

Before, During and After the Bulldozers – Sustaining Trees**By Kay J. Greeley, PE, ASLA, ISA**

The following is a presentation that was given at the recent California Urban Forest Council Conference in San Rafael: Threats to the Urban Forest.

During this presentation, I plan to outline some procedures that should be considered on every development project where existing trees are to be preserved. All of these procedures should be documented in what I am going to refer to as a Tree Preservation Plan.

As you just saw, the title of this talk is “Before, During and After the Bulldozers – Sustaining Trees.” That provides you with my first bit of information, which is: preservation of trees during construction spreads all the way from first project conception until long after the construction is complete. There are also steps to be considered and taken at every phase in-between. Leaving out or omitting any of these steps or activities can make the difference between preservation of mature trees and the creation of firewood.

A Tree Preservation Plan is basically documentation of all of the tree preservation measures to be followed for a particular project. In my experience, such plans are usually initiated in one of two ways:

First, a Tree Preservation Plan may be required by ordinance. I talked about actual tree preservation ordinances earlier in my first talk. Some agencies do not have specific ordinances relating to tree preservation. In these cases, a requirement to save mature trees might be somewhat hidden in another part of that agency’s development code. Often, it is a one-sentence statement to the effect of “All mature trees shall be retained where possible.” Some may have another statement to the effect of “A Tree Preservation Plan, or Tree Inventory, shall be submitted prior to issuance of the grading permit.” In other cases, agencies may generally impose this requirement through policy and then specifically impose the requirement on a project through the conditions of approval.

My concern with such policy statements and conditions is that the plan is often prepared half-heartedly, probably by the project landscape architect as opposed to an arborist, submitted, put into the project file, and never seen again. What I am saying is that if there is no requirement to

follow the plan, it is simply a waste of our time and the developer's money. A commitment to implementation of the plan is key.

On the flip side is the savvy owner that is committed to preservation of the mature trees on a property. This is the best situation, as the contractors can be informed beforehand of the job requirements.

As I mentioned at the beginning, the timeline for sustaining trees during a construction project should start before the initial site plan is complete. In total, there are five stages that should be considered. I will go through these five stages and then I will proceed to discuss the specific activities that occur at each phase in greater detail

The first task occurs before any site work. This is the pre-construction inventory. The arborist should get on the site and document the trees either before or at the same time as the surveyors perform the initial site survey. A very important benefit of this is insurance that all of the appropriate tree resources are located accurately on the future site plans.

The second task occurs during site planning. The project arborist needs to be very involved during the conceptual site layout, which usually involves working closely with the project architect and civil engineer. Otherwise, a design will not properly consider tree preservation issues. Over and over again, I see development plans that assume it is acceptable to change the grade all around the trunk of a tree, as long as the grade right at the trunk is preserved.

The third task occurs during construction and can be termed construction monitoring. This is the time when site development activities are proceeding around the trees. The arborist should be on-site and on-call as needed throughout this phase to insure that appropriate preservation measures are followed by the construction crew, as well as to monitor the health of the trees. Changes happen very quickly when large earth-moving equipment is on site and trees will not be protected without some time of monitoring.

The fourth task is any immediate post-construction maintenance that may need to be followed, such as fertilization, corrective pruning and additional watering.

The fifth and final task is the regular ongoing maintenance of the trees once they have stabilized from the construction project.

There are a series of tasks associated with each of the five time phases associated with a complete Tree Preservation Plan. They include the tree inventory that I already mentioned, development of design parameters for site planning, development and implementation of appropriate pre-construction preservation measures. In addition, the activities include the development of specific construction techniques and procedures, development of anticipated post-construction maintenance programs and finally, a how-to for ongoing maintenance procedures. I will now walk through the specifics of each of these components.

The tree inventory, sometimes called a Tree Report, documents information collected at the pre-construction inspection. For the most part, the information collected is not really a function of the proposed development. It is simply a recordation and evaluation of what is present on the development site. It is as important as the survey of the topography and any existing features on the site.

Every significant tree on the site, which is determined either by ordinance, policy and/or the project owner, should be tagged for reference over the remainder of the project. There are many types of tags available in the forestry catalogs. I prefer to use round aluminum tags that I stamp with the tag number using a metal punch, because they are very durable. I generally nail the tags to the north side of the tree with a galvanized roofing nail, about four feet up from the ground. This makes it easy for others to find the tags, especially in brushy conditions. The surveyor's will coordinate their data with your tag number insuring that all the right trees are including and creating consistency on all of the plans. If you nail your tags to the trees, I find it best to leave the tag hanging out a bit from the tree, otherwise the bark will start growing around the tag, potentially creating a defect. Make sure that you do nail it in tighter if the nail sticking out would cause a pedestrian hazard.

In addition to the location, the following information should be recorded:

- The species of each tree by botanical name. This information is important later during the design phase, as different trees may handle construction stresses differently.

- The physical dimensions of the tree should be recorded. This would include the trunk diameter, the height, the canopy diameter, and the canopy clearance above the ground. For trees that you expect to experience any type of impact, I recommend that you record the canopy diameter and canopy clearance above the ground at eight compass points. This will allow you to plot the canopy accurately on the site survey and will provide you with an indication if any trees will need to be raised for clearance.
- The health of each tree should be documented carefully. Potential hazards and structural defects should be identified at this time. During the design process, this will provide you with the information you need to develop a pre-construction hazard removal and maintenance program. It can also help you to prioritize which trees should be selected for preservation over others. If you don't already have a standardized data collection sheet, it would be very wise for you to develop one. If you need a go-by, you could start with the form contained in the ISA publication by Nelda Matheny and Jim Clark called "A Photographic Guide to the Evaluation of Hazard Trees in Urban Areas." You can modify that form to fit your own style and needs.
- Finally, I recommend that you take a photograph of each tree for reference and record purposes. It is much easier to remember which tree is which during the design phase when you can pull out your photos. They also provide you with a reference to judge any changes to the overall appearance of the tree over time. Of course, copies can also be incorporated into the Tree Preservation Plan. I find digital cameras to be especially handy for this purpose. The prices have come down on them and you don't have to worry about film going bad in your toolbox.

The site planning or design phase of the project can be the most difficult one for an arborist to properly become involved in. I have experienced numerous cases where the developer does not bring in the arborist until the day after construction starts, and only then because a Stop Work order was received. This can drastically reduce the opportunity for tree preservation. All I can recommend in this regard is continuing education to those we work with.

Other than outright removals due to site layout constraints, the biggest impact to trees in development is a function of the grading and drainage program. Once you have completed the

tree inventory and the survey has completed the existing site map, you need to accurately portray the canopy dimensions on the map. At that point, you also need to establish an appropriate root protection zone.

Many oak tree ordinances establish the root protection zone as five feet beyond the drip line of the tree. Usually there is a minimum distance of fifteen feet from the trunk specified for small or immature trees. Based upon my experience, I would like to see this distance increase to ten feet outside of the drip line to give a little more protection. I have seen other guidelines that state that the root protection zone should be twelve to eighteen inches of distance from the trunk for every inch of trunk diameter.

I once worked with a landscape architect that claimed to be responsible for the drip line plus five feet protected zone concept. The odd thing was that it had nothing to do with the root zone whatsoever. He thought it was a good idea because that left some working space between the tree canopy and whatever structure being built nearby. Otherwise painters, roofers and stucco contractors would lop off any branches that annoyed them. However it evolved, that extra five feet potentially provides for the preservation of a much larger root mass. Whatever root protection zone you feel to be appropriate, it should also be plotted on the base map created by the surveyors.

Once all of that information is recorded, you have essentially created a site constraints map as a function of existing trees. At this point you should also identify any trees that should be removed for health or safety reasons.

The civil engineer and the architect now have enough information with respect to the existing trees to enable their full consideration during site design. To the absolute greatest extent feasible, the grades within the root protection zone should not be disturbed in any way. Retaining walls, stem walls and other grade control structures can be used to absorb any grade changes. Trees can be prioritized for removal based upon the condition information I listed earlier. You will find that design is a process and the site plan may be revised a number of times before the final layout is determined. Generally speaking, compromises occur between the various disciplines to get the best compromise between preservation of existing trees, architecture and engineering.

A couple of issues to keep in mind with respect to grade changes is the potential change in ground water supply to a tree and how surface water patterns might change. You will always want to make sure that trees are not left at low points where water will collect. If trees are going to be left in drier situations, you will want to make sure that a point irrigation system is installed

Another design issue that can affect trees includes trenching for utilities and other underground lines. These lines should be routed outside of the root protection zone wherever possible. If they must encroach, they should be grouped to minimize the number of trenches that must be excavated.

There are many types of foundations systems that can be used besides the traditional continuous footing. If a foundation must encroach within the root protection zone, an alternative system such as a post and beam foundation can reduce the amount of excavation required.

Paving within the root protection zone of mature trees should be limited to pervious surfaces that allow air, water and nutrients to continue to reach the root zone. New surfacing materials become available all the time. New storm water retention rules will probably result in the development of even better materials in the near future.

Structures should be placed far enough away from tree canopies to eliminate the need for constant clearance pruning. Even though this may seem like common sense, it warrants mention here due to the number of times I see it proposed on development plans.

Now I would like to go into some tree preservation procedures that can be employed once site construction is ready to start.

During site preparation, any trees to be removed should be addressed. I recommend that they be marked with bright survey ribbons. Some people like to mark trees to remain. I am not comfortable with this method, as the ribbons can disappear. I would rather call the demolition crew back out to remove a tree that lost its marker than to have a tree that has lost its marker and is removed by mistake.

I recommend that removals always be performed by a qualified tree crew rather than by the grading contractor. Grading contractors generally remove trees by knocking them down and

pulling the stumps with heavy equipment. If trees to remain are nearby, their roots can be damaged by this activity.

Any pre-construction maintenance that was identified during the tree inventory or to provide clearance should be performed at this time. This will ensure the safety of people on the site and minimize the chance of collisions with low-hanging branches in areas where encroachment is to occur.

There are a number of preservation procedures that can be employed during the construction process. They include:

- Fencing of trees to be preserved at the edge of the designated root preservation zone and/or at the limits of encroachment. I recommend that chain link fencing be used, as it tends to be sturdy and to stay in place. As I mentioned earlier, the orange plastic safety fencing that is now popular tends to be on the ground after the first week of the job. The purpose of the fencing is fairly obvious; to keep people, equipment, materials, debris, and vehicles from compacting or contaminating the ground area within the root protection zone.
- Based on the current condition of the tree and how much grading is to occur around it, it may be wise to deep water the tree prior to site activities. Throughout construction, the trees may need periodic spraying to remove heavy dust build-up from the foliage. This may be needed as often as once per week. The water should not be a problem for the construction crew if the washing occurs at the end of the week.
- Any excavation to occur within the root protection zone should be performed with hand tools or small construction equipment, such as a Bobcat. Whenever possible, excavation should be performed in passes radially away from the tree to minimize root damage. Where roots must be cut, sharp pruning tools should be used rather than tearing them off.

The project arborist should observe all excavation activities to insure that proper care is taking. Though it can get a bit boring or tedious standing next to a backhoe all day, it is the only sure way to insure that the grading contractor will follow the prescribed procedures.

In addition to excavation, virtually every job experiences field changes. True field conditions always differ somewhat from the survey, which after all is a two-dimensional representation of field observations. You may not know that contour maps can be off by one-half of the contour interval. Therefore, if the contour interval on the plan is two feet, the elevations shown can be off by one foot. This can make a difference when it comes to preserving existing grades within a root protection zone. The project arborist must be ready to respond to requests for field changes and be able to continue to look out for the tree's best interest as the design evolves.

In addition to monitoring the actual construction activities, the health of the trees must be monitored throughout construction. Deep watering, fertilization, pruning, and pest levels must be monitored and addressed as needed. Remember, the trees are going to be under considerable stress due to the changes in the land surrounding them.

Following the completion of the site development, the trees will need continuing care until they re-stabilize. Planning for this activity should occur back at the beginning of the project to insure that the owner realizes that it is an integral part of the project and that it must therefore be budgeted for.

The project arborist should continue to supervise the maintenance of the trees to insure that the program is implemented properly. It may be appropriate to bring in the landscape maintenance crew to perform watering and fertilization activities at this point.

Maintenance activities at this point will continue to include many of the things that were taken care of during construction, including deep watering, fertilization, pruning, and pest monitoring and treatment. The project arborist will need to determine when the trees can be converted to more normal maintenance frequencies. This may vary by tree, depending on the species, location and how stressed the tree was during the construction process.

For the purpose of this talk, I do not plan to review what normal tree maintenance includes. I wanted to mention it here merely to be complete in discussing the requirements for sustainable trees. The tree preservation plan should include some discussion on long-term maintenance in that same spirit.

In closing, I would like to emphasize three main points:

First, preservation of trees during construction and long-term sustainability require early input.

Second, as I discussed during this talk, there are tasks that should occur before, during and after the bulldozers to promote the desired sustainability.

Finally and most simply, avoidance of impacts is the best practice for preservation of mature trees.