Discussion on Construction and Maintenance Management Strategies of Landscape Greening in Urban Construction

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Abstract: This paper aims to achieve long-term stability of landscape gardens. By integrating the core aspects of urban greening construction and maintenance management, it analyzes key construction points such as layout optimization based on site conditions, control of planting suitable plants, application of ecological paving, and the combination of garden ornaments with greenery. It also summarizes maintenance strategies including dynamic plant monitoring, periodic scientific pruning, improvement of soil physical and chemical properties, and emergency protection against extreme weather. The study elaborates on the technical pathway for the synergistic advancement of construction and maintenance. The research aims to demonstrate that integrated management, characterized by "construction adapting to site characteristics and maintenance following growth patterns," can effectively enhance the survival rate of garden vegetation and landscape stability. This achieves the integration of ecological functions, landscape effects, and use value, providing practical references for the high-quality construction of urban landscape greening.

1. Introduction

With the acceleration of urbanization, landscape greening has become an important carrier for improving the human living environment and enhancing urban ecological quality. However, its construction quality is often constrained by issues such as the disconnection between construction and maintenance, and insufficient technical adaptability. The construction phase of landscape greening lays the foundation for the landscape's formation, while maintenance management determines its long-term vitality; the two need to be closely linked and work synergistically. Based on this, this paper discusses the construction and maintenance management of urban landscape greening. It sorts out practical strategies from the construction dimensions of site adaptation, plant control, and functional optimization, as well as the maintenance dimensions of dynamic monitoring and scientific upkeep, providing ideas for solving the problem of "emphasizing appearance over substance, construction over management" in garden construction.

2. Greening Construction Schemes for Landscape Architecture in Urban Construction

2.1 Optimizing Greening Construction Layout Based on Site Geology and Hydrology

Conduct stratified geological testing, combining drilling and in-situ testing, focusing on detecting the organic matter content, porosity, and compaction degree of the 0-1.5m planting layer soil. Simultaneously, record the depth of the groundwater table, seasonal water level fluctuation curves, and soil permeability coefficient to form a detailed geological and hydrological distribution map. Develop differentiated layout strategies for different geological conditions. If an area has sandy soil prone to water and nutrient loss, plan it as a multi-layered planting area combining shrubs and ground cover, using interlocking root systems to enhance soil water and fertilizer retention. For low-lying areas with high groundwater tables (depth <1.2m), first construct a gravel blind drain drainage system (blind drain spacing 3-5m, gravel particle size 20-40mm), then design this area as a wetland plant zone, planting water-tolerant vegetation like iris and calamus to avoid root rot caused by waterlogging [1]. Optimize micro-topography combined with vertical design; create stepped planting belts on slopes >15°, control the width of each planting belt to 2-3m, and set low concrete retaining edges (height 15-20cm) to prevent soil erosion. Utilize topographic elevation differences to guide natural rainwater infiltration, achieving the dual goals of "layout adapting to geology, topography regulating hydrology."

2.2 Selecting Suitable Plants and Standardizing Planting Process Control

Establish a selection system prioritizing "native species + complementary ecological functions." Determine foundational tree species based on urban climate zoning, supplementing with companion plants according to the site's micro-environment. For example, select shade-tolerant ground covers like Hosta and Liriope in shaded understory areas, and pair resilient tree species like Platycladus orientalis and Broussonetia papyrifera along heavily polluted roads. Test the physiological indicators of plant seedlings, ensuring trunk diameter error ≤5% and root system integrity rate ≥90%, to avoid introducing plants carrying pests and diseases [2]. Improve planting soil: if soil pH <6.5, incorporate quicklime at 500-800g per square meter for adjustment; if organic matter content <2%, mix in decomposed sheep manure or compost to enhance fertility. When excavating seedlings, determine the root ball size based on trunk diameter, wrap the root ball tightly with straw rope to prevent breakage during transport. The planting pit should be 30-50cm larger than the root ball. Lay a 10-15cm thick mixed layer of crushed straw and decomposed organic fertilizer (ratio 1:2) at the pit bottom. After placing the seedling, adjust verticality (deviation ≤1°), backfill with layered compaction (each layer 20cm thick, compaction degree 85%-90%) to avoid voids causing root suspension. Water thoroughly immediately after planting and set up triangular supports, with support points at 1/2 to 2/3 of the trunk height, using soft rubber pads at contact points to prevent damage. Finally, mulch the tree base with a 5-8cm thick layer of pine needles or wood chips to reduce water evaporation and weed growth.

2.3 Using Ecological Paving Technologies to Enhance Landscape Practicality

Prioritize materials with both permeability and load-bearing capacity: use permeable concrete for main garden paths, with aggregate using 5-10mm single-grade basalt, cement-to-permeability agent ratio of 1:0.03, achieving a porosity of 15-20% and ensuring a permeability coefficient $\geq 1.0\times10^{-3}$ m/s. Use grass pavers for secondary paths and courtyard areas, selecting interlocking "checkerboard" pattern bricks with planting hole area ≥40%, filled with a mixture of planting soil and grass seeds, preserving green space while bearing pedestrian traffic. The base course for permeable paving uses a composite structure of graded crushed stone and permeable asphalt. Base thickness is determined by load: ≥20cm for main paths, 15cm (full crushed stone layer) for secondary paths. Compact layer by layer during installation to ensure base compaction ≥93%, preventing future settlement [3]. Implement drainage and maintenance support: install infiltration blind drains every 10-15m along paving edges (30cm wide, 40cm deep, filled with gravel wrapped in geotextile) to guide infiltrated rainwater into the municipal stormwater network. Maintain permeable paving regularly: clean pores with high-pressure water jet (pressure 2-3MPa) quarterly; replenish sealant on permeable concrete surfaces annually (dosage $0.2kg/m^2$); trim vegetation in grass paver areas semi-annually. This ensures the paving maintains permeability and long-term durability.

2.4 Refining Construction Details for the Integration of Garden Ornaments and Greenery

Coordinate the sequence of ornament foundation construction and planting according to the "hardscape first, softscape later" principle. Complete foundation construction for hardscape ornaments first; foundation excavation depth is determined by the ornament's weight, using C20 concrete with embedded Φ12 rebar for stability. Install the ornament body after 7 days of concrete curing. Construct softscape ornaments only after surrounding plants are established, to avoid root damage during excavation. Determine planting areas based on ornament size: plant low ground cover around small ornaments within a radius 1.5-2 times the ornament's diameter, creating a "point (ornament) and surface (greenery)" hierarchy. Plant medium shrubs on both sides of medium ornaments, controlling the ratio of shrub crown width to ornament width at 1:1.2 to avoid obscuring the ornament. Plant tall trees around large ornaments, with planting points ≥2m from the foundation to prevent root damage as trees grow. Utilize the height difference between tree canopies and ornament tops to create comfortable spaces with "shade above and seating below" [4]. Install a 5-10cm wide gravel isolation strip between ornaments and plants to prevent root intrusion. Apply preservative oil to wooden ornament surfaces to prevent rot from rain, and leave a 10-15cm ventilation gap under wooden structures to reduce moisture erosion. For hanging planter boxes with trailing plants, include drainage holes at the bottom and install drip trays underneath to prevent water from polluting the ground, ensuring long-term aesthetic harmony and functionality between ornaments and plants.

3. Maintenance Management Strategies for Urban Landscape Architecture

3.1 Establishing a Dynamic Monitoring Mechanism for Plant Growth Status

Build a layered monitoring system. Focus on monitoring leaf condition, branch growth, flowering, and fruiting above ground. Quarterly, use root monitoring tubes to observe root distribution and vitality underground, and use soil tensiometers to monitor soil moisture content in the root zone (0-60cm), ensuring sandy soil moisture is maintained at 12-18% and loam at 18-25%. Conduct simultaneous ambient monitoring (quarterly), including air humidity, light intensity, soil pH, and nutrient content[5]. Establish a monitoring data ledger using a "one plant, one file" model, recording each monitoring data set, plotting growth curves, and performing comparative analysis using Excel or specialized maintenance management software. If an indicator deviates from the normal range for two consecutive readings, immediately initiate cause investigation and develop targeted corrective measures, achieving closed-loop "monitoring-analysis-correction-feedback" management. Install smart monitoring devices on key plants for real-time data transmission to a management platform with automatic alarms for anomalies, enhancing monitoring timeliness and accuracy.

3.2 Implementing Scientific Pruning Maintenance According to Plant Growth Cycles

Define pruning cycles and core objectives. Deciduous trees follow the principle of "heavy pruning during dormancy, light pruning during growth." During dormancy, focus on thinning dense, diseased, insect-infested, and crossing branches, controlling the pruning amount to 15-20% of the total crown volume, while adjusting tree shape. During the growth period (April-October), only remove water sprouts and drooping branches (below 2m), with pruning not exceeding 5% [6]. Prune evergreen trees with "thinning as the main method, light pruning and slow release," conducted once each in March and September. Thin out dense inner branches to maintain crown ventilation and light penetration, ensuring spacing between inner branches is not less than 30cm, avoiding excessive heading cuts that stimulate overly vigorous bud growth. Differentiate pruning for flowering and foliage shrubs. Prune flowering shrubs 10-15 days after bloom, removing spent flower branches and retaining healthy buds, with cuts 1-2cm above the bud. Also, head back aging branches. Prune foliage shrubs once each in March and July, using shearing or shaping to maintain neatness. Clean up pruned branches and leaves promptly after pruning to avoid harboring pathogens. Standardize pruning operational details. Disinfect tools with 75% alcohol before use to prevent cross-contamination. Use the "three-cut method" for large branches: first undercut 1/3, then top cut, finally remove the stub, keeping stub height below 5cm to avoid bark tearing. Apply tree wound dressing to cuts larger than 2cm in diameter to promote healing [7]. Strengthen post-pruning care: water deeply once within 3 days after pruning, accompanied by light fertilization to provide nutrients for recovery. Monitor wound healing and reapply dressing and disinfect if abnormalities occur.

3.3 Regularly Improving Soil Physical and Chemical Properties to Ensure Vegetation Survival

Define testing cycles and indicators: conduct comprehensive soil tests each spring (March-April) and autumn (September-October), using the "five-point sampling method." Collect soil samples from 0-30cm and 30-60cm layers at each point. Test indicators include pH (suitable range 6.0-7.5), organic matter content (not less than 3%), bulk density, porosity, and salt content[8]. Develop differentiated improvement plans. For acidic soil (pH <6.0), apply quicklime at 500-800g/m², testing pH every six months to gradually adjust to the suitable range. For saline-alkali soil, combine "salt drainage + improvement": first excavate drainage ditches 60cm deep and 40cm wide, then apply desulfurized gypsum at 3-5kg/m² to reduce alkalinity. For compacted soil, perform mechanical loosening and incorporate decomposed straw or sawdust at 10-15kg/m² to increase porosity. If organic matter content is below 2%, apply decomposed organic fertilizer each spring and autumn using the "ring trench method": dig a ring trench 30cm wide and 20cm deep at the canopy drip line, mix organic fertilizer with topsoil before backfilling, avoiding direct root contact and potential burning[9]. Water deeply once within 15 days after improvement to integrate amendments with the soil. Loosen soil regularly to prevent re-compaction. Mulch the root zone with 5-8cm of wood chips or bark to reduce evaporation and slowly add organic matter through decomposition, forming a "improvement-maintenance-continuous optimization" soil management model.

4. Conclusion

This study summarizes urban landscape greening construction and maintenance management, concluding: Construction should focus on "adaptability," optimizing layout based on site geology and hydrology, selecting suitable plants, standardizing planting processes, applying ecological paving, and refining ornament-plant integration. This builds a "site-specific, functionally coordinated" construction system, solidifying the foundation for stable garden operation. Maintenance should adhere to the principle of "dynamism," relying on plant monitoring, periodic pruning, soil improvement, and extreme weather protection to form a "demand-based regulation, continuous optimization" maintenance model. Synergistic linkage between construction and maintenance is key: construction facilitates maintenance, and maintenance data feeds back into construction optimization. Their combination achieves the unity of ecological, aesthetic, and practical values in landscaping, avoiding the problem of "difficult post-construction management."

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