

Guidelines on Tree Transplanting

**Greening, Landscape and Tree Management Section
Development Bureau
The Government of the Hong Kong Special Administrative Region**

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1 Introduction

1.1 The ‘Guidelines on Tree Transplanting’ (The Guidelines) serves as a general reference with a view to providing systematic steps in assessing the feasibility and suitability of transplanting in the project feasibility/planning stage and the major considerations in design, documentation, implementation and post construction stages for proper tree transplanting works and the after care. The Guidelines should be read in conjunction with the Development Bureau Technical Circular (Works) No. 10/2013 and other tree protection practices during construction promulgated by the Greening, Landscape and Tree Management Section of the Development Bureau.

1.2 Transplanting is the term used to describe the digging and replanting of trees from one location to a new location. Due to the wide extent and morphology of tree root system, transplanting of trees usually involves substantial removal of roots. The whole transplanting process in particular for large trees is an engineering feat and requires substantial involvement of resources and time.

1.3 A decision to transplant a tree should be based on a balancing consideration of its conditions (e.g. form, health and structure), size, species, conservation status, amenity value, suitability for transplanting, environmental and cultural factors, functional and engineering considerations and cost effectiveness.



Photo 1

Transplanting of large trees requires substantial resources and time and in many cases an engineering feat

1.4 The decision making process requires a systematic approach. The following flow chart in Diagram 1 recommends the basic work flow with key considerations involved in making a decision to retain, transplant or remove a tree for a typical construction project.

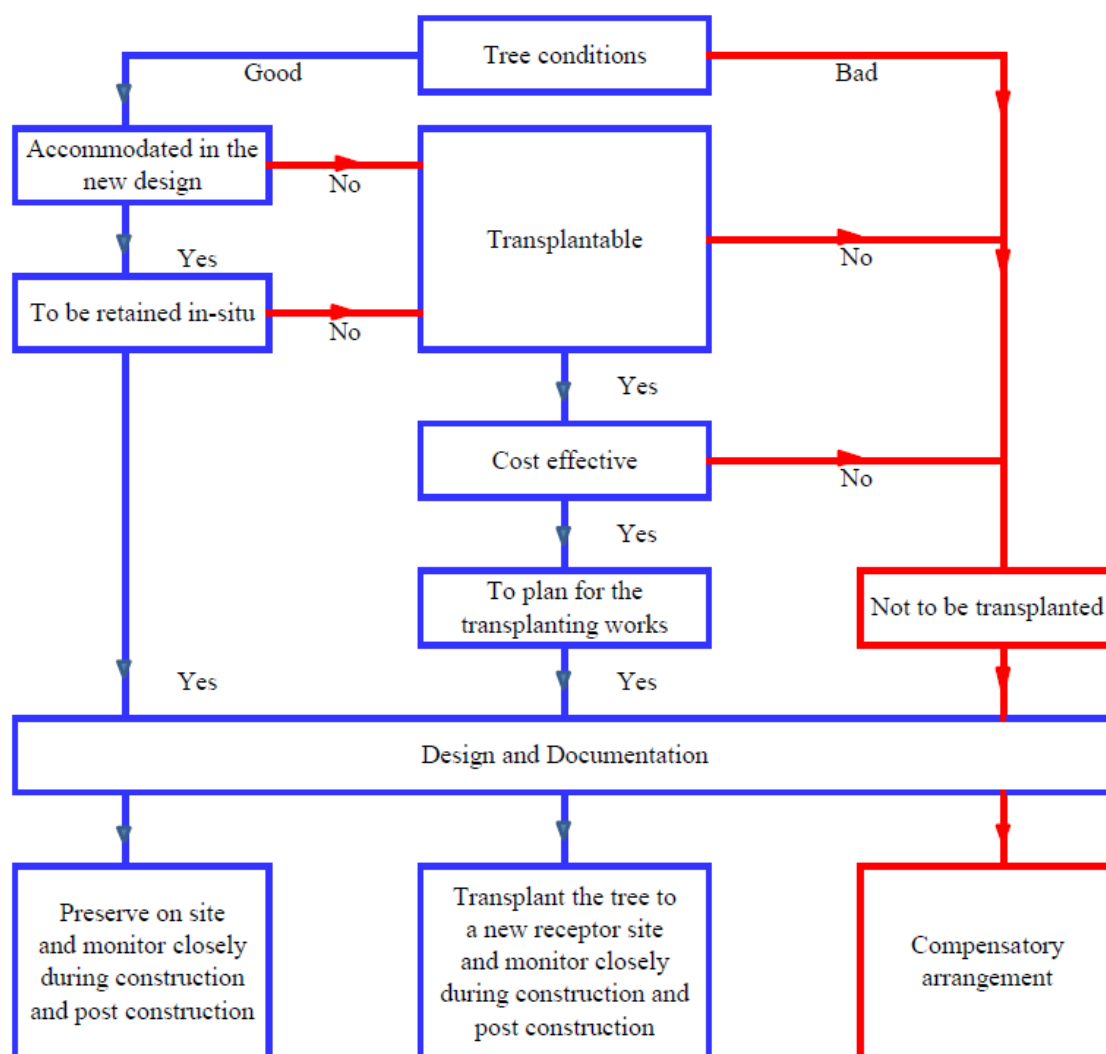


Diagram 1

The basic work flow with key considerations of tree transplanting for a typical construction project. Other factors such as species, conservation status of a tree, availability and suitability of a receptor site, access etc. should also be considered in parallel (paragraph 2.6 refers).

2 Planning

Trees affected by development projects

2.1 Trees should be properly preserved and no trees should be unnecessarily removed in development projects. Trees that are suitable for and worthy of preservation are identified in the planning or feasibility stage and should be properly preserved through careful and proper planning, design, implementation and post construction maintenance. Due consideration should be given to the existing trees that are healthy and structurally sound, in particular the valuable tree resources such as Old and Valuable Trees (OVTs)¹ and potentially registrable OVTs. Removal, i.e. transplanting or felling should be considered only if preservation is impractical.

2.2 A tree survey on the trees in a development project or other associated areas should be conducted to obtain the required information for developing site planning and tree preservation proposals.

2.3 Proposals to retain or transplant trees should be properly planned and implemented to ensure that sufficient space to accommodate the existing tree and its future growth, and adequate time for preparation of transplanting are available.

2.4 For situations where retaining the trees at their existing locations are not practicable, priority should be given to transplant the affected trees to other permanent locations within the project site where appropriate, so as to increase the trees' survival rate after transplanting and minimise the loss of greenery in the local environs; and if not practicable, transplant the affected trees to a suitable permanent location ex-situ. Location of the receptor site should preferably be in proximity to the project site for retention of amenity effect in the vicinity.

¹ Reference should be made to ETWB Technical Circular (Works) No. 29/2004 in preserving Old and Valuable Trees.

2.5 According to Development Bureau Technical Circular (Works) No. 10/2013, at least 12 months for the transplanting operation should be allowed apart from the time for consultation, identification of a suitable receptor location and approval process. Otherwise, justifications should be provided in the application for tree transplanting proposal.

Determining factors for transplanting

2.6 For trees that are considered impracticable to be preserved, the rationale behind any proposed transplanting of the trees concerned should be provided. The decision to retain, transplant or fell a tree should be a balancing act considering the following factors –

(a) General health, form and structure of the tree

Conditions of the trees to be transplanted including health, form and structure will affect the success of the proposed transplanting. As a general rule, trees with poor form/architecture, health or structure should not be considered for transplanting under normal circumstances.

Digging a tree for transplanting can remove as much as 90 percent of the absorbing roots which causes transplant shock to the tree. A transplanted tree should be able to re-establish sufficient roots to sustain itself. If the tree has poor health, the rates of survival and recovery will be low.

Trees suffer substantial stress and shock during construction and transplanting. The lifespan and health of the trees after transplanting have to be considered before transplanting to assess the cost effectiveness of the operation.

(b) Size of root ball / quality of root system

Larger trees need bigger root ball to encompass more roots to ensure adequate re-growth, as well as anchorage and stability. Transplanting may not be recommendable for situation where a reasonable root ball size cannot be achieved. Species that are normally difficult to transplant may benefit from larger

root balls more than those of species that are easily moved (Watson and Himelick, 1997). There should be a balance between the size of root ball, cost and technical aspects involved. International practices generally recommend a range of 8:1 to 10:1 for root ball diameter:trunk diameter. A larger root ball is recommendable for more mature trees to enhance better recovery after transplanting.

Trees growing on slopes, retaining walls or areas where formation of a root ball of reasonable size is not practicable are considered not transplantable.



Photo 2

Preparing the root ball of reasonable size for a tree growing on a slope or a retaining wall for transplanting is not practicable in many cases

(c) Size of trees

The size of trees that can be relocated is limited by logistical practicability and resource availability. As a general rule, transplanting a small tree can be more successful than the large ones of the same species. The logistical requirements and hence the cost of moving also increase substantially with the plant size, especially for off-site transplanting.

- (d) Species and conservation status of a tree
Invasive exotic tree species such as *Leucaena leucocephala* should not be considered for transplanting.
Trees having particular significance and high conservation value would be recommendable for transplanting in case they cannot be preserved on site.
- (e) Availability and suitability of a receptor site
Before transplanting, it is pertinent that a permanent receptor site, either within and outside the project site, should be located. If the new receptor site can only be available after a period of time, the trees should be properly maintained at the transit nursery.
- (f) Time for preparation
Adequate time should be allowed for preparation of the transplanting operation which includes the stage digging². Please see details in paragraph 4.4.
- (g) Maintenance party
Trees to be transplanted to a new receptor site may have a different party responsible for its subsequent maintenance. During the planning process, it is necessary to identify, consult and seek agreements from the long-term maintenance party for the transplanted tree(s).
- (h) Access to the existing and receptor locations and transportation
All factors including the access to existing and receptor locations, manoeuvring spaces and transportation to the

² Stage digging is a process by which portions of the root ball are dug over a period of time in order to allow the tree to acclimate to the stresses gradually.

receptor site (including availability of access to accommodate the tree, topography of proposed route, engineering limitation, etc.) and other site constraints should be considered.

Large transplanting machine may be needed. Accessibility of the site should be considered including the movement and set up of the transplanting equipment and the manoeuvrability of the operation machinery and vehicles. Moving a tree out of or into a site involves lifting to a vehicle and limitation of the size of a vehicle or transport safety requirements. It is not recommended to significantly prune tree to fit in transport vehicles.

(i) Site constraints

The locations of the tree and/or the receptor site may pose constraints to the transplanting works. Locations like underneath a flyover or footbridge, adjacent to a slope, too close to a building/structure, vehicular and pedestrian flows may add considerable difficulties to the transplanting work.

(j) Cost effectiveness

As considerable time, efforts and cost will be involved in the tree transplanting work and the tree will inevitably face difficulties for its regenerating growth, it is necessary to consider if the contribution of the tree after transplanting is proportionate to the cost.

Trees not to be transplanted

2.7 As transplanting of a large tree is a major engineering exercise which involves high cost, the amenity/cultural/environmental value of the tree against the transplanting cost should be assessed so as to determine whether the tree should be transplanted.

2.8 Trees with the following features should not be considered for transplanting under normal circumstances:

- (a) low amenity value;
- (b) irrecoverable form after transplanting (e.g. if substantial crown and root pruning are necessary to facilitate the transplanting);
- (c) low survival rate after transplanting;

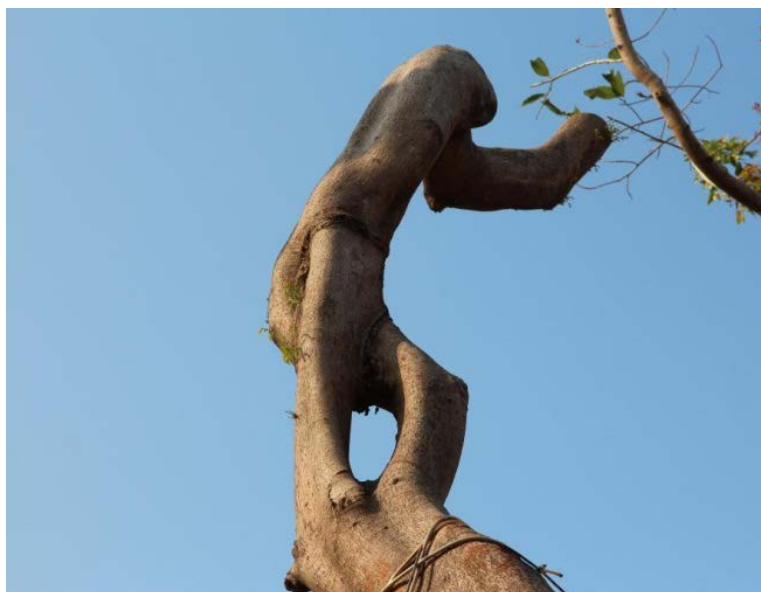


Photo 3

A tree is not desirable for transplanting if considerable branches have to be removed resulting in low amenity value

- (d) very large size (unless the feasibility to transplant has been considered financially reasonable and technically feasible during the feasibility stage);
- (e) with evidence or notable signs of over-maturity and onset of senescence;
- (f) with poor health, structure or form (e.g. imbalanced form, leaning, with major cavity/cracks/splits);

- (g) undesirable species (e.g. *Leucaena leucocephala* which is an invasive tree).

3. Design and Documentation

3.1 It is important to ensure that the requirements such as timing of root pruning, size of root ball, transplant and lifting requirement, monitoring and post transplanting maintenance, etc. have been properly planned and documented in the contract. All these works should also be properly supervised by tree specialist according to the contract specifications during and after construction.

3.2 Safety precautions

3.2.1 Tree transplanting, like other tree management works, should be conducted in a controlled and safe manner. Workers who are involved in transplanting trees should be given adequate instruction and supervision to ensure that tasks are completed in a safe manner³.

3.2.2 The sites shall be inspected for possible hazards prior to beginning any transplanting procedure. The location of utilities and other obstructions⁴ both below and above ground shall be taken into consideration prior to transplanting any tree.

³ Reference on work safety in tree works should be referred to the Guidelines on Arboriculture Occupational Safety and Health in www.trees.gov.hk.

⁴ Utilities and other obstructions include, but are not limited to gas, electric, communications, sewer, drainage, signage, overpasses, or bridges.

4 Transplanting operations

4.1 Tools and equipment

4.1.1 All tools and equipment should be appropriate to the operations and prepared in advance. Digging and root pruning tools shall be sharp and clean in order to cut without breaking, crushing or tearing roots. Mechanical digging and root pruning equipment shall be operated according to manufacturers' recommendations to minimise root damage.

4.1.2 Lifting cables, chains, straps, and/or slings shall be inspected and used according to manufacturers' instructions and specifications.

4.2 Timing of transplanting

4.2.1 In temperate areas, fall and spring are considered as optimal time for transplanting whereas it is not so clear in subtropical areas like Hong Kong. In general, summer is not a common transplanting season as evapo-transpiration rate is high and the transplanted trees will be under stress when transplanting work is taken place during that time. The risks of inclement weather and typhoons will also affect the work progress and the transplanting outcome.

4.3 Preparation of root ball

4.3.1 Root pruning is sometimes required before transplanting a tree. Sufficient time should be allowed between preparation and final lifting for development of new roots capable of sustaining and continuing the growth of the transplanted tree.

4.3.2 The root system of a woodland or open-grown tree will normally be widespread. Lifting such trees without initial preparation of a root ball will result in much of the root system being left in the soil. After transplanting, the tree crown may then die back, or the tree may not be able to recover and will die eventually.

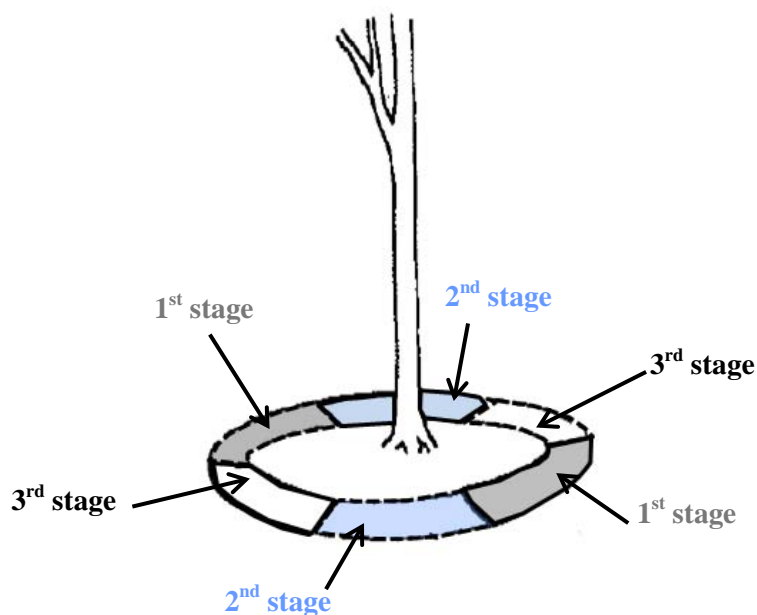
4.3.3 The root ball size varies depending on species, habit, location and specific attributes which shall be as large as practicable to maximise the potential of survival during and after transplanting while balancing other logistical and cost concerns. In general, the root ball diameter to tree diameter ranges from 8:1 to 10:1 according to international standards (except for a palm which may require a smaller root ball). The root ball sizes should be of a diameter and depth to encompass enough of the root system as necessary for establishment. Normally the diameter of a root ball is larger than its depth which seldom exceeds 1 metre. There may be practical difficulties in forming a root ball of regular shape or recommended size due to intrinsic conditions of the site or tree, e.g. conflict with adjacent structures or utilities. In such cases the advice of a tree specialist has to be sought on the optimal dimensions of the root ball to be achieved specific to the situation.

4.4 Stage digging

4.4.1 Root pruning to form a reasonable size of root ball is required and may be adjusted to suit specific tree species and/or imposed project constraints. For mature trees, root pruning is usually required to be carried out at different stages with a minimum of 1 month allowed for root regeneration between cuts. Stage digging can be carried out in the following stages in situations if the locations and work programme are considered suitable. The four stages are:

- (a) 1st stage – Dig a trench on the outside of the marked circumference in only two opposing segments;
- (b) 2nd stage – After a period of no less than 1 month since the 1st root pruning, dig a trench on the outside of the marked circumference in the adjacent two opposing segments;
- (c) 3rd stage – After another period of no less than 1 month since the 2nd root pruning, dig a trench on the outside of the marked circumference, in the remaining two opposing segments; and
- (d) 4th stage – After a further period of not less than 1 month since the 3rd root pruning, prepare the root ball and cut the underside

of the root ball, followed by uplifting and transplanting⁵.



The 4th stage in preparing the root ball by cutting its underside

Figure 1
Stage digging⁶

4.4.2 The width and depth of trench will vary for different trees and the excavated trench shall be backfilled with amended soil mix with growth hormones to encourage the growth of the fibrous absorption roots at the region of the cut zone.

⁵ Source: Section 25 of the General Specification for Building: Landscape Work

⁶ Source : BS 4043:1989 – Recommendations for Transplanting root-balled trees



Photo 4

Signs of fibrous roots are found on the peripheral of the root ball of a tree due for transplanting

4.4.3 Cuts must be clean to avoid tearing or breaking the roots. All cut roots shall be trimmed cleanly back to the healthy tissues to reduce the split and torn roots. Sharp cut ends can promote a flush of new fibrous roots, helping the trees recover faster from injuries.



Photo 5

Root cutting should be carefully arranged so that healthy roots can be preserved and no major feeding roots are unnecessarily pruned

4.5 Crown pruning

4.5.1 Pruning of tree crown during transplanting may not be necessarily beneficial to the trees as thinning the crown can reduce the tree's capability in making food and building up reserves. Excessive pruning can ruin the natural form of a tree and reduce photosynthesis.



Photo 6

Don't top, remove or prune substantially before transplanting. Topping will undermine health and structure and the affected tree may become a potential hazard

4.5.2 Crown cleaning however can be carried out to remove unhealthy, damaged, diseased, dead and crossed branches so as to minimise susceptibility to pests and diseases.

4.6 Pre-lifting operations

4.6.1 Tree lifting operations shall be carefully timed so as to enable direct delivery to the receptor site. No transplanting operations should commence until either the receptor site or the holding nursery is fully prepared. Tree uplifted must be transplanted and watered the same day. Watering before lifting is recommended.

4.6.2 Before uplifting, the outer edge of the previously dug trenches shall be loosened from the surrounding soil, and the root ball can be shaped with taper on the sides, slanting inward toward the base. The first cut around the perimeter of the root ball should be made with a sharp tool. Cuts should be clean to avoid tearing or breaking the roots. The shaping and final cuts should be done by hand. Do not stand on the root ball during the process. The root ball should stand on a pedestal of soil for shaping and burlapping before it is undercut.



Photo 7

When the surrounding soil is removed, the base of the root ball should be slanted inward to facilitate the lifting operation



Photo 8

Substandard size of a root ball will adversely affect the survival rate of a transplanted tree

4.6.3 Damp hessian is placed on the sides and across the tip of the ball and pinned. The hessian should cover the full circumference of the root ball with bottom skirt hanging out. This skirt is pinned to the root ball later after the tree is taken out of the hole. The base of the root ball should also be properly wrapped. This hessian shall be kept moist throughout the time of uplifting until the uplifted tree is transplanted in its new location.



Photo 9

Hessian should cover the full circumference of the root ball



Photo 10

Root ball is well protected by a metal net to facilitate transportation

4.7 Temporary support of trees before lifting

4.7.1 A tree after root pruning may not be having extensive root support during the interim of the transplanting process. It may be vulnerable to inclement weather, such as typhoon or heavy rainfall.

4.7.2 Removal of the root system may sometimes aggravate the natural form and balance of a tree and is prone to tree failure. When the stability of a tree is likely to be jeopardized, a temporary support, such as guying or simple prop is essential and important before the tree is delivered to the transit nursery or to the new receptor site.

4.7.3 Where appropriate, robust protective fencing to fence off the area of a tree undergoing stage cutting may be required. Regular inspection should also be made to adjust the physical support and to check for the stability of the tree, in particular after the passage of inclement weather, so that corrective action can be timely arranged.

4.8 Lifting and handling of root-balled trees

4.8.1 The root ball should be properly wrapped before lifting. Lifting should be done by direct lift, with padded protection for the tree, using a machine of appropriate capacity connected to the support around the root ball, not to any other part of the tree. Tree should not be lifted by the trunk as this can cause serious trunk injury but by its root ball which should be properly prepared and wrapped. Root balls that are not properly protected would easily collapse during transplanting due to its own weight.



Photo 11

Proper lifting up by the root ball, not by the trunk

4.8.2 Root ball without proper wrapping whether it is because of improper lifting method or being deformed during the lifting operation should not be allowed.



Photo 12

The base of the root ball should be properly wrapped and protected before and during lifting. A loose root ball base without wrapping is unacceptable.



Photo 13

Other than lifting the tree by its trunk which will damage the tree, many major roots have been severed and the size of the root ball is not adequate and not properly wrapped will undermine its survival chance after transplanting

4.8.3 It is essential that self-tightening slings around the trunk or branches should not be used as, when tensioned, they will bruise or rupture

the bark and could lead to tree death.



Photo 14

Lifting by the tree trunk will cause irreversible damage leading to the death of a tree

4.8.4 The branches should be tied to prevent injury. Do not tie so tightly that a sharp bend is created that could compress or break the branches. The trunk and branches should be padded with several thickness of burlap to prevent damages and injury during the transplanting operation.

4.9 Containerized root ball

4.9.1 Trees in containers are more resistant to root damage during transportation. This is a recommendable method of transplanting as the root ball is well protected and lifting of the boxed root ball during transplanting will give better protection during the transplanting operation and enhance better establishment of the tree afterwards.



Photos 15 and 16

Tree is well protected in a metal box during transplanting

4.10 Protection during transportation

4.10.1 Trees are often too tall to be transplanted in the upright position and are tipped to a horizontal position. Root ball may be flattened during transportation. When trees are being loaded on a lorry or trailer bed, care must be taken to avoid injuring the tree or breaking the soil ball. Crown of the tree should be carefully wrapped to minimise the risk of drying, branch damage due to excessive movements, and wind damage.



Photo 17

Tree crown should be carefully wrapped to minimise drying and wind damage during transportation. A poorly wrapped tree crown will easily be damaged during transplanting.

4.11 Preparation of receptor site

4.11.1 Trees will not tolerate highly compacted soil, which should be broken up over as large an area of the site as possible. Planting pits should be provided with drainage to allow effective percolation of water.

4.11.2 During pit preparation, the existing topsoil ploughed from digging should be stripped and put aside for reuse as much as possible and to avoid a distinct interface between the planting pit and the surrounding soil.

4.11.3 The width and the final depth of a planting hole are determined by the depth and firmness of the root ball and other characteristics of the site. The soil directly beneath the root ball should be undistributed or prepared to prevent settling.

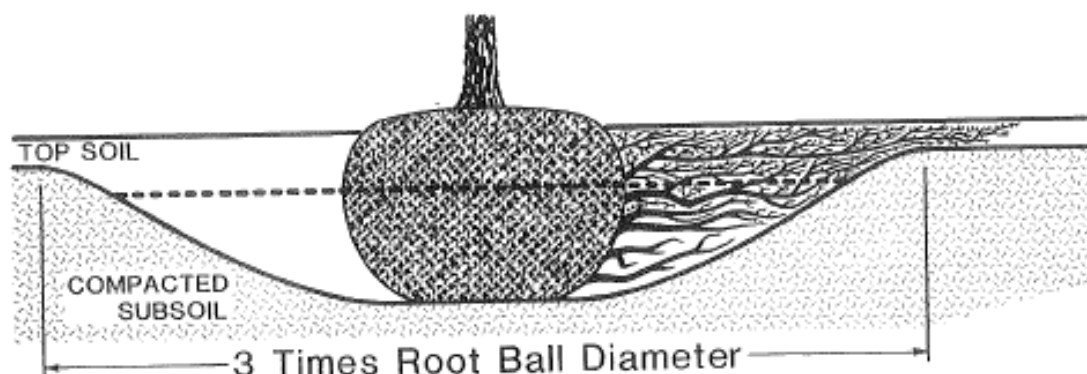


Figure 2

A planting hole that is two to three times the width of the rootball at the surface is optimum for most situations. Roots will grow vigorously toward the better soils near the surface (dotted line) rather than being trapped in the planting hole. (Watson and Himelick, 1997)

4.11.4 In general, the depth of the planting hole shall not exceed the depth of the root ball and the sides of the planting hole should be scarified. In general, the planting hole width should follow international practice⁷ at a minimum of 1.5 times the diameter of the rootball to suit the location.

4.12 Planting

4.12.1 Tree should preferably be placed in the same orientation from which they originated.

4.12.2 All root ball supporting materials should be removed from the planting hole prior to final back filling. Crown wrappings and fastenings used to tie in the branches for transport should be removed. Any branches damaged in transit should be properly pruned back to the nearest branch bark ridge.

⁷ Source : ANSI A300 - Trees, Shrub, and Other Woody Plant Maintenance – Standard Practices (Planting and Transplanting)

4.12.3 When finally set, the top surface of the root ball should not be below the surrounding soil. The bottom of the trunk flare should be at or above the finished grade. The back-fill soil shall be reinstated and settled in layered sections to limit future settling and prevent air pockets. It shall not be compacted to a density that inhibits root growth.

4.12.4 The backfill soil should be tamped firmly around the base to stabilise a tree, but the rest of the soil should be tamped only lightly, or left to settle on its own. Water should be added to the root ball and the backfill to bring the root ball to field capacity. Soaking will assist in settling the soil naturally.

4.12.5 Tree should be secured in position either by guys and stakes or by underground guying, as appropriate.

4.12.6 Immediately following planting and where appropriate, a soil saucer can be formed on the soil surface around the edge of the root ball circumference to permit rain or irrigation water to be retained and slowly infiltrate into the root ball perimeter.

4.13 Trees at the transit nursery

4.13.1 In some occasions, trees have to be temporarily moved to a transit nursery before the permanent receptor site is ready.

4.13.2 Transplanted trees temporarily kept at the transit nursery in general do not have strong and far reaching root system to support themselves. Proper supports should be therefore considered and applied where appropriate to the trees during their stay at the transit nursery until they are permanently relocated to the receptor sites.

4.13.3 Primary stress after transplanting is mostly due to drought stress. It is important to note that a tree kept in a root ball may not hold as much water as it is necessary to sustain its growth to recover from the stress. Hence it is important that all the transplanted trees should have a proper watering programme as part of the daily maintenance work in the transit

nursery.

4.13.4 Trees normally should not be placed in the transit nursery for more than two growing seasons. Care should be taken to ensure that roots will not grow kinked or become girdled. When roots encounter the container wall, they can be deflected up, down, or around the inside of the container wall. Girdling roots are damaging in the long run as they restrict the flow in the vascular system and can cause stress and eventually death of the tree and therefore should be avoided. Girdling roots would not allow normal spread of roots which in time would provide a better support to the tree. Hence girdling roots would compromise structural stability of a tree.

5 Post-planting Care

5.1 All newly planted trees are subject to stress until a normal spreading root system has developed. The primary objective of planting site preparation is to provide a quantity of backfill soil that promotes rapid initial root development and does not restrict root spread beyond the planting hole.

5.2 If trees are transplanted within the project site amidst the construction activities, they should be well protected with robust fencing.



Photo 18

Newly transplanted should be protected with robust protective fencing from all construction activities and adequate protective measures should be in place to avoid adding further stress to the trees

5.3 All newly transplanted trees should receive proper maintenance care in order to facilitate recovery of tree from the transplanting shock. It would be necessary to ensure the tree is stable before its root system is fully recovered to give support.

5.4 The stress of a tree can be observed immediately after transplanting or gradually after a period of time. Proper care after transplanting will help to assure survival and minimise stress and ensure a higher successful rate. Maintenance is a continuation of the transplanting process. Efforts and expenses can be wasted if trees are not given proper care after transplanting. Continued stresses and slackening growth can be visible during the initial transplanting period. Corrective actions should be adopted before further decline of the tree.

5.5 Mulching and watering

5.5.1 Mulch can be used to conserve soil moisture, to buffer soil temperature extremes, to control weeds and other competing vegetation, and to replenish organic matters and nutrients in the soil. A well-established layer of mulch can hold more water than the soil itself, without decreasing soil aeration. Mulch should not be placed too close to the tree trunk or root collar.

5.5.2 The size of the mulched area depends on the size of the tree. Mulch layer around 5cm thick usually covers the area where roots will grow during the first two years after planting. However mulch used should be free from pests and diseases. The root zone and base of trees should be free from shrubs or other planting to facilitate the proper establishment of trees.

5.5.3 Weed growth should be suppressed at the tree pit.

5.5.4 Sufficient and appropriate watering is important for the proper root growth. Provision should be made for watering, allowing for total wetting of the rooting volume to minimise susceptibility to stress and assure survival.

5.6 Support above and below ground

5.6.1 Staking or initial guying may help retain a tree in an upright position until sufficient roots are developed to anchor the tree⁸. Guys and stakes and ties should be removed, replaced or adjusted as necessary to ensure their effectiveness and to prevent constriction or abrasion damage to the tree.

5.6.2 In general, the supports can be removed after the tree establishment. Supports that stay too long without proper adjustment will do more harm than good to the trees.

5.7 Use of chemicals

5.7.1 Fertilisation may be unnecessary unless nutrient deficiency is confirmed. Moderate release of nutrients by decomposition of both mulch and organic matter added to backfill soil may be sufficient during the initial establishment period. Fertiliser burn is an obvious symptom of having insufficient water in a plant associated with an over application of fertiliser.

5.7.2 Wound dressings and tree paints have not been proven to be effective in preventing or reducing decay. They are not usually recommended unless specified for control of disease, borers, mistletoe or sprouts.

⁸ Further details on staking and guying supports of trees can be referred to the weblink
http://devb.host.ccgo.hksarg/en/tree_preservation/new/Staking_Guying_eng_aug2011.jpg

6 Transplanting of palms

6.1 Palms are monocots and do not have a cambium capable of generating new tissue to cover injured areas. Hence it is important to avoid any mechanical damage to the trunks of palms during the transplanting operation.

6.2 Palms do not have lush foliage. Excessive removal of healthy fronds offers little or no benefits. Terminal buds of palms must be carefully protected since it is from where the new growth develops.



Photo 19

Excessive and unnecessary removal of fronds will further stress a palm which will induce a longer recovery time from the transplanting shock

6.3 Palms are relatively easy to transplant because, as monocots, they have an adventitious root system composed of numerous fibrous primary roots that grow independently and periodically from the root initiation zone that radiate out from the base of the trunk with little or no branching; and as such a smaller root ball may be adequate. However, the root ball should have adequate mass and depth to structurally support the palm. The minimum root ball radius should also follow international practice of 6 inches (15 cm) from the base of the trunk at ground level⁹. Root balls larger than the minimum radius shall be preferred.

6.4 Palms that have been subjected to continued stresses caused by severe nutritional or water deficiencies often display a constriction of the trunk corresponding to the period of time during which the stress occurred (Watson and Himelick, 2013). Hence it is important to ensure that palms should quickly be reestablished to recover from the transplanting stresses.

⁹ Source : ANSI A300 - *Trees, Shrub, and Other Woody Plant Maintenance – Standard Practices (Planting and Transplanting)*

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