter of cuts can be adjusted.)* reduction cuts on each. *(Note to specifier: This section of "Branches to prune" relates to objective 4.)*
- 3) Reduce length by 30 percent on branches with bark inclusions or cracks.

12- to 15-inch DBH oaks (and other large-maturing) trees in automobile parking area:

(Note to specifier: Insert text from the section above substituting 14 feet for 18 feet.)

15- to 30-inch DBH trees:

- 1) Reduce length of primary branches and stems originating from the trunk in the lower half of total tree height with aspect ratio greater than one-half using an average of three (range 2 to 4) 3 to 4 inch diameter reduction cuts on each branch *(Note to specifier: The number and size of cuts can be adjusted to suit the site and the condition and size of trees. For example, the number of cuts per branch could be adjusted upward for larger branches and trees.). (Note to specifier: This section of "branches to prune" relates to objective 3 and 4.)*
- 2) Remove or reduce secondary branches growing downward from primary branches in the lower half of total tree height.
- 3) Remove all branches on lower 8 feet of trunk except branches larger than 6 inches *(Note to specifier: This number can be adjusted to suit the conditions, structure and size of trees and the site knowing that the larger the pruning cut on the trunk the greater the potential trunk decay. This can also be expressed as in the above section specifying aspect ratio instead of diameter. Aspect ratio is a more generic specification which can carry over to the larger number of situations.). (Note to specifier: This section of "Branches to prune" relates to objective 3.)*
- 4) Reduce length by 30 percent on branches with bark inclusions or cracks.

Limitations:

- 1) No heading or shearing cuts shall be made without authorization.
- 2) No more than one-half of the foliage shall be removed from an individual tree without authorization. *(Note to specifier: This number should be adjusted to accommodate the age and condition of trees and the site attributes. Adjust the number downward for older trees in poor health. Younger trees could tolerate a larger percentage provided trees were in a high state of vitality.)*
- 3) Less than 70% of cuts on live branches shall be branch removal cuts. *(Note to specifier: Including this statement in the specification ensures that the contractor uses some reduction cuts to prune the trees. Reduction cuts are necessary in order to perform the objectives in this specification. Adjust the percentage according to the site, location, age, and form of the trees. The percentage should be adjusted to suit conditions.)*
- 4) Make no removal cuts on the trunk larger than 6 inches diameter *(Note to specifier: This number should be adjusted to accommodate the age and condition of trees and the site attributes. Adjust the number downward for older trees in poor health. The diameter of the cuts should be adjusted to suit conditions.)*
- 5) Trees shall not be lion tailed. *(Note to specifier: Lion tailing is one of the most common sub-standard pruning practices in the tree industry. It can lead to poor tree architecture causing trees to fail prematurely. Including this statement in the limitations increases the likelihood that trees will be pruned according to specifications.)*
- 6) Wounds left by reduction and removal cuts shall not be coated with wound dressing or pruning paint of any kind. *(Note to specifier: Except for a small number of diseases such as oak wilt, there is no evidence that wound dressings help trees following pruning. This can be included in the Limitation section of every pruning specification if needed)*

General requirements: *(Note to specifier: The following five items should be included in every pruning specification because they are considered standard practice; in order to conserve space in this document, they will not be included in subsequent example specifications in this document.)*

- 1) All pruning cuts shall be made in accordance with the current ANSI A300 Part 1 Pruning Standard.

2) Work practices shall be consistent with the current ANSI A300 Part 1 Pruning Standard and the ANSI Z133 Standard.

3) Trees shall not be lion tailed or topped.

4) All work shall be performed under the supervision of an ISA Board-Certified Master Arborist. *(Note to specifier: Most states including Florida do not license arborists; some states e.g. Louisiana, New Jersey, Connecticut, and others license arborists).*

No tree shall be ascended using climbing spurs or spikes unless it is to rescue an injured worker or in cases of tree removal.

Debris removal: All debris will be removed from the work area daily.

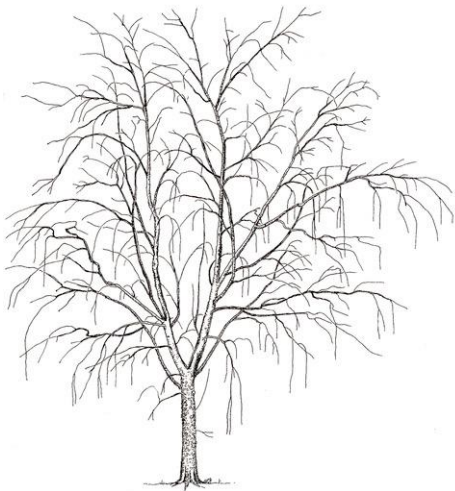
Completion date: Fall of this year.

Re-inspection: Trees will be re-inspected and considered for pruning 3 years after completion of the current pruning project *(Note to specifier: choose your own number appropriate for the circumstances.)*.

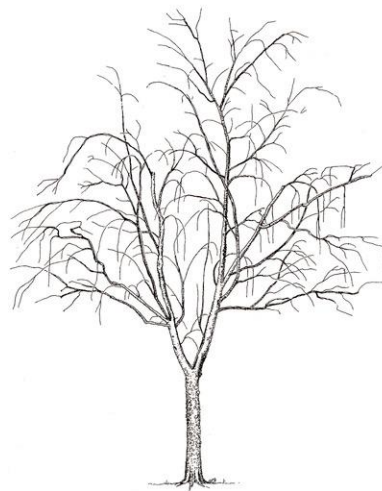
Contractor requirements: All potential contractors shall be present Monday morning 8 am to watch three trees pruned according to the specifications contained herein. *(Note to specifier: This is designed to demonstrate to contractors the pruning to be performed on the subject trees. Contractors may not be familiar with this approach to pruning and therefore might not be capable of - or they may resist - performing the specified work. The specifier should hire a contractor that understands the pruning required in the specification and this is a great way to expose contractors as to what is expected. Before choosing a contractor to perform the work, consider requiring them to demonstrate the pruning to the specifier. The specifier should be prepared to review work the day it starts and then several times weekly until contractor demonstrates that they are capable of performing the work as specified.)*

(Note to specifier: The Contractor requirements statement should be considered for inclusion in every pruning specification; in order to conserve space in this document, the Contractor requirements section will not be included in subsequent specification examples in this document.)

Example 2 detail:



Before pruning: The diameter of two branches have become nearly as large as the trunk measured directly above the union. Low branches are blocking pedestrians and drivers view of traffic signs.



After pruning: 1) Reducing the largest two branches (growing from trunk on lower left and middle right) with reduction cuts to improve branch architecture. 2) Removing lower secondary branches with removal cuts to raise the crown.

Example 3. Sample incomplete specification. *(Note to specifier: This incomplete specification is not recommended and serves only as an example to compare with the recommended detailed specifications presented above and in the remaining portion of the document. As you read through this sample, ask yourself what might be missing from this specification before reading the critique below.)*

Location: Highway rest stop.

Trees to prune:

- 1) 115 large-maturing planted trees of various species 12- to 15-inch trunk diameter measured 4.5 feet from the ground (DBH) along truck rest stop roadways, parking lot and sidewalks;
- 2) 47 large-maturing planted trees of various species 12- to 15-inch DBH along automobile rest stop roadways, parking lot and sidewalks;
- 3) 16 oaks 15 to 30 inches DBH located in the open landscape 40 feet or more from sidewalks and roadways.

Objectives:

- 1) Provide 18 feet of clearance over rest stop truck roadways, parking lots, and sidewalks.
- 2) Provide 14 feet clearance over rest stop automobile roadways, parking lots, and parking lots
- 3) Provide 14 feet clearance under the 16 oaks 15- to 30-inch DBH located more than 40 feet from roadways.

Debris removal: All debris will be removed from the work area daily.

Completion date: February 14 of the current year.

Critique of Example 3 specification. The incomplete specification above is missing some sections that can result in inconsistent and/or substandard work without meeting objectives. The following is a discussion of the implications of not including certain items.

Pruning system is missing. Including this makes it clear to the contractors that trees will retain their natural shape without topping, shearing, or lion tailing.

Purpose is missing. Including a purpose of pruning allows the contractor to perform the work to meet objectives as they relate to long term goals at the site.

Objectives: As written, the only objective is to provide clearance. While complete in this regard, it is often easy to achieve multiple objectives when pruning a tree. For example, pruning to reduce the likelihood of failure in storms would add very little to the overall expenditures required per tree because so much effort is made simply for crews to reach the tree. It is important to reduce likelihood of failure in planted trees at a rest stop and other locations where pedestrians, vehicles, or other potential targets are present.

Branches to prune: Writing this section is the most difficult (and important), requiring knowledge of tree biology, structure, and tree response to pruning. Including this section details how the work is to be accomplished including pruning cut size and pruning cut types to use, amount to remove, and where in the trees to prune. It is recommended that the type of information included in the detailed specification shown below is incorporated into the specification. Without this detail, the contractor may not provide the service in a manner that meets objectives while minimizing the negative impacts on tree health. For example, contractor could remove all branches back to the trunk on the roadside of the tree and meet the clearance objective in the specification. The specifier may have envisioned a different approach such as removing only drooping secondary branches and shortening but retaining all primary large branches low on the trunk; without specifying the detail shown below, there is no guidance on this issue.

Limitations: This section details the practices the specifier does and/or does not want performed on the trees. It is a powerful way to communicate work practices which may or may not be used on the trees.

Re-inspection: There is no designated pruning cycle or recommended return time when the tree should be pruned again. Including a pruning cycle in the specification allows the specifier and contractor to place the

pruning into a better context. More material (e.g. more cuts or larger cuts) should be removed where the pruning cycle is long (e.g. 10 years) than when the pruning cycle is shorter (e.g. 3 years).

Example Specifications: Large Maturing Trees (Trees Maturing at more than 35 Feet Tall)

The following five examples (4 through 8) form the base specifications for pruning medium- and large-maturing trees (such as oaks, mahogany, black olive, tabebuia, sweetgum, maples, and many other large-maturing trees) of different sizes or ages. They can be applied to trees in many different locations. The specifications that follow these five examples are more situational based. Phrases and sentences can be added or deleted to conform to tree owner objectives.

Most trees that require crown raising for under-tree visibility and clearance also benefit from structural pruning; the reader will notice that most examples include “improve crown structure” or “reduce likelihood of branch failure” as an objective. Also, sentences and phrases in the “branches to prune” section of any example specification can be used for other situations depending on tree structure, size, species and location.

Example 4. Pruning trees at planting. *(Note to specifier: The crown structure on most newly or recently planted trees can be improved significantly with structural pruning at planting or within the first year or two after planting. This specification could be applied to new trees with good vitality planted in any location. Pruning can be conducted to improve branch architecture without negative effects on the tree. The goal is to create one dominant leader toward the center of the crown by reducing the growth rate of the largest competing branches; this approach makes subsequent clearance under the crown easier. Growth suppression on these largest branches is accomplished by substantially reducing their length, or by removing them, or by a combination of reduction and removal. Making a reduction cut back to a lateral branch pointed away from the trunk is the best method of slowing growth on these branches that are competing with the one leader.)*

Trees to prune: 275 trees (a mix of medium- and large-maturing tree species) that are 3.5- to 6-inch caliper.

Pruning system: Natural.

Purpose: Create strong branch architecture; limit the need for major branch removal at maturity. *(Note to specifier: Removing large branches later can negatively impact tree health and stability and the type of pruning described below is the best method of avoiding this.)*

Objectives:

1) Improve crown structure (also known as branch architecture) by a combination of reducing and removing stems, branches, and leaders with an aspect ratio larger than one-half. Encourage growth in one dominant leader. *(Note to specifier: Aspect ratio is calculated as the diameter of the branch divided by (compared to) the diameter of the trunk measured directly above the branch union. Two-thirds can be adjusted to one-half (recommended ratio) for a more aggressive long-lasting pruning application.)*

Branches to prune:

1) Reduce length by two-thirds of all stems and branches with an aspect ratio larger than one-half by cutting back to a lateral branch that is larger (where possible) than one-third the diameter of the pruning cut (referred to as a reduction cut); make no pruning cuts on the stem retained as the leader.

Limitations:

- 1) No heading or shearing cuts shall be made without authorization.
- 2) Less than 20% of cuts on live branches shall be branch removal cuts. *(Note to specifier: Including this statement in the specification requires the contractor to use mostly reduction cuts to prune the trees. Reduction cuts are necessary in order to perform the work according to this specification. Adjust this percentage according to the site, location, age, and form of the trees.)*
- 3) Sprouts on the lower 5 feet of trunk shall not be removed unless larger than one-inch diameter.
- 4) No more than 50% of the foliage shall be removed from an individual tree without authorization.

5) All severed branches shall be removed by the end of the workday.

Debris disposal: All debris will be removed from the work area and recycled as mulch or disposed of at the City green waste recycling center.

Completion date: March 18.

Example 5. Pruning young trees planted in the last 5 years. Typical locations would be rest stops, interchanges, street trees, operation centers, and park trees.

Trees to prune: Forty-three oak (*Quercus*) and mahogany (*Swietenia*) street trees that are 5- to 10-inch DBH and 14 to 30 feet tall.

Pruning system: Natural.

Purpose: Create strong branch architecture; create clearance for pedestrians and vehicles under the crown; prevent large branch removal from the lower trunk later.

Objectives:

1) Improve crown structure (also known as branch architecture) by reducing or removing stems, branches, and leaders with an aspect ratio larger than two-thirds. Encourage growth in one dominant leader. *(Note to specifier: Aspect ratio is calculated as the diameter of the branch divided by (compared to) the diameter of the trunk measured directly above the branch union. Two-thirds can be adjusted to one-half for a more aggressive long-lasting pruning application.)*

2) Provide clearance for adjacent sidewalk and street. *(Note to specifier: Adjust language for the situation; for example, delete reference to sidewalk if there is no sidewalk present.)*

Branches to prune:

1) Reduce length by two-thirds of all stems and branches with an aspect ratio larger than two-thirds by cutting back to a lateral branch that is larger (where possible) than one-third the diameter of the pruning cut (referred to as a reduction cut); make no pruning cuts on the stem retained as the leader.

2) Remove at the trunk all branches that originate from the lower 7 feet of trunk so only one trunk (preferably the larger if there are two or more) remains. Remove additional secondary branches from primary branches to create 8 feet of clearance under the crown. *(Note to specifier: Adjust clearance height for the current and expected form of the species and the situation. You will notice that on slightly older and larger trees in the specification that follows (i.e., example 3) that clearance increases. The amount of clearance is governed by the location of the tree, growth rate, species, crown form, and when trees are expected to be pruned again.)*

3) Remove dead and broken branches greater than one inch in diameter at the point of attachment.

4) Remove branches and sprouts originating on the trunk below 7 feet including those growing from the **root collar**.

Limitations:

1) No heading cuts greater than one-inch diameter or shearing cuts shall be made without authorization. Heading cuts shall only be used to subordinate branches where a reduction cut is impractical because there is no lateral branch nearby.

2) Less than 50% of cuts on live branches shall be branch removal cuts. *(Note to specifier: Including this statement in the specification forces the contractor to use reduction cuts to prune the trees. Reduction cuts are necessary in order to perform this work according to this specification. Adjust this percentage according to the site, location, and form of the trees.)*

3) No more than 40% of the foliage shall be removed from an individual tree without authorization.

4) All severed branches shall be removed by the end of the workday.

Debris disposal: All debris will be removed from the work area and recycled as mulch or disposed of at the City green waste recycling center.

Completion date: March 18.

Example 6. Pruning young trees. Typical location would be rest stop, highway median, interchange, street tree, or other location within about 50 feet of the roadway.

Trees to prune: 640 oak (*Quercus*) and royal Poinciana (*Delonix*) street trees that are 10- to 16-inch DBH and 25 to 40 feet tall.

Pruning system: Natural.

Purpose: Create strong branch architecture; create clearance for pedestrians and vehicles under the crown; prevent large branch removal from the lower trunk later; reduce likelihood of future tree failure.

Objectives:

1) Improve crown structure (also known as branch architecture) by reducing stems, branches, and leaders with an aspect ratio larger than two-thirds. Encourage growth in one dominant leader. *(Note to specifier: Aspect ratio is calculated as the diameter of the branch divided by the diameter of the trunk measured directly above the branch union.)*

2) Provide clearance for adjacent sidewalk and street. *(Note to specifier: Adjust language for the situation; for example delete reference to sidewalk if there is no sidewalk present).*

Branches to prune:

1) Remove at the trunk all branches and sprouts less than four inches in diameter *(Note to specifier: Adjust the diameter of the branch to meet conditions)* that originate from the lower 12 feet of trunk. Reduce all larger branches growing from the lower 16 feet of trunk using 3 to 4 reduction cuts of approximately 3 inches diameter to remove about 50% of foliage on each. Remove additional secondary branches from the lower crown to create 8 feet of clearance under the crown on sidewalk side and 16 feet clearance on street side. *(Note to specifier: Adjust clearance height for the current and expected form of the species and the situation. You will notice that clearance increases on slightly older and larger trees in the specification that follows. This amount of clearance is governed by the location of the tree, growth rate, species crown form, and when trees are expected to be pruned again).*

2) Reduce the three branches with the largest aspect ratio in the upper half of the tree using one 3-inch reduction cut on each.

3) Remove dead, dying, diseased, and broken branches greater than one inch in diameter at the point of attachment. *(Note to specifier: Adjust diameter of branches to remove based on species attributes and site conditions).*

4) Reduce (preferred) or remove (less preferred) branches that touch other branches.

Limitations:

1) No heading or shearing cuts shall be made without authorization.

2) Less than 35% of cuts on live branches shall be branch removal cuts. *(Note to specifier: Including this statement in the specification forces the contractor to use reduction cuts to prune the trees. Reduction cuts are necessary in order to perform this work according to this specification. Adjust this percentage according to the site, location, and form of the trees.)*

3) No more than 40% of the foliage shall be removed from an individual tree without authorization.

4) All severed branches shall be removed by the end of the workday.

5) Trees shall not be lion tailed. *(Note to specifier: Lion tailing is one of the biggest problems in the tree industry. It can lead to poor tree architecture causing trees to fail prematurely. Including this statement in the limitations section increases the likelihood that trees will be pruned according to specifications.)*

Debris disposal: All debris will be removed from the work area and recycled as mulch or disposed of at the City green waste recycling center.

Completion date: March 18

Re-inspection: 3 years.

Example 7. Pruning medium-aged trees. Typical situations include street tree, tree growing in turf or ground cover, rest stop, highway median, parking lot island, park, operations facility, or median strip. *(Note to specifier: Medium-aged trees are those approximately 30 to 40 years old and with a DBH of 15 to 30 inches. Adjust clearance height for the current and expected form of the species and the situation).*

Trees to prune: All black olive and mahogany street trees 16 to 25 inches DBH on American Ave.

Pruning system: Natural.

Purpose: Reduce likelihood of future live and dead branch failure; create strong branch architecture; create clearance for pedestrians and vehicles under the crown.

Objectives:

- 1) Improve crown structure (also known as branch architecture) by reducing stems, branches, and leaders with an aspect ratio larger than two-thirds. *(Note to specifier: Aspect ratio is calculated as the diameter of the branch divided by the diameter of the trunk measured directly above the branch union.)*
- 2) Reduce likelihood of dead and live branches breaking and dropping from tree.
- 3) Provide 14 feet clearance from ground to bottom of branches.

Branches to prune:

- 1) Remove at the trunk all branches less than three inches in diameter that originate from the lower 12 feet of trunk. *(Note to specifier: Adjust the specified height to match objective for the particular site).* Reduce larger primary branches originating on the lower 16 feet of trunk using three or four 3-inch diameter reduction cuts at the ends of branches and three 2-inch diameter branch removal cuts back to primary branches to provide 14 feet of vertical clearance over the pavement. Remove additional secondary branches from the lower crown to create 10 feet of clearance under the crown on sidewalk side. *(Note to specifier: Adjust clearance height for the current and expected form of the species and the situation. You will notice that on slightly older and larger trees clearance increases. This amount of clearance is governed by the location of the tree, growth rate, species crown form, and when trees are expected to be pruned again).*
- 2) Remove dead, detached, and broken or cracked branches greater than one inch in diameter at the point of attachment. *(Note to specifier: Adjust diameter of branches to remove based on species attributes, location and site conditions. Dead branches on trees in open lawn areas without targets may not need pruning, or the dead branch diameter threshold can be increased to 1.5 inches or even larger).*
- 3) Reduce length by one-third on remaining primary branches with an aspect ratio larger than two-thirds by cutting back to a lateral branch using one or two 2- to 4-inch diameter reduction cut(s). Make no pruning cuts on the stem retained as the leader. *(Note to specifier: Adjust percentage and diameter of branches to remove based on species attributes, location and site conditions.)*

Limitations:

- 1) No heading cuts greater than one inch shall be made without authorization.
- 2) No more than 50% of cuts shall be branch removal cuts.
- 3) No more than one-third of the foliage shall be removed from an individual tree without authorization.
- 4) All severed branches shall be removed by the end of the workday.
- 5) Trees shall not be lion tailed. *(Note to specifier: Lion tailing is one of the biggest problems in the tree industry. It can lead to poor tree architecture causing trees to fail prematurely. Including this statement in the limitations increases the likelihood that trees will be pruned according to specifications.)*

Completion date: June 7.

Re-inspection: 3 years.

Example 8. Pruning mature trees. Typical location might include street tree, open lawn area, rest stop, or highway interchange.

Trees to prune: 54 trees greater than 30 inches DBH in the lawn area of the Interstate interchange.

Pruning system: Natural.

Purpose: Preservation of mature trees.

Objectives:

- 1) Improve aesthetics within the tree planting zone.
- 2) Reduce risk of branch, trunk and whole tree failure.
- 3) Enhance visibility under tree crowns.

Branches to remove:

- 1) Remove dead, nearly dead, broken and detached branches 2.5 inches and larger in diameter at the point of attachment. *(Note to specifier: Reduce the diameter [e.g. 1 inch] in locations where pedestrians and/or vehicles will pass under trees.)*

2) Remove branches less than six inches diameter from the lower 10 feet of trunk.

Branches to reduce in length by one-quarter to one-third:

1) Reduce branches that extend outside of the shape of the main crown. Reduction in length shall be accomplished using reduction cuts 3 to 4 inches in diameter. Some trees may not require this depending on crown shape and where no branches extend beyond the rest of the crown.

2) Reduce the largest four branches (4 is an average per tree but could range from one to 6 depending on the tree) measured at the trunk (*Note to specifier: You could write instead "reduce the four largest aspect ratio branches". Specify the number of branches here that make the most sense for the situation considering the compartmentalization ability of the species, the pruning cycle, and condition of the trees.*) that originate 10 feet or more from the ground with four 3 to 4 inch diameter reduction cuts on each for a total of 16 reduction cuts per tree.

3) Reduce length by 30 percent on branches with bark inclusions or visible cracks.

Limitations:

1) No heading or shearing cuts shall be made without authorization.

2) No more than one-fourth (*Note to specifier: Use your own number here; 25% is only a suggestion. More may have to be removed in certain circumstances to meet one or more of the objectives*) of the foliage shall be removed from an individual tree without authorization.

3) All severed branches shall be on the ground by the end of the workday.

4) Trees shall not be lion tailed. (*Note to specifier: Lion tailing is one of the biggest problems in the tree industry. It can lead to poor tree architecture causing trees to fail prematurely. Including this statement in the limitations increases the likelihood that trees will be pruned according to specifications.*)

Completion date: July 24.

Re-inspection: 3 years.

Example Specifications: Palms

Example 9a. Palms without crownshaft (such as the native *Sabal palmetto*).

Trees to prune: 140 palms 10 to 15 feet behind the guard rail at edge of highway shoulder.

Palms do not need to be pruned. (*Note to specifier: Most landscape palms do not require pruning to remain strong because they naturally grow with one trunk. There is antidotal evidence that pruning live foliage from palms could increase damage in strong storms, such as hurricanes.*)

Example 9b. Palms without crownshaft (such as *Sabal* and *Washingtonia*).

Trees to prune: Trees to prune: 16 palms 10 to 15 feet behind guard rail at the edge of highway shoulder.

Pruning System: Natural

Purpose: Improve aesthetics.

Objective: Remove all leaves with more than 50 percent dead (brown) tissue. (*Note to specifier: Adjust the percentage to suit the desired aesthetic.*)

Leaf removal: Remove leaves at the trunk by cutting through the base of the petiole without cutting into live trunk tissue.

Limitations: Remove no leaves that are entirely green; remove no leaves that are mostly chlorotic. (*Note to specifier: Chlorosis on lower foliage indicates a nutrient deficiency; removing these leaves could cause chlorosis on retained green leaves causing a further decline in health. Palms in this condition require fertilizer to promote health; without it the palms may die.*)

Debris disposal: The brush shall be hauled away from the site.

Completion date: May 1.

Example 10. Palms with crownshafts such as foxtail palm (*Wodyetia bifurcate*) and Royal palm (*Roystonea alata*).

Trees to prune: 140 palms 10 to 15 feet behind the guard rail at edge of highway shoulder.

Palms do not need to be pruned.

EXAMPLE SPECIFICATIONS: Conifers and other excurrent trees

Example 11. Pine trees.

Trees to prune: Pines (*Pinus spp.*) on the north edge of the lawn about 20 feet from building.

Pruning System: Natural

Purpose: Reduce likelihood of the whole tree or tree parts striking the building in tropical storms.

Objective: Reduce branch length while maintaining natural crown form.

Branches to prune: Live branches - Reduce the five largest diameter primary branches, plus any other branches with rust disease or other cankers forming depressions or cracks in the wood, using one 2-to 3-inch reduction cut on each. Dead branches – Remove dead branches 2 inches in diameter and larger. *(Note to specifier: Smaller dead branches are not likely to cause damage in a tropical storm)*

Limitations: No branch removal cuts at the main stem shall be used on live branches. No reduction cuts shall be made greater than 4 inches in diameter without approval from the project arborist. Do not reduce tree height.

Debris disposal: The brush is to be chipped and left on site under the trees for mulch.

Completion date: Within the next two weeks to comply with the nesting bird study recommendations.

Example Specifications: Highway/Street/Parking Lot Trees

Example 12. Interchange slope (shrubs).

Shrubs to prune: Approximately 200 Japanese privet (*Ligustrum japonica*) on the four interchange slopes at the base of overpass bridge.

Pruning system: Natural.

Objective: Reduce in size, maintain current shape.

Branches to prune:

1) The longest and tallest five live branches shall be reduced by half their length using reduction cuts. In most cases the pruning cuts will be positioned inside the retained crown edge with a hand pruner as to be hidden from view. This method of reduction leaves a more natural irregular – not smooth – edge to the plants. *(Note to specifier: There is no doubt that reducing back to a specified height [e.g. 6 feet] using engine-powered hedging shears is a more efficient and less expensive method of reducing plant height. The choice of reduction methods is dictated by the location of the plants and the desired outcome.)*

2) Dead branches greater than one-inch diameter shall be removed at the position of a live lateral branch or at the point of origin at ground level.

Limitations:

1) Engine-powered hedging devices shall not be used to reduce size; use hand shears only. *(Note to specifier: Delete this limitation if powered hedging devices will be utilized to reduce plants.)*

Debris disposal: Remove all debris.

Completion date: Spring of this year.

Re-inspection: 3 years.

Example 13. Young trees along turnpike and interstate entrance/exit ramp.

Trees to prune: 110 mix of species including mahogany (*Swietenia*), royal Poinciana (*Delonix*), oak (*Quercus*), and yellow trumpet trees (*Tabebuia*) that are 8- to 14-inch DBH and 20 to 30 feet tall.

Pruning system: Natural.

Purpose: Provide clearance for roadway and mowers; reduce likelihood of future storm damage to trees and potential lane blockage from resulting debris.

Objectives:

1) Reduce tree crown width to provide 35 feet clearance *(Note to specifier: use the distance appropriate for the site)* between roadway edge and the edge of the tree foliage on roadway side of trees. If the tree trunk is within 35 feet

of the roadway edge, then remove the tree by cutting it at the trunk base. *(Note to specifier: Removal of misplaced trees may be controversial but will provide a reduction in maintenance. Once tree crowns are reduced in width to provide clearance, they grow back quickly to their original dimension requiring routine pruning to keep the roadway clear.)*

2) Raise crown to provide 10 feet clearance for mowers.

3) Improve crown structure (also known as branch architecture) by reducing stems, branches, and leaders with an aspect ratio larger than one-half. Encourage growth in one dominant leader.

Branches to prune:

1) Remove at the trunk all branches and sprouts less than three inches in diameter that originate from the lower 10 feet of trunk. Reduce all larger branches growing from the lower 16 feet of trunk using 3 to 4 reduction cuts of approximately 2 to 3 inches diameter to remove 60% of foliage on each. Remove additional secondary branches from the lower crown to create 10 feet of clearance under the crown. *(Note to specifier: Adjust clearance height for the location of the tree, growth rate, species crown form, and when trees are expected to be pruned again).*

2) Remove dead and broken branches greater than 2.5 inches in diameter at the point of attachment. *(Note to specifier: Adjust diameter of branches to remove based on species attributes, potential mower damage from chopping fallen dead branches, and other site conditions.)*

Limitations:

1) No heading or shearing cuts shall be made without authorization.

2) Less than 70% of cuts on live branches shall be branch removal cuts. *(Note to specifier: Including this statement in the specification ensures that the contractor uses reduction cuts to prune the trees. Reduction cuts are necessary in order to perform this work according to this specification. Adjust this percentage according to the site, location, and form of the trees.)*

3) No more than 50% of the foliage shall be removed from an individual tree without authorization.

4) All severed branches shall be removed by the end of the workday.

5) Trees shall not be lion tailed. *(Note to specifier: Lion tailing is one of the biggest problems in the tree industry. It can lead to poor tree architecture causing trees to fail prematurely. Including this statement in the limitations increases the likelihood that trees will be pruned according to specifications.)*

Debris disposal: All debris will be removed from the work area and recycled as mulch or disposed of at the City green waste recycling center.

Completion date: January 20.

Re-inspection: 3 years.

Example 14. Medium-aged and mature trees along turnpike and interstate entrance/exit ramp.

(Note to specifier: Medium-aged and mature trees are those approximately 30 years and older and with a DBH over 16 inches.

Trees to prune: All black olive, oak and mahogany trees more than 16 inches DBH.

Pruning system: Natural.

Purpose: Provide clearance for roadway and mowers; reduce likelihood of future storm damage to trees and potential lane blockage from resulting tree debris.

Objectives:

1) Reduce tree crown width to provide 35 feet clearance *(Note to specifier: use the distance appropriate for the site)* between roadway edge and the edge of the tree foliage on roadway side of trees. If the tree trunk is within 35 feet of the roadway edge, then remove the tree by cutting it at the trunk base. *(Note to specifier: Removal of misplaced trees may be controversial but will provide a reduction in maintenance. Once tree crowns are reduced in width to provide clearance, they grow back quickly to their original dimension requiring routine pruning to keep the roadway clear.)*

2) Raise crown to provide 10 feet clearance for mowers and visibility under trees.

3) Improve crown structure (also known as branch architecture) by reducing stems, branches, and leaders with an aspect ratio larger than two-thirds. Encourage growth in one dominant leader.

Branches to prune:

- 1) Remove at the trunk all branches and sprouts less than three inches in diameter that originate from the lower 10 feet of trunk. Reduce all larger branches growing from the lower 16 feet of trunk using 3 to 4 reduction cuts of approximately 2.5 to 4 inches diameter to remove 60% of foliage on each. Remove additional secondary branches from the lower crown to create 10 feet of clearance under the crown. *(Note to specifier: Adjust clearance height for the location of the tree, growth rate, species crown form, and when trees are expected to be pruned again).*
- 2) Reduce length on the four largest remaining primary branches using two 3 to 4 inch diameter reduction cuts which will remove an estimated 50-60% of the foliage from the ends of these branches.
- 3) Remove dead and broken branches greater than 2.5 inches in diameter at the point of attachment. *(Note to specifier: Adjust diameter of branches to remove based on species attributes, potential mower damage from chopping fallen dead branches, and other site conditions.)*

Limitations:

- 1) No heading or shearing cuts shall be made without authorization.
- 2) The stem retained as the dominant leader shall not be pruned.
- 3) Less than 70% of cuts on live branches shall be branch removal cuts. *(Note to specifier: Including this statement in the specification ensures that the contractor uses reduction cuts to prune the trees. Reduction cuts are necessary in order to perform this work according to this specification. Adjust this percentage according to the site, location, and form of the trees.)*
- 4) No more than 40% of the foliage shall be removed from an individual tree without authorization.
- 5) All severed branches shall be removed by the end of the workday.
- 6) Trees shall not be lion tailed. *(Note to specifier: Lion tailing is one of the biggest problems in the tree industry. It can lead to poor tree architecture causing trees to fail prematurely. Including this statement in the limitations increases the likelihood that trees will be pruned according to specifications.)*

Debris disposal: All debris will be removed from the work area and recycled as mulch or disposed of at the City green waste recycling center.

Completion date: January 20.

Re-inspection: 3 years.

Example 15 . Forest edge strip for many miles.

Trees to prune: Trees in their natural state (i.e. not planted) along rural interstate, divided highway or two-lane road.

Pruning system: Topiary/natural combination.

Purpose: Reduce likelihood of tree failure; provide clearance.

Objective: Reduce length of branches growing toward travel lanes.

Branches to prune:

- 1) Branches larger than 4 inches *(Note to specifier: Adjust this diameter for the trees in question)* diameter - measured at the pruning cut - that are growing toward the travel lane should be reduced in length using heading cuts retaining approximately a 4 to 6 foot- long branch section or stub attached to the trunk. Smaller diameter branches can be pruned, but this is not a requirement.
- 2) The height of trees more than 6 inches dbh *(Note to specifier: Adjust this diameter for the trees in question)* with the bottom 25% of trunk length leaning more than 10 degrees toward the travel lanes should be removed with a final cut at the base of the trunk or reduced in height by 25% using reduction cuts on the longest and tallest stems on the leaning side. *(Note to specifier: Adjust the degrees and percentage according to conditions.)*

Limitations: No branch removal cuts shall be used at the main stem.

Debris disposal: The brush is to be removed from the sight at the end of each week.

Re-inspection: 3 years.

Example 16. Divided highway median.

Tree location: Median in the center of the roadway.

Trees to prune: Large-maturing planted trees of various species 12- to 16-inch DBH.

Pruning system: Natural.

Purpose: Minimize current and future interference with truck and other vehicle traffic; reduce likelihood of future tree failure.

Objectives:

- 1) Provide 15 feet clearance from ground to bottom of lowest branches over roadway. *(Note to specifier: Clearance height can be adjusted to meet site requirements and tree form. Change the height in the "Branches to prune" section below to match.)*
- 2) Reduce likelihood of tree failure.

Branches to prune:

- 1) Remove all primary branches and stems – regardless of diameter or orientation- originating on the lower 10 feet of trunk. *(Note to specifier: This distance could be as low as 8 feet depending on the upward angle of the branch segments close to the trunk. The goal is to create 15 feet of clearance between ground and the lowest branch over the roadway.)* so there is only one trunk vertically to 10 feet. *(Note to specifier: Compared to removing only secondary branches from primary branches to create clearance – referred to as lion tailing - this approach reduces likelihood of branches and foliage growing back and blocking visibility in the future. Large pruning wounds on the trunk might be required on certain trees, but this is a good trade-off for these young trees.)* Remove secondary branches growing downward into the clearance zone from low primary branches.
- 2) Reduce length of the three largest diameter branches originating above 10 feet trunk height with two 3- to 3.5- inch diameter reduction cuts on each pruned branch. *(Note to specifier: Adjust the number and diameter of cuts so approximately 60% of foliage and buds are removed from each pruned branch.)*
- 3) Reduce length by 30 percent on branches with bark inclusions or cracks.

Limitations:

- 1) No heading or shearing cuts shall be made without authorization.
- 2) No more than one-half of the foliage shall be removed from an individual tree without authorization. *(Note to specifier: This number should be adjusted to accommodate the age and condition of trees and the site attributes. Adjust the number downward for trees in poor health.)*
- 3) Less than 70% of cuts on live branches shall be branch removal cuts. *(Note to specifier: Including this statement in the specification ensures that the contractor uses reduction cuts to prune the trees. Reduction cuts are necessary in order to perform the work according to this specification. Adjust the percentage according to the site, location, age, and form of the trees. The percentage should be adjusted to suit conditions.)*
- 4) Trees shall not be lion tailed. *(Note to specifier: Lion tailing is one of the biggest problems in the tree industry. It can lead to poor tree architecture causing trees to fail prematurely. Including this statement in the limitations increases the likelihood that trees will be pruned according to specifications.)*

Debris removal: All debris will be removed from the work area daily.

Completion date: Fall of this year.

Re-inspection: Trees will be re-inspected and considered for pruning 3 years after completion of the current pruning project. *(Note to specifier: choose your own number appropriate for the circumstances.)*

Example 17. Raise crown at Interstate/turnpike interchange.

Trees to prune: 78 large maturing planted (approximately 30 feet apart) native trees of various species 12 to 16-inch dbh.

Pruning system: Natural.

Purpose: Provide visibility under the tree crowns and clearance for mowers; reduce failure potential in storms

Objectives:

- 1) Provide 18 feet clearance from ground to bottom of lowest branches. *(Note to specifier: Clearance height can be adjusted to meet site requirements. Change the height in the "Branches to prune" section below to match).*
- 2) Reduce likelihood of failure in tropical storm events.

Branches to prune:

- 1) Remove all branches – regardless of diameter - originating on the lower 18 feet of trunk so there is only one stem and no branches from ground vertically to 18 feet. This approach will be dependent on branch architecture of

individual trees. On trees where more than 60% of the foliage would be removed following this specification, remove only the largest diameter branches in the lower 18 feet while retaining approximately 40% of the foliage; do not execute step #2 below.

2) Reduce length of the three largest diameter branches originating above 18 feet trunk height with two 3 inch diameter reduction cuts on each.

Limitations:

1) No more than 60% of foliage shall be removed from any tree.

2) No heading cuts shall be made.

3) Trees shall not be lion tailed. *(Note to specifier: Lion tailing is one of the biggest problems in the tree industry. It can lead to poor tree architecture causing trees to fail prematurely. Including this statement in the limitations increases the likelihood that trees will be pruned according to specifications.)*

Debris removal: All debris will be removed from the work area daily.

Completion date: Fall of this year.

Re-inspection: 3 years.

Example 18. Clearance from sidewalk, street and buildings downtown.

Trees to prune: 120 street trees 12 to 18 inches dbh on Main Street adjacent to two- and three-story buildings.

Pruning system: Natural.

Purpose: Provide clearance for pedestrians and vehicles; create strong branch architecture; prevent large branch removal later.

Objectives:

1) Provide 8 feet vertical clearance over sidewalk and 14 feet over street.

2) Provide 5 feet of horizontal clearance from buildings.

3) Improve branch architecture by developing or maintaining a dominant trunk.

Branches to prune:

1) Remove all primary branches and sprouts (including suckers from the root collar) less than 4 inches diameter originating on the lower 10 feet of trunk on the sidewalk side and 14 feet on the street side of trees *(Note to specifier: This distance could be as low as 8 feet depending on the upward angle of the branch segments close to the trunk.)* so there is only one vertical trunk to 10 feet *(Note to specifier: Compared to removing only secondary branches from primary branches to create clearance – referred to as lion tailing - this approach reduces likelihood of branches and foliage growing back and blocking visibility in the future. The 4-inch diameter pruning wounds on the trunk might be required on certain trees; this is a good trade-off for these young trees.)* Remove secondary branches growing downward into the clearance zone from other branches. On branches larger than 4 inches diameter in the lower 10 (sidewalk side) or 14 (street side) feet of the trunk, reduce the length of the downward and upward growing portions with a total of four reduction cuts and remove other branches as needed to meet clearance. *(Note to specifier: The following four sentences present an alternative method of specifying work referred to above that is more generic and applicable to a large number of tree species and sizes. Remove primary branches that are less than one-half the trunk diameter originating on the lower 10 feet (sidewalk side) or 14 feet (street side) of trunk, and reduce those that have a larger aspect ratio. This is accomplished by using 3 to 4-inch diameter (specify a number such as 4 reduction cuts) reduction cuts to a) shorten (reduce) the longest and the most upright branches and b) removing those drooping downward. About half the foliage should be removed on each reduced primary branch. Remove secondary branches growing downward into the clearance zone from other branches.*

2) Reduce length of the three largest diameter branches on the trunk originating above 10 feet (sidewalk side) or 14 feet (street side) trunk height with two 3 to 3.5-inch diameter *(Note to specifier: Number and diameter of cuts can be adjusted.)* reduction cuts on each.

3) Remove dead, dying, diseased, and broken branches one inch or larger in diameter at the point of attachment. Reduction cuts can be used in cases where the retained lateral branch has adequate foliage and no die-back.

4) Reduce all branches that grow toward the buildings using 1 to 2.5-inch diameter reduction cuts resulting in 5 feet of horizontal clearance.

5) Reduce length by 30 percent on branches with bark inclusions or cracks.

Limitations:

- 1) No heading or shearing cuts shall be made without authorization.
- 2) No more than one-fourth of the foliage shall be removed from an individual tree without authorization. *(Note to specifier: One-third of the foliage may have to be removed on trees that have not been pruned in some time or on certain trees with many low growing branches.)*
- 3) All severed branches shall be removed by the end of the workday.
- 4) Make no removal cuts on the main trunk larger than 4 inches; at least six pruning cuts shall be reduction cuts 3 to 3.5 inches diameter. *(Note to specifier: This can vary with the particular trees being pruned. Adjust as needed to meet objectives.)*
- 5) Trees shall not be lion tailed. *(Note to specifier: Lion tailing is one of the biggest problems in the tree industry. It can lead to poor tree architecture causing trees to fail prematurely. Including this statement in the limitations increases the likelihood that trees will be pruned according to specifications.)*

Completion date: June 7.

Re-inspection: 3 years.

Example 19. Residential street trees (young trees).

Trees to prune: 175 8 to 12-inch dbh oak and maples in an urban neighborhood.

Pruning system: natural.

Purpose: Clear branches from street signs (e.g. stop signs, warning signs) and traffic lights; create future clearance by directing growth into one dominant trunk.

Objectives:

- 1) Create clearance by raising the crown to 12 feet (street side) measured between street and lowest point of foliage or branches and 8 feet on sidewalk side;
- 2) Improve branch architecture by reducing growth rate of (or removing) the largest diameter low branches.

Branches to prune:

- 1) Remove an average of the largest four (range 3 to 5 per tree) primary branches (diameter measured at the trunk) on the lower 15 feet of trunk. Smaller diameter branches can remain but should be shortened or removed to meet the clearance objective *(Note to specifier: leaving small diameter branches along the lower trunk protects it from mowers, damage from people, and direct sun and may reduce sprouting. Sprouting is not bad for the tree, its simply annoying. Number of large branches can be adjusted depending on objectives and branch architecture.);* reduce the length of branches with aspect ratios greater than one-half growing from the trunk 15 feet and higher using 2 inch diameter reduction cuts.
- 2) Reduce length by 30 percent on branches with bark inclusions or cracks.

Limitations:

- 1) No heading cuts should be used.
- 2) No more than 70% of pruning cuts will be branch removal cuts. *(Note to specifier: Adjust this percentage to account for tree architecture and number of primary branches along the lower trunk. Where they are few low branches to remove, the percentage of branch removal cuts will be much less and the percentage of reduction cuts will be much higher.)*
- 3) Remove no more than 50% of foliage.
- 4) Trees shall not be lion tailed. *(Note to specifier: Lion tailing is one of the biggest problems in the tree industry. It can lead to poor tree architecture causing trees to fail prematurely. Including this statement in the limitations increases the likelihood that trees will be pruned according to specifications.)*

Completion date: June.

Re-inspection: 4 years.

Example 20. Residential street trees (medium-aged/mature trees).

Trees to prune: 175 20 to 30-inch dbh Jacaranda (*Jacaranda*) and mahogany (*Swietenia*) trees in an urban neighborhood.

Pruning system: natural.

Purpose: Clear branches from street signs (e.g. stop signs, warning signs) and traffic lights; reduce likelihood of branch and whole-tree failure.

Objectives:

- 1) Create clearance by raising the crown to 14 feet (street side) measured between street and lowest point of foliage or branches and 10 feet on sidewalk side;
- 2) Improve branch architecture by reducing growth rate of the largest diameter branches and those with defects.

Branches to prune:

- 1) Remove (removal cuts) secondary branches toward the edge of the crown and reduce primary branches (reduction cuts) with cuts 4 inches or less in diameter to create clearance under crown. *(Note to specifier: The diameter of cuts can be adjusted to meet the objective.)*
- 2) Reduce all primary branches larger than one-half the trunk diameter (diameter measured at the trunk) on the lower 25 feet of trunk using four reduction cuts 3 to 3.5 inches in diameter on each branch. Where the trunk divides into two or more stems or branches, reduce all but one located in (or nearest to) the center of the crown using four 3 to 3.5 inch diameter reduction cuts on each. Smaller diameter branches growing from the trunk can remain but should be shortened or removed to meet the clearance objective *(Note to specifier: The number of cuts and diameter of cuts can be adjusted to meet the objective of slowing their growth rate. Where there are equal sized stems, more cuts and/or larger cuts may be needed.)*
- 3) Reduce length by 30 percent on branches with bark inclusions or cracks.

Limitations:

- 1) No heading cuts should be used.
- 2) Trees shall not be lion tailed. *(Note to specifier: Lion tailing is one of the biggest problems in the tree industry. It can lead to poor tree architecture causing trees to fail prematurely. Including this statement in the limitations increases the likelihood that trees will be pruned according to specifications.)*
- 3) No more than 50% of pruning cuts will be branch removal cuts. One of the objectives is to reduce likelihood of failure and that is best accomplished using reduction cuts, not removal cuts. *(Note to specifier: Adjust this percentage to account for tree architecture and number of primary branches along the lower trunk. Where they are few low branches to remove, the percentage of branch removal cuts will be much less and the percentage of reduction cuts will be much higher.)*
- 4) Remove no more than 50% of foliage.
- 5) No removal cuts shall exceed 4 inches diameter.
- 6) Trees shall not be lion tailed. *(Note to specifier: Lion tailing is one of the biggest problems in the tree industry. It can lead to poor tree architecture causing trees to fail prematurely. Including this statement in the limitations increases the likelihood that trees will be pruned according to specifications.)*

Completion date: June.

Re-inspection: 3 years.

Example 21. Parking lot large-maturing young trees.

Trees to prune: 54 8 to 14-inch dbh shade trees in parking lot islands and buffer strips.

Pruning system: Natural.

Purpose: Clear branches from security lights, store signage, and traffic signs; create current and future clearance by directing growth into one dominant trunk.

Objectives:

- 1) Create under-clearance by removing and reducing length of branches in the lower 10 feet of the crown;
- 2) Reduce the appropriate side of the crown to provide 6 feet clearance back from security lights;
- 3) Improve branch architecture by reducing growth rate of (or removing) the largest diameter low branches and directing future growth away from security lights.
- 4) Remove dead branches.

Branches to prune:

- 1) Remove the largest two (range 1 to 3 per tree) primary branches (diameter measured at the trunk) on the lower 10 feet of trunk. *(Note to specifier: An alternative is to reduce these two largest low branches 75% with a reduction cut or two, and plan on removing them next time. This approach results in a smaller void in the crown.)* Smaller diameter branches can remain but can be shortened to meet the clearance objective *(Note to specifier: Leaving small diameter branches along the lower trunk protects it from mowers, damage from people, and direct sun and may reduce sprouting. Sprouting is not bad for the tree, it's simply annoying. Number of large branches can be adjusted depending on objectives and branch architecture.)*
- 2) Reduce branches growing toward security lights using reduction cuts to meet clearance objective.
- 3) Reduce the length of branches with aspect ratios greater than one-half growing from the trunk 10 feet and higher using two 2-inch diameter reduction cuts on each. *(Note to specifier: Adjust number of cuts according to tree size and aspect ratio with more and/or larger cuts on larger trees and larger aspect ratios.)*
- 4) Remove dead branches 1 inch and larger.
- 5) Reduce length by 30 percent on branches with bark inclusions or cracks.

Limitations:

- 1) No heading cuts should be used.
- 2) No more than 20% of pruning cuts on live branches will be branch removal cuts. *(Note to specifier: Adjust this percentage to account for tree architecture and number of primary branches along the lower trunk. Where there are few low branches to remove, the percentage of branch removal cuts will be less and the percentage of reduction cuts will be much higher.)*
- 3) Remove no more than 50% of foliage. If more than 50% will be removed, perform work in "Branches to prune" section in order; i.e., perform #1 first, then 2, then 3 until about 50% is reached.
- 4) Trees shall not be lion tailed. *(Note to specifier: Lion tailing is one of the biggest problems in the tree industry. It can lead to poor tree architecture causing trees to fail prematurely. Including this statement in the limitations increases the likelihood that trees will be pruned according to specifications.)*

Completion date: January.

Re-inspection: 4 years.

Example 22. Parking lot large-maturing medium-aged trees.

Trees to prune: 17 15 inch and larger dbh shade trees in parking lot islands and buffer strips.

Pruning system: Natural.

Purpose: Clear branches from security lights, store signage, and traffic signs; create current and future clearance by directing growth into one dominant trunk.

Objectives:

- 1) Create under-clearance by removing and reducing length of branches in the lower 10 feet of the crown;
- 2) Reduce the appropriate side of the crown to provide 6 feet clearance back from security lights and direct future growth in the other direction;
- 3) Improve branch architecture by reducing growth rate of (or removing) the largest diameter low branches and directing future growth away from security lights.
- 4) Reduce branches with defects.
- 5) Remove dead branches.

Branches to prune:

- 1) Remove the largest primary branch (diameter measured at the trunk) on the lower 10 feet of trunk. *(Note to specifier: An alternative is to reduce this low branch 60 to 75% with a reduction cut or two allowing some view under the tree. This approach results in a smaller void in the crown and no pruning wound on the trunk.)* Smaller diameter branches can remain but can be shortened to meet the clearance objective *(Note to specifier: Leaving small diameter branches along the lower trunk protects it from mowers, damage from people, and direct sun and may reduce sprouting. Sprouting is not bad for the tree, it's simply annoying. Number of large branches can be adjusted depending on objectives and branch architecture.)*

- 2) Reduce branches growing toward security lights using reduction cuts to meet clearance objective.
- 3) Reduce the length of branches with aspect ratios greater than one-half growing from the trunk 10 feet and higher using three to five 2 to 3 inch diameter reduction cuts on each. *(Note to specifier: Adjust number and size of cuts according to tree size and aspect ratio with more and/or larger cuts on larger trees and larger aspect ratios.)*
- 4) Remove dead branches 1 inch and larger.
- 5) Reduce length by 30 percent on branches with bark inclusions or cracks.

Limitations:

- 1) No heading cuts should be used.
- 2) No more than 20% of pruning cuts on live branches will be branch removal cuts. *(Note to specifier: Adjust this percentage to account for tree architecture and number of primary branches along the lower trunk. Where there are few low branches to remove, the percentage of branch removal cuts will be less and the percentage of reduction cuts will be much higher.)*
- 3) Remove no more than 50% of foliage. If more than 50% will be removed, perform work in "Branches to prune" section in order; i.e., perform #1 first, then 2, then 3 until about 50% is reached.
- 4) Trees shall not be lion tailed. *(Note to specifier: Lion tailing is one of the biggest problems in the tree industry. It can lead to poor tree architecture causing trees to fail prematurely. Including this statement in the limitations increases the likelihood that trees will be pruned according to specifications.)*

Completion date: February 24.

Re-inspection: 4 years.

Example 23. Parking lot small-maturing trees.

Trees to prune: Tree-form yaupon holly, ligustrum, crapemyrtle, lilac and others in parking lot islands and buffer strips.

Pruning system: Natural.

Purpose: Clear branches for under-crown visibility, mower operation, and access to vehicles.

Objectives:

- 1) Create clearance under the crown by removing and reducing length of branches in the lower 8 feet of the crown; multiple stems will be clearly visible following pruning. *(Note to specifier: Adjust the distance to account for tree size.)*
- 2) Remove dead branches.

Branches to prune:

- 1) Remove and reduce live branches in the lower 8 feet of the tree removing approximately 30% of foliage.
- 2) Remove dead branches 1/2 inch and larger.

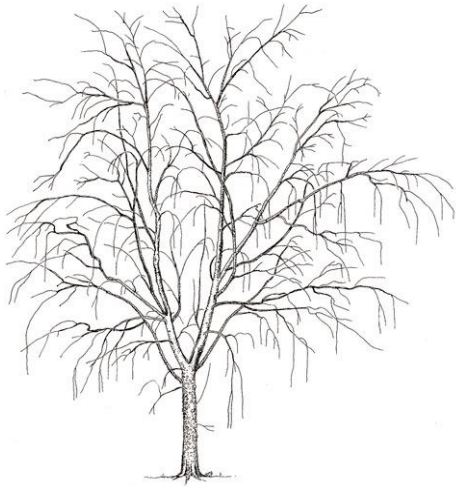
Limitations:

- 1) No heading cuts should be used.
- 2) Remove no more than 35% of foliage.

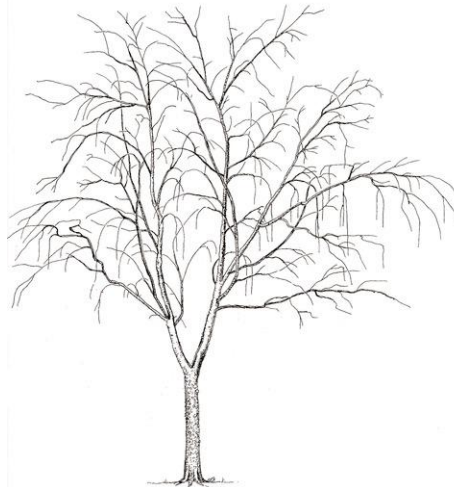
Completion date: March 12.

Re-inspection: 2 years.

Example 23 detail:



Before pruning: Lower branches are blocking sight lines to signs.



After pruning: Lower branches are removed using branch removal cuts to create the desired clearance.

Example Specifications: Office Building/Residential Trees

Example 24. Specification for a single tree with an upright crown form.

Tree to prune: Large oak (*Quercus*) in the front yard.

Pruning system: Natural.

Objective: Reduce the risk of live and dead branch failure.

Branches to prune:

- 1) Remove dead, dying, and broken branches greater than 1 inch in diameter at the point of attachment to a healthy branch.
- 2) Reduce the branch on the north side (~8-inch diameter) with a crack and dead twigs using a 3-inch reduction cut.
- 3) Reduce the five largest upright-growing branches using two 2.5- to 3-inch diameter reduction cuts on each branch for total of ten reduction cuts.

Limitations:

- 1) No heading cuts should be used.
- 2) Remove no more than 35% of foliage.

Completion date: Early spring of this year.

Re-inspection: 2 years

Example 25. Single conifer tree residential.

Trees to prune: Two pines (*Pinus spp.*) in the northeast corner of the property.

Pruning System: Natural

Objective: Maintain their natural form by reducing and raising the outer crown to provide clearance for construction of the proposed building.

Branches to prune: Reduce branches on the north side of the tree by 8 to 10 feet and reduce lower branches on the west side to a height of 35 feet.

Limitations: No branch removal cuts at the main stem shall be used on live branches. No reduction cuts shall be made greater than 4 inches in diameter without approval from the project arborist. Do not reduce tree height.

Debris disposal: The brush is to be chipped and left on site under the trees for mulch.

Completion date: Within the next two weeks to comply with the nesting bird study recommendations.

Re-inspection: 2 years.

Example 26. Small grouping of trees.

Trees to prune:

One Sycamore (*Platanus occidentalis*)

Three Baldcypress (*Taxodium distichum*)

Two Live oaks (*Quercus virginiana*)

Diameter:

18-inch

18 to 24-inch

16 to 18-inch

Location:

rear of house

right rear of yard

rear yard

Pruning system: Natural.

Objectives:

- 1) Reduce likelihood of failure in wind events.
- 2) Provide 6 to 8 feet of clearance from house.
- 3) Raise crown of baldcypress to 9 feet to allow a view of the pond

Branches to prune:

- 1) Remove dead branches, greater than 2 inches in diameter, extending over yard.
- 2) On live oak, reduce one 10-inch diameter live branch over house by 10 to 12 feet using three 3 inch diameter reduction cuts. (*Note to specifier: Change the number and diameter of cuts to meet objectives*)
- 3) Reduce branches with aspect ratio larger than half using 2 reduction cuts 3 inches diameter on each branch.

Limitations: No heading cuts shall be made.

Debris removal: All debris will be removed from the work area.

Completion date: Fall of this year.

Re-inspection: 2 years.

Example 27. Residential shrubs and hedge.

Shrubs to prune: Five Japanese privet (*Ligustrum japonica*) in front of house.

Pruning system: Topiary. (*Note to specifier: Specify shape where applicable*)

Objective: Reduce height and width of the plant 20% while maintaining shape. (*Note to specifier: Change the percentage to meet size objectives*)

Branches to remove: Dead, dying, diseased, and broken branches.

Shear: New growth that is outside the desired shape of the crown. Do not cut to expose interior branches that do not have live leaves.

Debris disposal: Remove all debris.

Completion Date: Spring of this year.

Re-inspection: 3 months.

Example 28. Reduction on two mature trees.

Tree to prune: Large poplar (*Populus*) and sweetgum (*Liquidambar*) in the lawn.

Pruning system: Natural.

Purpose: Reduce likelihood of the 90 feet tall tree, live branches, and dead branches from striking three adjacent homes in storms.

Objective:

- 1) Reduce height of the tree 10 to 15 feet.
- 2) Remove dead branches.

Branches to prune:

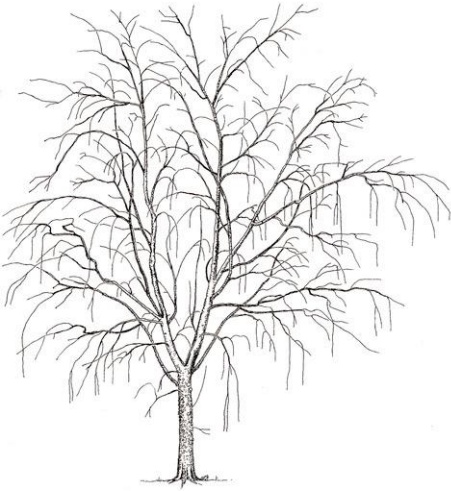
- 1) The five largest aspect ratio primary branches and stems shall receive three 2.5 to 3.5-inch reduction cuts each, for a total of 15 reduction cuts. Heading cuts not to exceed 3.5 inches diameter may be used where reduction cuts are not practical because there are no nearby lateral branches. (*Note to specifier: Choose the pruning cut number and diameter appropriate for the situation.*)
- 2) Remove dead branches 1 inch and larger back to live branches.

Limitations: No heading cuts shall be used except on a branch or two where the reduction cut would exceed 3.5 inches diameter.

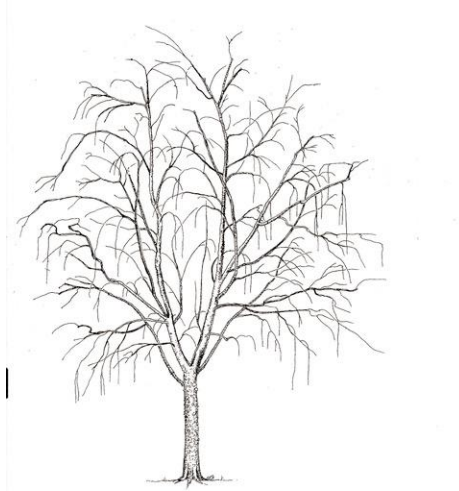
Completion date: Late spring of this year.

Re-inspection: 2 years. *(Note to specifier: When crown reduction is specified, consideration should be given to maintaining the crown in a reduced state in perpetuity.)*

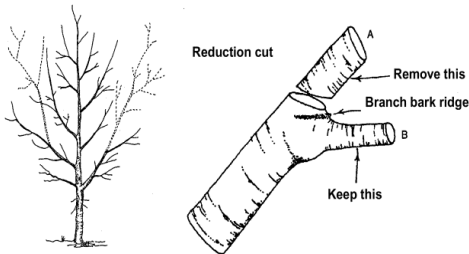
Example 28 detail:



Before pruning (above): Tree crown is larger than desired.



After pruning (above): Reduce size of the crown using fifteen 2.5 to 3.5-inch diameter reduction cuts.



Reduction cut (left): Reduction cut removes the larger of components at a union retaining the smaller.

Example 29. Reduce section of crown.

Tree to prune: Trumpet tree (*Tabebuia*) in the side yard ten feet from the building.

Purpose: Clear tree branches from the building.

Pruning system: Natural.

Objective: Reduce crown by approximately 8 feet on the building side to create 4 to 6 feet horizontal clearance.

Branches to prune: Reduce the two largest branches growing toward the building using two or three 2.5 to 3 inch diameter reduction cuts, for a total of 4 to 6 reduction cuts. One or two heading cuts can be substituted where a reduction cut is not practical such as in cases where a suitable lateral branch is absent.

Limitations: Heading cuts, if needed, may not exceed 3.5 inches diameter.

Completion date: Spring of this year.

Re-inspection: 2 years.

Example 30. Reduce crown density on small-maturing trees.

Tree to prune: Japanese maple with 7-inch diameter trunk in front yard.

Pruning system: Natural.

Objective: Reduce crown density to allow more sunlight to reach under the crown to stimulate turfgrass growth. *(Note to specifier: One of the best methods of crown thinning is structural pruning. This approach accomplishes the stated objective in addition to reducing the likelihood of branch breakage. Structural pruning makes reduction cuts on the ends of the longest – and typically largest diameter – primary branches. Reduction and removal cuts can be used in combination to thin the edge of the crown).*

Branches to prune:

- 1) Shorten the largest six primary branches using 3 to 4 reduction cuts 1/4 to 3/4 inch diameter cuts on each.
- 2) Remove 20 to 30 branches about 1/4 to 1/2 inch diameter from the edge of the crown to thin and visually balance the tree to achieve a uniform but not smooth crown outline. *(Note to specifier: Use your own number and diameter of pruning cuts as appropriate for the situation.)*
- 3) Reduce (preferred) or remove branches that touch other branches that are in more desirable positions.
- 4) Remove dead branches 1/4 inch and larger.

Limitations:

- 1) No pruning cuts on live branches should be made within 3 feet of the trunk. *(Note to specifier: Use your own distance as appropriate for the situation.)*
- 2) No heading cuts shall be used on live branches.

Completion date: Spring of this year.

Re-inspection: 2 years.

Example 31. Reduce crown density on large mature trees.

Trees to prune: 18 mature maples along Happy Park Entrance Road.

Pruning system: Natural.

Purpose: Encourage turfgrass growth under the tree crown by increasing light penetration to the ground.

Objectives:

- 1) Reduce crown density to allow more sunlight to reach under the crown. *(Note to specifier: One of the best methods to reduce crown density is structural pruning. Structural pruning makes reduction cuts on the ends of the longest – and typically largest diameter - branches. Both reduction and removal cuts can be used to thin the crown).*
- 2) Create a uniform (but not smooth) crown outline
- 3) Remove dead branches greater than 1-inch diameter where they occur

Branches to prune at the periphery (outer surface) of the crown:

On each tree, 35 reduction cuts and 25 branch removal cuts should be made on the largest diameter and longest primary branches and dense branch clusters in the crown. Pruning cuts shall be 1 to 1.5 inches diameter. *(Note to specifier: substitute the appropriate pruning cut number and diameter for the situation.)*

Limitation: No live branches shall be removed from the trunk.

Completion date: Spring of this year.

Re-inspection: 5 years.

EXAMPLE SPECIFICATIONS: general

Example 32. Raising the crown on a young large-maturing tree.

Location: Back yard by swing

Tree to prune: 10-inch DBH linden.

Pruning system: Natural.

Purpose: Raise the bottom of the entire crown to provide 8-foot clearance under the tree and reduce likelihood of tree and branch failure.

Objectives:

- 1) Provide 8 feet clearance from ground to bottom of lowest branches. *(Note to specifier: Clearance height can be adjusted to meet site requirements and tree form. Change the height in the “Branches to prune” section below to match.)*

2) Improve branch architecture. *(Note to specifier: Although the customer may not have requested this service, this objective can be added – with their authorization - to provide more value.)*

3) Remove dead branches.

Branches to prune:

1) Remove all primary branches – regardless of diameter or orientation- originating on the lower 8 feet of trunk so there is only one trunk vertically to 8 feet *(Note to specifier: Compared to removing only secondary branches from primary branches to create clearance – referred to as lion tailing - this approach of removing branches from the trunk or reducing them reduces likelihood of branches and foliage growing back and blocking visibility in the future. Large pruning wounds on the trunk might be required on certain trees, but this is a good trade-off for these young trees. If not removed now, these low branches would continue growing and will require even larger pruning cuts to remove from the trunk later.)* Remove secondary branches growing downward into the clearance zone from low primary branches.

Alternatively: On individuals where more than 50% of the foliage on the tree *(Note to specifier: This percentage can be adjusted downward.)* would be removed following this specification, adjust the procedure to only remove those primary branches that are less than one-half the trunk diameter originating on the lower 8 feet of trunk, and reduce those that have a larger aspect ratio. *(Note to specifier: Estimating the percentage of foliage removed is difficult and people often do not agree. This is a judgement call by the specifier and the contractor. Because all parties may not agree on the percentage of foliage remaining on the tree after pruning, the specifier and contractor should come to agreement prior to beginning the work. While this approach minimizes trunk decay from larger pruning cuts on the trunk, reduced branches are likely to sprout resulting in the need for clearance again in the near future depending on location of the cuts.)* Reducing the largest aspect ratio branches is accomplished by using 2 to 2.5 inch diameter reduction cuts to a) shorten (reduce) the longest and the most upright portion of the branches and b) removing lateral branches drooping downward. About half the foliage should be removed on each reduced primary branch; do not execute step #2 below. *(Note to specifier: Specify the number of cuts to perform per branch such as 3 to 4.)*

2) Remove dead branches greater than 1 inch diameter. *(Note to specifier: Specify diameter appropriate for the situation..)*

One or both of the next two strategies can be performed where less than about 35 percent of foliage was removed in #1 above.

3) Reduce length of the three largest diameter branches on the trunk originating above 8 feet trunk height with two 2 to 2.5 inch diameter *(Note to specifier: Number and diameter of cuts can be adjusted.)* reduction cuts on each.

4) Reduce length by 30 percent on branches with bark inclusions or cracks.

Limitations:

1) No heading or shearing cuts shall be made without authorization.

2) No more than one-half of the foliage shall be removed from an individual tree without authorization. *(Note to specifier: This number should be adjusted to accommodate the age and condition of trees and the site attributes. Adjust the number downward for older trees in poor health.)*

3) Less than 80% of cuts on live branches shall be branch removal cuts. *(Note to specifier: Including this statement in the specification ensures that the contractor uses reduction cuts to prune the trees. Reduction cuts are necessary in order to perform the work according to this specification. Adjust the percentage according to the site, location, age, and form of the trees. The percentage should be adjusted to suit conditions.)*

4) Make no removal cuts on the trunk larger than 5 inches diameter *(Note to specifier: This number should be adjusted to accommodate the age and condition of trees and the site attributes. Adjust the number downward for older trees in poor health.)*

5) Trees shall not be lion tailed. *(Note to specifier: Lion tailing is one of the most common sub-standard pruning practices in the tree industry. It can lead to poor tree architecture causing trees to fail prematurely. Including this statement in the limitations increases the likelihood that trees will be pruned according to specifications.)*

Debris removal: All debris will be removed from the work area daily.

Completion date: Fall of this year.

Re-inspection: Trees will be re-inspected and considered for pruning 3 years after completion of the current pruning project (*Note to specifier: choose your own number appropriate for the circumstances.*).

Example 33. Raising the crown on a medium-aged large-maturing tree.

Location: Front of property near driveway and street

Tree to prune: 20 inch DBH large-maturing shade tree.

Pruning system: Natural.

Purpose: Raise the bottom of the entire crown to provide 12 foot view clearance under the tree and reduce likelihood of tree and branch failure.

Objectives:

- 1) Provide 12 feet clearance from ground to bottom of lowest branches. (*Note to specifier: Clearance height can be adjusted to meet site requirements and tree form. Change the height in the "Branches to prune" section below to match.*)
- 2) Improve branch architecture. (*Note to specifier: Although the customer may not have requested this service, this objective can be added – with their authorization - to provide more value.*)
- 3) Remove dead branches.

Branches to prune:

- 1) Remove all primary branches – regardless of diameter or orientation- originating on the lower 12 feet of trunk so there is only one trunk vertically to 12 feet (*Note to specifier: Compared to removing only secondary branches from primary branches to create clearance – referred to as lion tailing - this approach of removing branches from the trunk or reducing them reduces likelihood of branches and foliage growing back and blocking visibility in the future. Large pruning wounds on the trunk might be required on certain trees, but this is a good trade-off for these medium-aged trees. If not removed now, these low branches would continue growing and will require even larger pruning cuts to remove from the trunk later.*) Remove secondary branches growing downward into the clearance zone from low primary branches.

Alternatively: On individuals where one or more removal cuts on the trunk would be 5 inches and larger, (*Note to specifier: This diameter can be adjusted according to conditions.*), adjust the procedure to only remove those primary branches that are less than 5 inches on the lower 12 feet of trunk, and reduce those that are larger. (*Note to specifier: While this approach minimizes trunk decay from larger pruning cuts on the trunk, reduced branches are likely to sprout resulting in the need for clearance again in the near future depending on location of the cuts.*)

Reducing the larger branches is accomplished by a) making 3 inch diameter (*Note to specifier: Specify diameter appropriate for the situation.*) reduction cuts to shorten (reduce) the longest and the most upright portion of the branches and b) removing lateral branches drooping downward. About half the foliage should be removed on each reduced primary branch. (*Note to specifier: Specify the number and type of cuts to perform per branch such as 3 to 4 reduction cuts and 4 to 5 removal cuts.*)

- 2) Remove dead branches greater than 1 inch diameter. (*Note to specifier: Specify diameter appropriate for the situation.*)

One or both of the next two strategies can be performed where less than about 35 percent of foliage was removed in #1 above.

- 3) Reduce length of the three largest diameter branches on the trunk originating above 12 feet trunk height with three 2.5 to 3.5 inch diameter (*Note to specifier: Number and diameter of cuts can be adjusted.*) reduction cuts on each.

- 4) Reduce length by 30 percent on branches with bark inclusions or cracks.

Limitations:

- 1) No heading or shearing cuts shall be made without authorization.

2) No more than 35 percent of the foliage shall be removed from an individual tree without authorization. *(Note to specifier: This number should be adjusted to accommodate the age and condition of trees and the site attributes. Adjust the number downward for older trees in poor health.)*

3) Less than 80% of cuts on live branches shall be branch removal cuts. *(Note to specifier: Including this statement in the specification ensures that the contractor uses reduction cuts to prune the trees. Reduction cuts are necessary in order to perform the work according to this specification. Adjust the percentage according to the site, location, age, and form of the trees. The percentage should be adjusted to suit conditions.)*

4) Make no removal cuts on the trunk larger than 7 inches diameter *(Note to specifier: This diameter should be adjusted to accommodate the age and condition of trees and the site attributes. Adjust the number downward – reducing branches instead of removing them - for older trees in poor health.)*

5) Trees shall not be lion tailed. *(Note to specifier: Lion tailing is one of the most common sub-standard pruning practices in the tree industry. It can lead to poor tree architecture causing trees to fail prematurely. Including this statement in the limitations increases the likelihood that trees will be pruned according to specifications.)*

Debris removal: All debris will be removed from the work area daily.

Completion date: Fall of this year.

Re-inspection: Trees will be re-inspected and considered for pruning 3 years after completion of the current pruning project. *(Note to specifier: choose your own number appropriate for the circumstances.)*

Example 34. Raising the crown on a large mature tree.

Location: Front of property near driveway and street

Tree to prune: 32 inch DBH large mature shade tree.

Pruning system: Natural.

Purpose: Raise the bottom of the entire crown to provide 14 foot view clearance under the tree and reduce likelihood of tree and branch failure. *(Note to specifier: Clearance height can be adjusted to meet the objectives of the site.)*

Objectives:

1) Provide 14 feet clearance from ground to bottom of lowest branches. *(Note to specifier: Clearance height can be adjusted to meet site requirements and tree form. Change the height in the “Branches to prune” section below to match.)*

2) Improve branch architecture. *(Note to specifier: Although the customer may not have requested this service, this objective can be added – with their authorization - to provide more value.)*

3) Remove dead branches.

Branches to prune:

1) Remove all primary branches originating on the lower 14 feet of trunk so there is only one trunk vertically to 14 feet *(Note to specifier: Compared to removing only secondary branches from primary branches to create clearance – referred to as lion tailing - this approach of removing branches from the trunk or reducing them reduces likelihood of branches and foliage growing back and blocking visibility in the future. Large pruning wounds on the trunk might be required on certain trees, but this is a good trade-off for these medium-aged trees. If not removed now, these low branches would continue growing and will require even larger pruning cuts to remove from the trunk later.)*

Remove secondary branches growing downward into the clearance zone from low primary branches.

Alternatively: On individuals where one or more removal cuts on the trunk would be 7 inches and larger, *(Note to specifier: This diameter can be adjusted according to conditions.)*, adjust the procedure to only remove those primary branches that are less than 7 inches on the lower 14 feet of trunk, and reduce those that are larger. *(Note to specifier: While this approach minimizes trunk decay from larger pruning cuts on the trunk, reduced branches are likely to sprout resulting in the need for clearance again in the near future depending on location of the cuts.)*

Reducing the larger branches is accomplished by a) making 3 to 4 inch diameter *(Note to specifier: Specify diameter appropriate for the situation.)* reduction cuts to shorten (reduce) the longest portion of the branches and b) removing lateral branches drooping downward. About half the foliage should be removed on each reduced

primary branch. *(Note to specifier: Specify the number and type of cuts to perform per branch such as 3 to 4 reduction cuts and 4 to 5 removal cuts.)*

2) Remove dead branches greater than 1 inch diameter. *(Note to specifier: Specify diameter appropriate for the situation.)*

One or both of the next two strategies can be performed where less than about 15 percent of foliage was removed in #1 above. *(Note to specifier: Specify percentage appropriate for the situation.)*

3) Reduce length of the three largest diameter branches on the trunk originating above 14 feet trunk height with three 2.5 to 3.5 inch diameter *(Note to specifier: Number and diameter of cuts can be adjusted.)* reduction cuts on each.

4) Reduce length by 30 percent on branches with bark inclusions or cracks.

Limitations:

1) No heading or shearing cuts shall be made without authorization.

2) No more than 15 percent of the foliage shall be removed from an individual tree without authorization. *(Note to specifier: This number should be adjusted to accommodate the age and condition of trees and the site attributes. Adjust the number downward for older trees in poor health.)*

3) Less than 80% of cuts on live branches shall be branch removal cuts. *(Note to specifier: Including this statement in the specification ensures that the contractor uses reduction cuts to prune the trees. Reduction cuts are necessary in order to perform the work according to this specification. Adjust the percentage according to the site, location, age, and form of the trees. The percentage should be adjusted to suit conditions.)*

4) Make no removal cuts on the trunk larger than 7 inches diameter *(Note to specifier: This diameter should be adjusted to accommodate the age and condition of trees and the site attributes. Adjust the number downward – reducing branches instead of removing them - for older trees in poor health.)*

5) Trees shall not be lion tailed. *(Note to specifier: Lion tailing is one of the most common sub-standard pruning practices in the tree industry. It can lead to poor tree architecture causing trees to fail prematurely. Including this statement in the limitations increases the likelihood that trees will be pruned according to specifications.)*

Debris removal: All debris will be removed from the work area daily.

Completion date: Fall of this year.

Re-inspection: Trees will be re-inspected and considered for pruning 3 years after completion of the current pruning project *(Note to specifier: choose your own number appropriate for the circumstances.)*

A Plan for Training Planted Shade Trees

Establish a pruning cycle and objectives. Pruning cycle depends on quality of nursery stock, growth rate, climate, and species. A pruning cycle is proposed below. Objectives typically encompass training trees into a strong branch architecture that is also compatible with the long-term uses of the site. Decide on strategies to meet objectives.

Although it is best to begin the proposed program at planting, you may enter at any time.

25 year overview:

1) Establish and maintain a dominant leader by subordinating all but one codominant stem.

2) Space the largest primary branches apart by removing or shortening nearby branches.

3) Anticipate future form and function by training and pruning early to avoid cutting large branches later; removing large branches can initiate decay in the trunk (i.e., instead of allowing a low branch to get large then removing it when it droops, anticipate this by shortening it earlier).

4) Position the lowest main permanent limb high enough so it will not droop and have to be removed later. The lowest permanent branch should typically be positioned no lower than about 15 feet from the ground.

5) Encourage branches to remain less than half the trunk diameter by reducing their length.

Strategies at planting

- If branch architecture is perfect with one dominant leader, do not prune.
- All branches will eventually be removed on trees that are less than 4 inches caliper.
- Do not remove more than about 35 percent of live foliage.
- Shorten or remove leaders and branches competing with the main leader.
- If there is no dominant leader, create one by cutting back all stems and branches with aspect ratio larger than 1/2 except one that will become the leader.

Strategies two or three years after planting

- All branches will eventually be removed on trees less than 4 inches caliper.
- Do not remove more than 35 percent of live foliage.
- Shorten or remove all stems and branches with aspect ratio greater than ½.
- Shorten or remove large, low branches to improve clearance.

Strategies five years after planting

- Most branches are still temporary and will eventually be removed from the tree so keep them small by reducing their length.
- Do not remove more than 35 percent of live foliage.
- Shorten or remove all stems and branches with aspect ratio greater than ½.
- Shorten or remove large, low branches to improve clearance.
- Shorten aggressive branches growing from the bottom half of the canopy that have reached into the top third of the tree.
- There should be only one large branch per node (no clustered branches); shorten those nearby so only one is present.

Strategies ten years after planting

- Shorten or remove all stems and branches with aspect ratio greater than ½.
- Do not remove more than 25 to 35 percent of foliage.
- Determine the best position of the lowest permanent branch and shorten all aggressive branches lower than this limb.
- Shorten branches - by half - within 12 to 18 inches of largest diameter branches (there should be only one large branch per node (no clustered branches)).
- Shorten aggressive branches growing from the bottom half of the canopy that have reached into the top third of the tree.
- Shorten low branches that will have to be removed later.

Strategies fifteen years after planting

- Shorten or remove all stems and branches with aspect ratio greater than ½.
- Identify several permanent branches spaced several feet apart and shorten nearby (within 18 to 36 inches) competing aggressive branches.
- There should be only one large branch per node (no clustered branches).
- Shorten or remove large branches lower (on the trunk) than the first permanent branches.
- Shorten aggressive branches growing from the bottom half of the crown that have reached into the top third of the tree.

Strategies twenty years after planting

- Shorten or remove all stems and branches with aspect ratio greater than ½.
- Identify five to ten permanent scaffold limbs and shorten others that compete.
- Shorten or remove large branches lower (on the trunk) than the first permanent branch.

- Shorten aggressive branches growing from the bottom half of the canopy that have reached into the top third of the tree.
- Shorten low branches that will have to be removed later.

Strategies twenty-five years after planting

- Shorten or remove all stems and branches with aspect ratio greater than ½.
- Continue to space apart permanent branches.
- Shorten branches within 36 inches of permanent branches.
- Shorten or remove large branches lower (on the trunk) than the first permanent branch.
- Shorten aggressive branches growing from the bottom half of the crown that have reached into the top third of the tree.
- Shorten low branches that will have to be removed later.

With seven prunings in the first twenty-five years after planting, a strong branch architecture develops that can place the tree on the path to becoming a permanent fixture in the landscape. Less-frequent pruning may be needed if good-quality nursery trees were planted with a dominant leader, and trees were irrigated appropriately until established.

List of Details (illustrations) for Inclusion in Pruning Specifications

Chose one or more details listed below to help illustrate specifications.	
Name of illustration	MS Word illustration file name
Branch removal cut	Removal
Branch removal with inclusion	Removalinclusion
Branch removal dead	Removaldead
Reduction cut	Reduction
Double reduction cut	Doublereduction
Heading cut	Heading
Crown raise young tree	Crownraiseyoung
Crown raise and structural 1	Crownraisestructural1
Crown raise and structural 2	Crownraisestructural2
Crown raise and structural 3	Crownraisestructural3
Crown raise mature tree	Maturecrownraise
Structural pruning young	Structuralyoung1
Structural pruning upright branches	Structuralupright
Structural pruning spreading branches	Structuralspreading
Structural pruning mature tree	Maturecrownstructural
Structural pruning process mature tree	Maturestructuralprocess
Reduce crown size	Reducesize
Reduce crown size detail	Reducesizedetail
Reduce crown density	Maturereducedensity
Raise and structural pruning	Matureraiseandstructural
Pruning at planting	Pruneplanting

Available at: <https://www.dropbox.com/sh/73gt6ec42gdij7/AAB08VBHSjLhRR-Z24yRyt1ja?dl=0>

Suggested Readings

Suggested publications essential to preparing pruning specifications available from the International Society of Arboriculture, Atlanta, GA.

American National Standards Institute. 2017 (latest edition as of this writing). American National Standard for Tree Care Operations—Tree, Shrub, and Other Woody Plant Maintenance—Standards practices. ANSI A300 Part 1, Pruning. New York: American National Standards Institute.

American National Standards Institute. 2017 (latest edition as of this writing). American National Standard for Arboricultural Operations - Safety requirements. ANSI Z133-2017. New York: American National Standards Institute.

Gilman, E.F., B. Kempf, N. Matheny, and J. Clarke. 2013. Structural Pruning: A Guide for the Green Industry. Urban Tree Foundation, Visalia California, 84 pgs.

Gilman, E.F. 2012. An Illustrated Guide to Pruning. 3rd ed. Albany, NY: Delmar Cengage Learning, 476 pgs.

Lilly, S., E.F. Gilman, and T. Smiley. 2019. International Society of Arboriculture Best Management Practices, Pruning. 3rd ed. Atlanta Georgia: International Society of Arboriculture.