

Research on Urban Tree Relocation Application and Maintenance: A Case Study of Longhua District, Shenzhen

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Abstract:

In recent years, the development of greening initiatives has become a prevailing trend, with tree relocation increasingly gaining public attention. As a critical component of landscape greening, the procedures for tree relocation have become particularly vital in economically developed regions of China, especially concerning post-relocation maintenance management and pest control in landscaping projects. Given this context, this paper takes Longhua District, Shenzhen as a case study to preliminarily examine the approval process for tree relocation and subsequent construction maintenance management, aiming to provide a reference for tree relocation practices.

Keywords:

Tree Relocation, Greening Maintenance, Application Process, Urban Trees

1. Introduction

As an essential component of urban construction, landscape architecture has gained increasing public attention. Trees, being a vital element of urban landscaping, play an indispensable role in enhancing the aesthetic and ecological value of cities. With Shenzhen's rapid urban development, past incidents of indiscriminate tree felling have highlighted the critical importance of standardized tree relocation approval procedures. Equally crucial is the post-relocation maintenance management of transplanted trees. As the saying goes, "Landscaping relies 30% on planting and 70% on maintenance." The management of tree relocation encompasses multiple stages, including application approval, excavation, transportation, post-planting pruning, and irrigation. Without scientific management practices, issues such as poor landscape quality and tree deterioration may arise. Therefore, research and implementation of proper tree relocation and maintenance protocols are of utmost necessity.

2. Regulations, Procedures and Principles for Tree Relocation Application and Approval

The tree relocation approval process in Longhua District, Shenzhen is governed by multiple regulations including Articles 25 and 27 of the Guangdong Urban Greening

Regulations, Guangdong Provincial Government Order No. 128 (2008), No. 142 (2009), Yue Jian Fa Zi (2009) No. 34, and Shen Fu (2012) No. 8. These stipulate a three-tier approval system: projects involving 200+ trees require municipal greening authority review and government approval; those with 20-199 trees or specimens exceeding 80cm DBH are approved by municipal authorities; while projects affecting <20 trees are decided at district level with municipal filing.

The standardized procedure requires applicants to submit comprehensive documentation (including plans, expert assessments and public notices) to greening authorities, who conduct preliminary reviews within 5 working days - issuing Shenzhen Tree Relocation Certificates for approved cases or written rejections. Construction-related relocations require simultaneous submission of supervision plans and temporary green space occupation permits, while emergency operations must complete documentation within 30 days post-relocation. All applicants must implement protective measures before approval. This framework serves as an operational model for urban tree management in Shenzhen and potentially other cities.

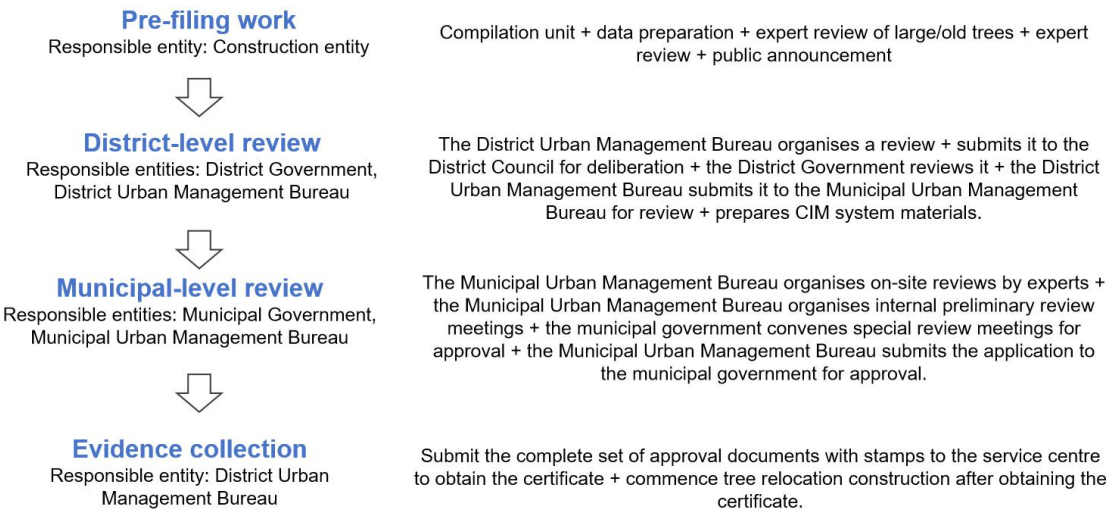


Figure 1. Application and approval process.

The preliminary application phase encompasses documentation preparation by designated entities, including preliminary data collection, special assessment of large/mature trees, expert review, and public disclosure. (Figure 2)

Pre-application work: Responsible entity – Construction entity

compiling unit	Preparation of materials	Expert opinion on large/old trees	expert review	public disclosure
The compiling unit has completed the compilation of the approval documents. Large tree: trunk diameter ≥ 50 cm (at 1.3 m height) Old tree: age ≥ 50 years Ancient tree: age ≥ 100 years	1. Determine the boundaries of the urban green space, set boundary markers, and mark the project boundary lines; 2. Identify the species, quantity, and specifications of trees to be relocated within the project area, and tag, photograph, and locate them (RTK); 3. Prepare aerial photographs of the entire project area (set of construction drawings) and a presentation PowerPoint; 4. Confirm the list of trees within the project area with the property rights unit and supervisory unit; 5. Relocate the planting sites for the trees (coordinate with each district to implement); 6. Conduct a tree assessment based on project documentation; 7. Develop a tree relocation/felling/pruning plan; a compensation plan for permanent green space occupation; a temporary greening plan; and an assessment of the planting outcomes after relocation.	For projects involving large trees/old trees, a detailed and comprehensive discussion of the uniqueness of the relocation of large trees and old trees is required. Argue the possibility of not relocating large trees and whether the plan is feasible.	Participating entities: experts, construction entities (or construction management entities), commissioned compilation entities, tree ownership entities, urban management bureaus, design entities, etc.; Expert requirements: principles have been filed with the urban management bureau, experts with relevant senior professional titles, excluding those with conflicts of interest.	After completing the revisions based on expert opinions, a 7-day public notice period will be conducted.

Figure 2. Pre-application workflow.

The district-level review phase involves a multi-tiered evaluation process conducted by the District Urban Management Bureau, including: organized re-examination, district-level deliberation, district government review, submission to municipal urban management authorities for verification, and preparation of City Information Modeling (CIM) system documentation. (Figure 3)



Figure 3. District-level review process.

The municipal review phase involves a comprehensive evaluation process conducted by the Municipal Urban Management Bureau, including organizing expert field investigations, holding internal pre-review meetings, convening special approval review sessions with the municipal government, and submitting the final proposal for municipal government approval. (Figure 4)



Figure 4. Municipal-level review process.

Upon completion of these three phases, the applicant may proceed with certification, having met the preliminary requirements for urban tree relocation approval. This final stage involves submitting the complete approved documentation with official seals to the service center for certification, followed by initiating the tree relocation construction process.

Trees are an integral part of urban ecosystems, providing ecological services such as oxygen production, air purification, noise reduction, and climate regulation. They are also a component of urban culture, bearing witness to the history and evolution of cities and serving as a shared memory and emotional anchor for urban residents. However, in actual planning and construction, it is inevitable that trees in existing green spaces will be damaged to some extent due to road widening, building demolition, and other factors, and the relocation or felling of trees is unavoidable. In

light of this reality, efforts should be made to minimise the relocation of existing trees, adhering to the principle of ‘preserve as much as possible, relocate only when necessary,’ and striving to retain valuable trees whenever feasible. For trees that must be relocated, priority should be given to transplanting or reusing them within the project site boundary, and efforts should be made to select parks, ancillary green space, or production green spaces as transplant sites or temporary nurseries to minimise relocation distance, costs, and damage to the trees. The relocation process must be carefully planned to ensure ‘one-time relocation,’ avoiding secondary relocations [1]. In practical terms, healthy trees with good form and adaptability to the target environment should be selected, and transplantation should be conducted during their dormant period (late autumn to early spring) to improve survival rates. If off-season transplantation is necessary, it should be done on cloudy days or before rain, with enhanced care. For tree species with low survival rates, winter frozen-soil transplantation may be considered, with proper root insulation [2]. The entire relocation process must be conducted scientifically and rigorously to ensure high tree survival rates and the full realisation of ecological benefits. (Figure 5)

Evidence collection: Responsible unit - District Urban Management Bureau

Submit the complete set of approval documents with stamps to the service hall to obtain the certificate

After the Mayor's Meeting and completion of the municipal bureau's approval process, the complete set of documents shall be stamped by all relevant parties, including the construction unit, urban management bureau, maintenance unit, tree receiving unit, and compiling unit, on the corresponding documents (two sets of documents for tree relocation and urban green space occupation). The original documents shall be submitted to the service hall for reporting and certification, while the electronic copies shall be scanned and submitted to the district urban management bureau.

Conduct tree relocation construction after obtaining evidence

An administrative permit must be obtained before formally commencing tree relocation and permanent green space occupation projects. Construction must strictly adhere to the tree and green space areas approved on the permit, and tree relocation must be completed within the approved completion deadline. After relocation, the contractor must maintain the trees for at least six months. The Urban Management Bureau must inspect the condition of the relocated trees every three months.

Figure 5. Evidence collection process.

3. Current Status of Tree Relocation Management and Maintenance Practices

Tree relocation involves complex operational procedures that require meticulous execution. During greening construction, contractors must pay particular attention to underground utility lines, strictly adhering to the "1-survey, 2-test, 3-excavate" protocol [1]. When encountering obstructions to prevent damage to underground infrastructure. Any discovered issues must be immediately reported to supervision, design, and administrative departments.

3.1. Tree Uprooting and Specialized Relocation Techniques

3.1.1. Tree Uprooting Methodology

Pre-uprooting preparations require complete assembly of necessary materials including binding ropes/straps, wooden boards, support poles, pliers, wire, shovels, picks, spades, rooting powder, nutrient solutions, wound sealant, lifting slings, aeration tubes, shade nets, moisture blankets, and tree wrap fabrics. For trees

scheduled for relocation, pre-irrigation should be conducted 48 hours in advance to maintain proper root ball moisture (preventing soil dispersion), coupled with thorough pre-relocation site surveys of both original and destination locations to assess terrain and environmental conditions.

Site Preparation Protocol: Prior to planting, the designated area must undergo thorough land leveling and tillage to remove debris, followed by excavation of planting pits sized according to the root ball specifications of each specimen. Concurrent preparation of organic fertilizer and backfill soil is required, with strict avoidance of excessively large or deep pit dimensions that could compromise transplantation success [3].

Root Ball Specifications and Excavation Timing: The root ball diameter should generally measure 6-8 times the tree's DBH (diameter at breast height), expanding to 7-10 times during Shenzhen's dry winter months, with a height approximately two-thirds of the diameter. Optimal transplantation windows prioritize pre-budding spring or post-leaf-fall autumn periods [4], with Shenzhen's ideal operational timeframe spanning October to May.

Root Ball Packaging Specifications: The root ball shall be securely wrapped using moistened non-woven fabric as the primary protective layer, followed by structural reinforcement with either wire mesh or strapping bands (applied in mandarin-orange or pentagonal patterns) to prevent soil dispersion and maintain structural integrity during transport. (Figure 6)



Figure 6. *Soil ball binding.*

Trunk Protection and Disease Prevention Treatment: During Shenzhen's dry seasons, biodegradable tree wrap shall be applied from the root collar upward to the first branch junction to prevent bark cracking, physical damage, and pest/disease infestation.

Scientific pruning: Root system—trim torn wounds, retain rootlets, disinfect severely cracked roots and bandage them; Tree crown—use the “branch trimming and trunk preservation method,” control the intensity of pruning according to tree species differences (heavy pruning for banyan trees, light pruning for camphor trees), smooth the cut surface and apply a protective agent, remove diseased and insect-infested branches/crossing branches.

Anti-rot and root-promoting measures: After soil ball preparation, spray a broad-spectrum fungicide (such as carbendazim) to prevent rot, and simultaneously apply root-promoting hormones (NAA 50-100 ppm or IBA 100-200 ppm) to promote new root regeneration. (Figure 7, Figure 8)

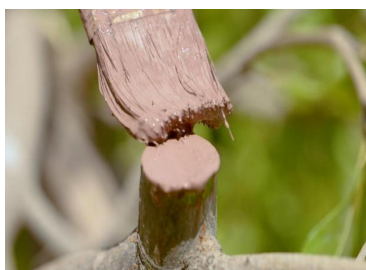


Figure 7. *Wound application.*



Figure 8. *Spraying preservative on the roots.*

3.1.2. Special measures for tree relocation

Scientific pruning and root removal: Pruning of nursery stock should first remove dead branches, diseased or insect-infested branches, and overcrowded branches to maintain a complete tree shape and ensure good ventilation and light penetration. Simultaneously remove dead roots, diseased or insect-infested roots, and split roots to avoid transplant damage.

Standardized soil ball excavation: Dig a ring-shaped trench to shape the soil ball and maintain its integrity; After binding with grass rope, moisten and reinforce with a spray, then wrap the soil ball with shade cloth/film, and finally use steel pipes to support the tree trunk to prevent breakage.

Safe lifting and transportation: Do not use steel wire ropes for direct lifting; use flexible slings to protect the bark; select loading and transportation based on the on-site planting volume, handle the soil ball gently and securely, and aim to complete planting of the transplanted seedlings on the same day. (Figure 9, Figure 10)



Figure 9. *Tree hoisting.*



Figure 10. *Lashing before hoisting.*

Precise planting positioning: Planting should be slightly higher than the original ground level by 5-15 cm to prevent root rot after transplanting. When lowering the tree into the planting hole, first adjust its direction to determine the orientation of the crown's viewing side. Once the tree trunk is straightened, remove the packaging and simultaneously backfill with nutrient-rich soil in layers, compacting it firmly. Install 2-4 drainage pipes at a 40-45° angle (for pesticide and fertilizer application channels). (Figure 11)



Figure 11. Ventilation pipe installation.

Tree support: Use triangular/quadrangular supports (cedar poles/galvanized steel pipes), with a base diameter of ≥ 6 cm; Support points are located at the $2/3$ mark of the tree trunk, with a ground angle $\leq 60^\circ$, and ground stakes are used for reinforcement to prevent settlement; finished supports are used for binding materials, with matching ties considered. Padding materials are selected from non-woven fabric or moisture-retaining fabric. After binding, inspect the support poles for loosening, and secure them to the ground stakes to ensure stability. (Figure 12)

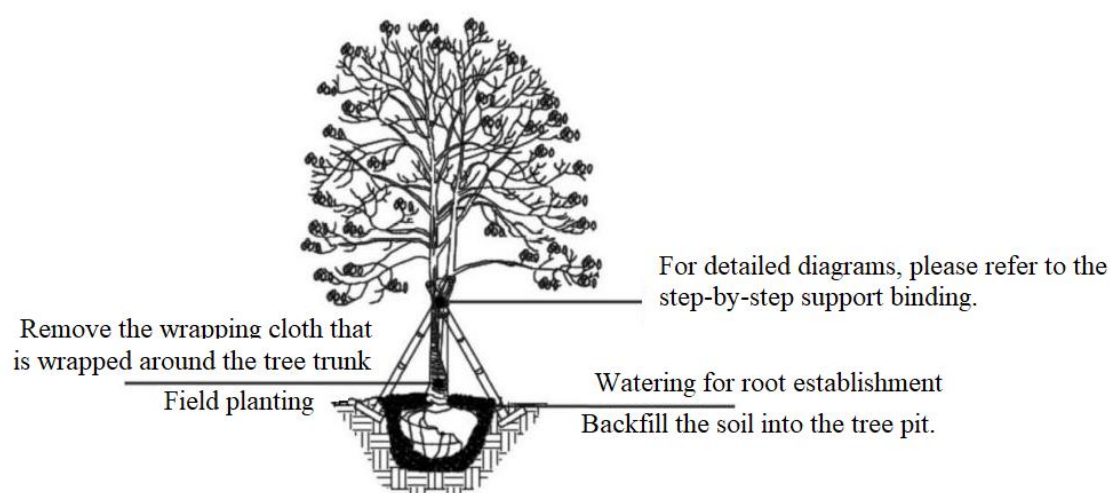


Figure 12. Supporting diagram.

3.2. Current Status of Tree Relocation Management

Weak Professional Capabilities of Maintenance Entities: Trees are an important component of urban ecosystems, and tree relocation and maintenance is a highly technical task requiring specialized knowledge and skills [5]. However, due to inadequate self-assessment and insufficient understanding of their capabilities by tree relocation and maintenance management units, the growth conditions of urban green space plants are poor; The lack of rationality in on-site maintenance management methods also easily leads to on-site chaos, low efficiency, resource waste, and safety vulnerabilities. In the tree relocation process, Shenzhen residents play the role of participants, and their individual levels of literacy can result in differences in green awareness [6].

Dual deficiencies in social participation and regulation: Tree relocation and maintenance management is a public welfare endeavor that requires participation and support from all sectors of society. However, interdepartmental collaboration is loose, enforcement of illegal relocation activities is lax, public awareness campaigns are insufficient, and social support mechanisms have not been activated.

Incomplete maintenance management system: Plant maintenance management requires a systematic plan and organization. When there is a lack of a full-cycle maintenance plan and inadequate response to environmental risks, plant growth and health will be affected.

Shortcomings in personnel quality and training mechanisms: There is a lack of professional skill training for tree relocation personnel, and their overall quality is low [1,7]. The relocation quality management system does not cover the entire process, resulting in suboptimal outcomes and quality in the overall maintenance work.

3.3. Tree Transplantation and Maintenance Techniques

In tree transplantation and maintenance, a series of technical operations—including water supply, tree support, humidity maintenance, light provision, fertilizer supply, pest and disease control, nutrient solution delivery, lawn greening, and continuous maintenance of transplanted trees—are particularly critical for the growth and landscape effects of trees after transplantation [8,9,10,11].

Light provision: Trees prefer bright, diffused light and have some shade tolerance. They cannot withstand intense sunlight, which can scorch leaves, causing yellowing and leaf burn. Excessive shade should also be avoided, as it can lead to excessive leaf drop. From May to September, shade should be provided, or plants should be placed in areas with ample diffused light. During other times, sufficient sunlight should be provided.

Water supply: Watering is a crucial step during tree transplantation to ensure root water absorption and maintain soil moisture during the growing season. Watering should be controlled in winter, as excessive moisture in the soil at low temperatures can cause root rot.

Maintaining environmental humidity: The tree prefers a humid environment. During the growing season, when the weather is sunny and the air is dry, frequently spray water on the branches, leaves, and surrounding environment to increase relative humidity.

Proper fertilization: During the initial relocation period, growth regulators can be applied around the planting holes to promote root development. For large trees with low survival rates or those transplanted out of season, nutrient solutions should be injected into the trunk based on weather conditions and water requirements (remove the drip bags promptly after survival and seal the openings with a coating agent). Fertilization should primarily use organic fertilizers, tailored to tree species, age, growth stage, and soil fertility. Apply fertilizers on sunny days using methods such as hole application, ring application, or radial trench application [1], with a depth of $\geq 0.5\text{m}$ and within the vertical projection area of the tree crown (expanding with tree age); Small trees can be broadcast-fertilized but require soil loosening and watering to promote penetration. Fertilization timing should meet the needs of the tree's critical growth period, combining basal fertilizer with top-dressing to ensure fertilizer efficacy [12].

Pest and disease control: Adhere to the principle of “prevention first, comprehensive management” [13], ensuring urban landscape harmony while enhancing ecosystem stability through scientifically configured plantings [14]. Specific implementation should be tailored to regional characteristics and pest types, strictly enforcing plant quarantine to prevent the spread of invasive pests, optimizing

planting designs to avoid mixed planting of susceptible species, and supplementing with physical control measures such as light traps and soil treatments [15]. Biological control should be prioritized for long-term ecological regulation, while chemical control should be used as a last resort with caution (e.g., using Sufosate for aphids and applying 800-1000 times diluted thiabendazole for root rot). The use of highly toxic and high-residue pesticides is strictly prohibited. In daily management, monitoring should be strengthened, diseased branches and insect-infested leaves should be promptly removed and burned, and tree trunk cavities should be filled. Concurrently, intensive cultivation and fertilizer and water regulation should be implemented to enhance tree vigor. Combined with dead branch removal, drainage to prevent waterlogging, and pest and disease forecasting, a sustainable management loop should be established.

Nutrient solution delivery: All relocated trees in Shenzhen (with a trunk diameter ≥ 20 cm) must be administered nutrient solutions via trunk injection to promote rooting and budding, enhance tree vigor, improve survival rates, and accelerate recovery. The frequency of injections should be adjusted based on tree vigor (typically 2–4 times), and after completion, switch to administering clean water (1 bottle daily) until tree vigor is fully restored.



Figure 13. Hanging nutrient solution (Image source: Work photo).

Complete lawn maintenance: Before establishing the lawn, thoroughly clear debris and plant roots from the soil bed to a depth of over 30 cm to ensure the soil is loose, well-aerated, and well-drained; continuously control weeds; adjust the soil pH to a neutral range of 6–7; implement periodic water and fertilizer management, regular mowing (avoiding excessive damage), and integrated biological and chemical pest and disease control; dynamically update and maintain damaged areas to ensure the uniform appearance and ecological function of the lawn[16].

Continuous maintenance after relocation: Tree maintenance is a long-term process that requires ongoing attention and care to ensure healthy growth.

4. Conclusions

The standardized approval process and scientific maintenance management of urban landscape tree relocation are of critical importance. To ensure the success of relocation efforts, it is essential to strictly adhere to the hierarchical approval system and uphold the principles of “preserve as much as possible, relocate in one go, and transplant nearby.” During the relocation process, advanced techniques must be applied, including dynamic adjustment of root ball specifications, scientific wrapping and anti-corrosion root promotion, high-position planting combined with air-permeable tubes, support systems, and nutrient solution infusion, to maximize survival rates and recovery speed. To address issues such as insufficient professional

capabilities, poor regulatory coordination, and inadequate public participation in maintenance management, it is imperative to establish a comprehensive traceability mechanism, develop specialized technical guidelines, prioritize biological pest control, and establish a public supervision platform through scientific means. Only by doing so can the relocation process be effectively standardized, significantly improving the survival rate and growth potential of relocated trees, and ensuring they continue to play their core role in optimizing the environment, beautifying the city, and preserving ecological and cultural values.

Conflicts of Interest

The author declares that there is no conflict of interest regarding the publication of this article.

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