

Preliminary Exploration on the Construction of Urban Landscape Gardens and the Maintenance Management of Road Greening

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Abstract: The construction of urban landscape gardens and the maintenance management of road greening are crucial components of urban ecological construction and the improvement of the human living environment, playing decisive roles in the initial quality and long-term effects of green landscapes, respectively. This paper focuses on the construction of urban landscape gardens and the maintenance management of road greening. It first elaborates on the core technologies and quality control points in the construction of urban landscape gardens, then analyzes the core content and technical methods of road greening maintenance management, and proposes corresponding optimization strategies. It aims to provide practical references for enhancing the construction quality of urban landscape gardens and strengthening the maintenance management level of road greening.

1. Introduction

With the continuous acceleration of urbanization, the urban population has been steadily increasing, and the urban ecological environment is facing numerous challenges, such as the intensification of the urban heat island effect, a decline in air quality, and a reduction in biodiversity. In this context, as an important part of the urban ecosystem, urban landscape gardens can not only regulate the urban climate, purify the air, and conserve water sources but also provide residents with places for leisure and entertainment and shape a unique urban cultural landscape. Therefore, in-depth exploration of effective strategies for the construction of urban landscape gardens and the maintenance management of road greening holds significant practical importance and value. It has also become an urgent and important issue in the current field of urban construction.

2. Core Technologies and Quality Control Points in the Construction of Urban Landscape Gardens

2.1 Technical Preparations and Basic Control in the Pre-construction Phase

Technical preparations and basic control in the pre-construction phase are prerequisites for ensuring the orderly progress of landscape garden construction, focusing on "feasibility assessment" and "risk anticipation." At the technical preparation level, it is essential to conduct on-site reviews of design drawings, taking into account the actual topography, landforms, and the distribution of underground pipelines at the site. The plant configuration areas and hardscape layouts shown in the drawings should be adjusted to ensure compatibility with onsite conditions. In addition, the soil property detection should be fully carried out to clarify indicators including fertility, acid-alkalinity and permeability of the soil before formulating a technical plan for land improvement to create favorable conditions for later plant growth.

First and foremost, for the basic control process, comprehensive material inspection acceptance mechanisms should be set up especially for plant seedlings and construction materials. Standards of quality should be defined explicitly in accordance with design standards, strict checks to ascertain the growth status and root integrity of seedlings, specifications and nature of construction materials, so as to prevent dismissal of sub-standard materials into the engineering process. Construct detailed

construction technical disclosure documents according to the phase and procedural logic of the project, clarify technical parameters and operating specifications at each stage. Organizing specialized training for construction personnel to let the construction team deeply understand there are technical essentials, and avoid quality problems from the source due to technical misunderstandings.

2.2 Implementation of Core Technologies and Process Control in the Mid-construction Phase

The mid-construction stage is the core of turning design blueprints into real Landscapes, with a focus on the two main land features: plant planting and hardscape construction — reinforcing precision in implementation through technology empowerment; rigorous process control. Planting technology implementation: according to the growth characteristics of different plants, determine appropriate planting procedures and technical methods, including excavation specifications of planting holes, control of planting depth and initial fixation measures after planting to ensure that plants can take root stably in the new environment. Simultaneously while coordinating between plant and environment, the planting density & landscape layout pattern should be reasonably planned to have sufficient growth space for plants and achieve the expected visual effect.

In hardscape construction, all operations should be strictly performed according to technical specifications, including foundation excavation, structural construction and surface decoration. Hardscape facilities should be structurally stable and practically functional, so each process needs to be well controlled with satisfactory technical parameters. In the process control, we should build a regular quality inspection mechanism, and actively arrange relevant professionals to inspect the construction quality regularly, mainly for whether there are smooth links between each construction process and whether various technical indicators have passed the standard, so as to find detours in time. Strengthen coordination and cooperation between the links of construction, coordinate the construction progress of plant planting and hardscape, avoid problems such as poor quality and low efficiency due to process conflicts in the construction process, so that overall construction work can be orderly brought together and promoted.

2.3 Initial Maintenance Technologies and Quality Acceptance Control in the Post-construction Phase

The implementation of initial maintenance technologies and quality acceptance control in the post-construction phase are important linking links to ensure the long-term stability of the landscape garden effect, taking into account both "plant adaptation" and "quality assurance." In terms of initial maintenance technology implementation, targeted maintenance plans should be formulated according to the plant varieties and growth stages, reasonably controlling the frequency and amount of watering to avoid affecting plant growth due to excessive or insufficient water. Meanwhile, appropriate pruning of branches and leaves should be carried out according to plant growth conditions to adjust plant morphology and reduce nutrient consumption. Early monitoring and prevention of pests and diseases should also be conducted to help plants quickly adapt to the new environment and shorten the slow-growth period through scientific maintenance. For hardscape facilities, initial protection work should be carried out, and reasonable measures should be taken to prevent newly completed facilities from being damaged by external forces, ensuring the integrity of hardscape facilities.

Quality acceptance control should be based on design drawings and industry norms, and a multi-dimensional comprehensive acceptance index system should be established, which should not only include core indicators such as plant survival rate, overall landscape appearance, and functional integrity of hardscape facilities but also take into account implicit requirements such as construction process compliance and ecological adaptability, forming a comprehensive and rigorous acceptance standard framework. In the acceptance implementation stage, a three-party collaborative acceptance mechanism involving design units, construction units, and supervision units should be established. Through on-site inspections to verify the planting effect and hardscape construction situation, combined with professional technical testing methods to quantitatively evaluate the quality of soil improvement and the operation status of irrigation systems, the acceptance results

should objectively reflect the construction quality.

3. Core Content and Technical Methods of Road Greening Maintenance Management

3.1 Daily Basic Maintenance: Building a Plant Growth Guarantee System

Daily basic maintenance, as the core link to maintain the normal growth of road greening plants and ensure landscape stability, should establish standardized operational procedures centered around "water and fertilizer regulation" and "environmental optimization." In water and fertilizer management, differentiated water and fertilizer supply plans should be formulated by fully considering the soil physicochemical properties of road greening areas and the growth cycle laws of different plants. Water management should adjust the irrigation frequency and method according to seasonal and climatic changes to avoid plant withering due to drought or root rot caused by excessive irrigation. Fertilizer application should be based on the nutritional needs of plants at different growth stages, scientifically combining nitrogen, phosphorus, potassium, and other nutrients, and paying attention to the reasonable combination of base fertilizer and top dressing to enhance plant stress resistance and promote healthy branch and leaf growth through precise fertilization.

Meanwhile, regular soil improvement and weed removal work should be carried out. In response to problems such as soil compaction and poor permeability that are prone to occur in road greening soil, physical loosening methods can be used to improve soil structure and enhance soil water and fertilizer retention capacity. The removal of weeds should follow the principle of early detection, early removal, and make sure to eliminate all weeds manually or mechanically in a timely manner to prevent competition between greening plants for nutrients and water so that greening plants can grow fully spaced apart from each other while maintaining the overall cleanliness and beauty effect of road greening ^[1].

3.2 Specialized Technical Treatments: Optimizing Landscape Morphology and Plant Health

Specialized technical treatment is a widely applicable means of improving greening quality, whose core purpose is to maintain the morphology and health of road greening plants by handling their cultivation. For pruning and shaping work, reasonable pruning time classification and tree-type determination should be carried out based on plant species, growth characteristics and functional requirements of road traffic. For trees, priority should be given to the management of tree heights and crown causal shape and bee; were more than high, causes any occlusion of a passage or normal use of road facilities. Shrubs and hedges should be pruned regularly so that contour lines remain neat, and the continuity of landforms is maintained. In terms of ground cover plants, the height controlling should be properly controlled to prevent overwhelming range and destroy landscape floor structure. When performing pruning, the operation on pruning cuts must be emphasized, and corresponding protection measures should be taken to avoid wound infection and promote rapid healing of plant wounds, so that plants can grow healthily.

Pest and disease control is another important part of specialized technical treatments, following the principle of prevention first and comprehensive management. To do this, we advocate a basic approach that reinforces close monitoring of plant growth conditions, thereby providing the tools to detect symptoms of pests and diseases earlier on than would be normal, followed by physical/biological control methods (i.e., using trapping devices to capture/preserve pests insect natural enemies through encouraging their reproduction to suppress pest development). At the same time, low-toxicity and low-residue chemical agents should be used as little as possible but carefully selected, the dosage and interval of use strictly limited to avoid harm to the surrounding environment and human body health, so that road greening plants can be in a state of health all year round ^[2].

3.3 Dynamic Monitoring and Emergency Management: Ensuring the Stable Operation of the Greening System

The dynamic monitoring and emergency management of road greening are the main measures to deal with sudden situations in road greening and play a crucial role in ensuring the long-term stability of the road greening system. Dynamic monitoring: A dynamic monitoring mechanism needs to be established to regularly inspect the growth status of road greening plants and the integrity of facilities, detailed logging of problems such as abnormal plant growth, landscape damage and facility failure. The rules of occurrence should be sorted out by data analysis to assist decision-making of maintenance management. At the same time, it is necessary to pay attention to extreme weather and human damage in advance, and make early warning plans according to risk prediction and prevention.

Special disposal plans should be made for every one-off situation in emergency management. For example, when subject to heavy rain, strong wind and high or low temperature shock stress stimulated by extreme weather, timely protection measures should be taken (reinforcing and supporting trees in windy places; implementing anti-cold and heat preservation measures for cold intolerant plants; strengthening irrigation and water replenishment in drought-prone areas). For greening damage caused by human-caused destruction and traffic accidents, a rapid response mechanism should be established, and personnel should be organized to carry out repairs in the first time, replacing damaged plants and repairing damaged facilities to minimize the impact on the road greening landscape and ecological functions and ensure the continuous and stable operation of the road greening system.

4. Optimization Strategies for the Construction of Urban Landscape Gardens and the Maintenance Management of Road Greening

4.1 Establishing a Collaborative Mechanism between Construction and Maintenance to Strengthen Full-cycle Linkage

The construction of urban landscape gardens and the maintenance of road greening are not independent links. Breaking the divide between the two, and building a full cycle collaborative mechanism is essential to establishing seamless end-to-end linkages from construction to maintenance. During the first stage planning of project, it should be motivated to have the maintenance team involved in advance where feasible and practical so that maintenance team members can take part in discussions on construction plan design. With experience in long-term maintenance, they can make recommendations for optimizing plant choice and technical parameters for planting design as well as structural design of hardscape materials to prevent the risk of unreasonable design that increases later maintenance difficulty.

A communication mechanism highlighting the construction team and Maintenance team needs to be in place while it is being constructed. Maintenance staff can regularly visit the construction site to understand the progress of the planting (planting), soil treatment, and quality of hardscape construction, quickly find problems that may affect later maintenance and feedback to the construction team for timely adjustment. The ideal handover process is an established one that occurs after completing your project. On the one hand, the construction team shall give abundant technical information about construction to the maintenance team (e.g. varieties of plants, planting period, soil improvement measures and irrigation system layout); on the other hand, do on-site technical disclosure so that those responsible for later maintenance can fully understand these knowledge points and ensure scientific maintenance afterwards.

4.2 Promoting Technological Innovation and Application to Improve Management Efficiency and Quality

New technologies and new materials should be actively introduced in the construction of urban landscape gardens and road greening maintenance management, so as to improve management efficiency and quality through technological empowerment. Digital technologies are applied in the

construction process, such as using BIM technology to conduct three-dimensional modeling of landscape gardens, plan and simulate plant planting effect and structure stability of hardscape facilities, and help to identify design and construction conflict in advance, optimizing project engineering process. With the help of intelligent planting equipment, it is possible to achieve precision hole digging and quantitative fertilization, reducing manual operation errors and improving construction efficiency.

In the maintenance management stage, a smart maintenance system can be introduced. By installing soil moisture sensors, pest and disease monitoring equipment, etc., real-time data on soil moisture, plant growth status, and pest and disease occurrence can be collected. Big data analysis technology can be used to process the data and generate personalized maintenance plans to guide maintenance personnel in carrying out precise irrigation, fertilization, and pest and disease control work, avoiding blind maintenance. Meanwhile, the promotion and use of eco-friendly materials and technologies should be encouraged, such as using biodegradable mulch to inhibit weed growth in road greening maintenance, reducing the use of chemical herbicides, selecting native plant varieties with strong pollution resistance and stress resistance, lowering maintenance costs, and enhancing the ecological stability of the road greening system ^[3].

4.3 Improving the Management System Construction to Strengthen Personnel and Responsibility Control

A sound management system is an important support for ensuring the construction quality of urban landscape gardens and the maintenance effect of road greening. It is necessary to optimize from two aspects: personnel management and responsibility control. In personnel management, a professional talent training mechanism should be established, and construction and maintenance personnel should be regularly organized to participate in professional training, covering the latest construction technologies, maintenance methods, and eco-friendly concepts. At the same time, skill assessments should be carried out, and the assessment results should be linked to job promotion and salary treatment to motivate personnel to improve their professional capabilities.

In terms of responsibility control, it is necessary to clarify the responsible entities for each link of construction and maintenance and establish a clear responsibility system. Construction quality targets and maintenance effect indicators should be decomposed into specific departments and individuals to ensure that all work is carried out by specific people. Meanwhile, a supervision and assessment mechanism should be improved, and a professional supervision team should be organized to regularly inspect and assess the construction quality and maintenance work. Scientific assessment indicators should be formulated, including plant survival rate, landscape integrity rate, and pest and disease control effect. Rewards should be given to outstanding teams and individuals, and those who fail to meet the standards should be held accountable and urged to make rectifications within a time limit. Through strict supervision and assessment, the standardization and standardization of construction and maintenance work should be promoted.

5. Conclusion

In conclusion, the construction of urban landscape gardens and the maintenance management of road greening are long-term projects that run through urban ecological construction and landscape shaping. Their quality and efficiency are directly related to the improvement of the urban human living environment quality and the stability of the ecosystem. Therefore, it is necessary to provide systematic ideas for solving problems such as separation, extensive management, and non-standardization that may exist in current construction and maintenance through multi-dimensional optimization strategies. In the future urban development process, garden landscape construction and road greening maintenance management need to continuously adapt to the new requirements of urban ecological construction and make dynamic adjustments according to actual situations to promote urban landscape gardens and road greening to continuously exert ecological, ornamental, and social benefits and lay a solid ecological foundation for building a more resilient and vibrant modern city.

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