Study on tree transplantation technology in urban landscape construction

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Abstract: With the rapid advancement of urbanization, urban landscaping plays a vital role in improving ecological quality. As a core component of greening projects, large tree transplantation demonstrates significant advantages in optimizing urban green space structures and enhancing landscape aesthetics. This paper systematically explains the concept and significance of large tree transplantation in urban landscaping, analyzes its technical characteristics and operational principles, and explores scientific methods for quality control and maintenance management across key stages including seedling selection, pit excavation, tree removal, and soil ball packaging. By implementing comprehensive precision management and standardized technical protocols throughout the transplantation process, transplant survival rates can be substantially improved, providing robust technical support for the sustainable development of urban ecological landscape systems.

1. Introduction

At the present day China, urbanisation is under high-speed acceleration and environment quality based on living standards has become one of important criteria for sustainable development of a city. On this account, landscaping is the most important tool for significantly improving both functionality and landscape beautification of cities, while the construction process has received increasing public scrutiny. The Large tree transplantation is a key technical element in landscape engineering, which not only greatly enhances the visual and ecological value of urban green space in the short-term scale but also an irreplaceable method for rare species protection as well as vegetation structure optimization at the ecosystem level. Still, it is a process with many moving parts – plant selection, soil component adaptation, lift and transport methods, planting techniques and post-transplant care to name a few. Incorrect procedures can quickly cause tree injury or impaired mortality. This study will therefore carry forward the scientific basis surrounding transplanting and improving construction management process as both practical imperatives to improve urban landscaping project functions in terms of quality and ecology.

2. The concept and significance of tree transplantation in urban landscape construction

2.1 Concept

Large tree transplantation (LTT) is one of the critical technical measures in urban greening that aims to relocate mature trees previously growing in their original sites into new greenspaces using systematic standardization and procedural protocols. It provides an operational mechanism to redistribute urban greening investments and reconstruction of the landscape. It seems to be simple transplantation of trees, but the meaning actually includes several operations like plant physiological regulation, soil adaptation, mechanical lifting and positioning in place for transportation. If, except in the "Code for Construction and Acceptance of Landscape Gardening Engineering" standards: trees with a trunk diameter greater than 20cm (deciduous trees) or 15cm on evergreen trees are considered as large trees. Due to the fragility of their delicate root systems, these behemoth creatures require just as much care as one drop could lead to irreversible physiological loss. This means that the construction should be done primarily depending on structural stability and integrity within defined parameters, carefully protecting trunks and canopies in excavation, transport and planting. To not break, tip over, or go thirsty once they are settled into those new locales[1].

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2.2 Significance

Large tree transplantation is a key step in improving quality and ecology of urban landscapes. Compared to newly planted saplings, they provide greater volume for carbon storage and faster shade coverage. Upon transplanting, they produce a high level of green coverage and landscaping visuals in a matter of days reducing the construction cycle time for landscaping to hours versus weeks while improving unit area biodiversity. This approach is also distinct from conventional "zero-start" greening models, as model outputs use more developed plants to derive the spatial layout of vegetation to improve ecological resilience. Moreover, for rare ornamental species or ancient trees of historical value to prune their ecology and sustain development in the new habitat transplantation is a good means for ex-situ conservation and propagation. Large tree transplantation is not only an effective means of bridging ecological gaps and enhancing green system functions among increasingly scarce urban land and dwindling ecological spaces in China, but also offers up potential pathways for sophisticated and efficient landscape management. This initiative holds significant importance for promoting urban ecosystem civilization and rationalizing green space.

3. Characteristics and application principles of tree transplantation technology

3.1 Main characteristics of tree transplantation technology

3.1.1 High difficulty of transplantation

Transplanting large trees introduces more variables than it does with conventional saplings. With time, trees grow a root system which covers greater area, becomes more complex and can grow to great depths; however their regenerative capacity declines tremendously. Roots are easily damaged by shrinkage or rupture during excavation and transport, while uneven stress on the trunk can lead to fractures at a later stage; this inevitably results in higher maintenance costs. France, even larger trees can suffer a lot from upper drainage and are reliant on water and nutrients which requires good husbandry. Failure to maintain it properly can result in the transplant being lost[2].

3.1.2 The operation process is tedious

Longer preparatory treatments are usually needed to allow trees transplanted into-field conditions enough time to become acclimatized. This includes the development of new root systems and growth regulation, which are some early preparations. The entire process can be broken down into precursor work, on-site activities, transport and setting in position, as well as post-planting maintenance. Every step of this process is critical, and very time-consuming with little to no margin for error.

3.1.3 Outstanding greening results

Large trees transplanted successfully in a short period as well achieves "instant landscape effect" by enriching ecological quality and layered beauty of green spaces. With minimal pruning and maintenance, these trees quickly learn to exhibit eye-catching appearances that help them become showcase specimens of urban greening, not only improving the ecological profile of the city but also boosting its aesthetic value!

3.2 Basic principles of tree transplantation technology

3.2.1 Tree balance principle

Pruning above-ground parts is a necessity during transplantation due to inevitable root damage, so dynamic balance in tree vigor needs to be maintained. The principle involves the coordinated connection between underground roots and above-ground branches in terms of nutrient supply and growth, While heavy pruning will decrease root burden, inadequate regrowth regulation could result in decreased photosynthetic ability and poor recovery. Thus, the intensity of pruning should be determined scientifically, integrating species characteristics with quantified root damage severity and physiological needs in addition to landscape criteria[3].

3.2.2 Principle of analogous habitats

Much of the ability to transplant trees is determined by how closely the new environment matches their native habitat. Data trained into trees which stood for a basis consist of key ecological history components as climate, soil create-up, moisture reputation and sunlight opportunity. However, trees are not very adaptable when grown in sites far from the origin where they were raised. For example, transplanting alkaline tolerant species into acidic soil usually results in transplant failure. Thus, we should conduct a reasonable evaluation of the soil and climate conditions of the destination before transplantation. Appropriate soil amelioration needs to be performed to simulate the original habitat in an ecological environment, so as to effectively promote successful survival and sustained growth.

4. Key points of tree transplantation technology in urban landscape construction

4.1 Seedling selection

One should do thorough research based on local topography, climate, sunlight conditions and hydrological environment to find the best suited tree species scientifically before transplanting large trees. In case of selection of species, both ecological adaptation to the local ecosystem and characteristics such as compatibility with tree age and variety should be given importance. The greening projects in southwestern China:Choosing evergreen species such as osmanthus, crape myrtle and red-leaf plums are the most common;In addition, it is recommended that people can transplant tropical or subtropical common mountain trees and magnolia plants according to local conditions in southern Kunming[4].

4.2 Digging pits

Because the climates of northern and southern China differ greatly, seasonal rainfall and soil moisture should be fully considered when transplanting schedules are determined. Where soils are heavy loams of clay character in the more humid southern areas, evaluation of soil structure and drainage capacity is imperative before excavation to reduce root rot from waterlogging. Pit size = 810X trunk diameter in diameter and 80% below the root ball height. The outer compacted soil must be placed separately from the subsoil during excavation. All debris and hard matter must be removed from the pit so that the soil there is ready for future planting.

4.3 Tree digging

Use the size of the tree as a guide to ensure you have excavated outwards for 3-5 times its diameter depending on your particular circumstances, i.e. This usually includes making a circular area around the center trunk and digging down in concentric circles, so as not to damage the root system. When you work, increase the working area to a 60-80 cm clearance zone. You also slow your digging on the last 20cm when you have reached that depth of soil use a shovel to smooth off the bottom of your ball and help give it stability after we transport it.

4.4 Earth packing

Once the root ball was formed, immediate stabilizing and binding needs to be done. Step 1 is to tie grass shoes along the lower head and upper foot in a horizontal "belt" (width: about 15-20 cm) band from the bottom length of 15-20 cm that increases stability. Then move on to the "pepper-eye" method- wrapping ropes around the root ball through different angles and fastening them at alternating points. This method allows not to crack when lifting and shipping. This process provides structural integrity throughout the planting and handling of the plant itself, while also ensuring safe transport without damage to the structure.

5. Quality control method of tree transplantation technology in urban landscape construction

5.1 Scientific treatment of trees

A complete tree condition assessment should be carried out before transplanting large trees, and management strategies determined by physiological characteristics. Preservation of natural crown morphology during preparation is also essential for evergreen trees. Where practicable, the professional staff are to reduce transpiration by removing dead branches and fallen leaves. In cases where trees have intact root balls, the pruning process can be adequately simplified. The standard for deciduous tree pruning before transplant is 1/3 to 1/2 of all parts of the foliage removed to reduce water demand. Transplanting at extreme weather conditions (such as high temperature or extremely cold climate) needs an adaptation to climate in nature for more survival stability.

5.2 Contracted work during the transplanting phase

Once tree preparation is completed, the key safety elements involve securing the trunk and main branches. Measure and Cushion This essential step usually involves binding limbs with organic materials like straw ropes or burlap bags to create margin cushioning and protection. Grounding needs to be done in shaded spots away from the sun so moisture evaporation doesn't occur too quickly, taking away some of this soil water holding capacity that trees rely on for moisture stress resistance. The moisture content of the sections that have been wrapped must be measured on an ongoing basis by workers who also use misting techniques, as needed. Such a means of scientific wrapping not only avoids physical damage during transit but also helps prevent risks caused by violent impacts and friction, thus ensuring both security and stability during the transplanting procedure.

5.3 Lifting and transportation

In simple terms, the process of lifting and transportation has the most demanding technical criteria in all steps of the transplanting workflow. Also, when lifting requires choosing cranes or forklifts according to the size and shape of trees as well as its center of gravity. The center of gravity of the root ball when prepared for transport must be situated exactly at the center to prevent crushing or damage to the roots in transit. Structurally, the crown has to be pointing towards the back with proper ropes for full anchorage. Since bumpy roads can loosen or break up soil, cushioning materials need to be recycled and packed in the root ball of the tree to provide shock absorption and stability.

5.4 Planting tips

Tree planting commonly regarded as one of the most vital phases in the whole process of transplantation needs to be performed according to technical basis. 1, Designing the tree pit layout in a proper way before starting to plant so that it could be premeditated on the base of amount and distribution of roots for adequate space for growth, determining dimensions and modal. If the soil in the area is not of good quality, like a heavy clay soil or poorly aerated compacted fill, then pit specifications should be increased appropriately to ensure accuracy around vertical excavation that mitigates against problems such as slumping walls or pooling (water accumulation). At the same appease stage, At the compliance with deep of excavation. Pre-minimum depth of 30 cm loose soil for vice soil in pit bottom of tent to further improved permeability / waterrich quality, And other parameters + improve breathing and solubilizing environment so on . Moreover, when backfilling, topsoil and new soil should be kept separately and labelled for layered treatment of the soil to enhance its structure. And if roots or branches are damaged during the transplant, they should be removed immediately and in a smooth cut. The ended tips should be covered with preservatives or shut in a plastic film to avoid that the pests find them, since they can harm recovery in the future.

5.5 Subsequent maintenance and management

5.5.1 Water management

That makes it have unebalance transpiration and CAN be easy to deshydrate after being

transplanted. Therefore, under the premise of proper arrangement of watering times and area, insulation should be done by wrapping the tree trunk. Do not water only one corner of the root, so that the soil surrounding it is moist and balanced, to create a good water environment.

5.5.2 Stimulating root growth

Under new environmental conditions, trees experience reduced absorption capacity, necessitating the use of plant growth promoters like rooting powder to activate root regeneration. Additionally, appropriate irrigation is essential for efficient nutrient uptake, enhanced root vitality, and accelerated adaptation of the tree.

5.5.3 Weeding and soil loosening

After the tree plantation, it is of great importance to keep an appropriate plant environment clean and well-ventilated. The work of weeding and loosening the soil regularly will help eliminate any weeds competing for water, nutrients, or sunlight from the vines. Again, stay away from human trampling or vehicle damage to tree base area. Loose soil allows air and water to flow through easily, which promotes healthy root growth; OpenBlock dirt helps further this course by loosening the dirt that the roots intermingle with so they can continue growing.

6. Conclusion

With the increasing urbanization, landscape engineering is one of the important cornerstones to developing eco-cities and promoting green development and ecological civilization. The transplantation of large trees plays a critical role in urban greening, both for properly structured vegetation and for sustainable and pleasing city ecosystems. This approach will significantly improve the ecological performance of urban greenspaces, promote rational vegetation allocation and increase aesthetic value. In order to achieve successful transplantation, careful management over the entire process and systematic investigation are required. This will ensure sufficient improvements of urban ecology using green space in conjunction with continuously tuned technical methods to support successful transplantations. These efforts will in the end provide an injection of energy into the sustainable development process of landscape architecture in China.

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