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# Study on Influencing Factors and Control Points of Design Estimate of Landscaping Engineering

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**Abstract:** In recent years, China's landscaping projects have developed vigorously, and the growth rate of urban garden green space areas has been maintained at about 5%. Overall, with the development of the national economy and the support of macro policies, people's demand for close to nature and beautify the environment is gradually increasing, which has brought new growth momentum for the development of the landscaping industry. Simultaneously, from the perspective of future economic development and urban development, the landscaping industry still has a lot of room for development. However, with the rapid development of landscape engineering, the problem of cost control of landscape engineering is becoming more prominent, the phenomenon of budget overestimation is common, and there are many factors affecting the cost of landscape engineering, which brings difficulties and challenges to the analysis of its influencing factors and cost management. How to scientifically analyze the influencing factors and control the cost has become an important link in the landscaping project. To solve the above problems, this paper takes the design stage of landscaping engineering as the background, takes the design estimate of landscaping engineering as the research object, through literature research and data collection, fully excavates the main influencing factors of the design estimate stage of landscaping engineering, analyzes the key points of cost control, and provides reference ideas and directions for the later cost management and control.

**Keywords:** Landscape engineering; Design estimate; Main influencing factors; Cost control

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## 1. Background and significance of the topic

### 1.1. Background of the topic

With the concept of "Jinshan Yinshan" (golden mountains and silver mountains) deeply rooted in people's hearts, China's landscaping projects have experienced vigorous development. People are increasingly focused on the construction of these projects, which not only play a crucial role in social and economic activities but also significantly contribute to economic and cultural development, enriching people's spiritual life. However,

with the rapid development of landscaping projects in China, the problems existing in cost estimation and control also become prominent.

The "three super" phenomenon—namely budget overestimation, budget overruns, and final account overbudget—occurs from time to time. Many uncertain factors affect the construction cost of landscaping projects, including local hydrogeological conditions, regional differences in seedling prices, variations in planting and maintenance practices among construction personnel, extended management and protection periods, and high risks. These factors present difficulties and challenges in analyzing influencing factors and management costs for landscaping projects [1].

To solve the above problems, this paper takes the design stage of landscaping engineering as the background, takes the design estimate of landscaping engineering as the research object, through literature research and data collection, fully excavates the main influencing factors of the cost of landscaping engineering design stage, analyzes the key points of cost control, and provides reference ideas and directions for cost management and control.

## 1.2. Significance of topic selection

Through literature research and data collection, effective method support and theoretical support are provided for the influencing factors and cost control of landscaping engineering in the design stage, which has important theoretical and practical significance as follows [2].

(1) The cost control of landscaping engineering is mainly concentrated in the three stages: design, bidding, and construction. The analysis finds that the impact of the design stage on project cost accounts for about 75%, so the research on the influencing factors and control points of the design stage provides theoretical support and management direction for later project management costs [3].

(2) Scientific analysis of the influencing factors and control methods of landscaping engineering in the design stage is not only conducive to the control of the whole process cost of the project but also conducive to promoting the healthy and rapid development of the industry and promoting stable economic growth.

## 1.3. Main research contents and ideas

The extensive collection, sorting, and analysis of a large number of similar engineering design estimates, statistical analysis, literature research, and historical case analysis are used to excavate and analyze the influencing factors of landscape greening engineering design estimates, to provide the basis for subsequent engineering cost control.

## 1.4. Main research methods adopted

### 1.4.1. Literature research method

The literature research method is a method to collect, identify, and sort out the literature, analyze, and study the referable literature, to understand the objective cognition of the transaction. This paper will use the literature research method to analyze and study the engineering estimation and cost control domestically and internationally, and combined with the research direction of this paper, analyze the influencing factors and control points of the design budget of landscaping engineering [4].

### 1.4.2. Systematic analysis

The systematic analysis method refers to the problem solved as a system, carries out a comprehensive analysis of various elements in the system, and summarizes, and comprehensively understands the characteristics of the

object studied and the rule relationship between them. In the whole research process of this paper, the method of systematic analysis is always used. In the selection process of impact indicators, the factors affecting the design budget of landscaping engineering are listed as many as possible, and then the influencing factors are classified and sorted by the concept of systematic analysis. Finally, the main factors affecting the design budget of landscaping engineering are determined by systematic analysis and other methods followed by forming the index system that affects the cost [5].

### 1.5. Research objectives to be achieved

Through analyzing the design budget estimate and project examples of landscaping engineering, and using statistical analysis, literature research, and other methods, the main factors affecting the design budget estimate of landscaping engineering are dug out, and the control points of the cost of landscaping engineering are analyzed. This provides data support for the budget personnel engaged in landscaping engineering and provides ideas and directions for the early decision-making and cost management of landscaping engineering.

## 2. Related concepts of design estimates

### 2.1. Basic concept of design estimate

The design estimate is an important part of the design document. It is a document prepared by the design unit based on the preliminary design (expansion preliminary design) drawings, budget quota (budget estimate index), cost quota, and budget price of equipment and materials in the construction area from preparation to completion and delivery of all costs [6].

### 2.2. Contents of the design estimate

The design budget estimate can be divided into three levels: unit project budget estimate, comprehensive budget estimate of a single project, and total budget estimate of the construction project [7].

#### 2.2.1. Unit project budget

The unit project refers to a project with relatively independent construction conditions, it is a component of a single project. The budget estimate of a unit project is generally composed of budget estimate quota or budget quota group price. From the perspective of cost composition, it can be divided into labor costs, materials costs, machinery costs, enterprise management fees, profits, and so on. It is the basic unit that constitutes the design estimate [8].

#### 2.2.2. Budget estimate of a single project

The “single project” refers to a project with independent design documents, which has a certain production capacity or is put into operation after completion. It is an integral part of the construction project.

The comprehensive budget estimate document of a single project generally includes a preparation description, a comprehensive budget estimate table, and a unit project budget estimate table. The contents include the budget estimate of the construction project, the budget estimate of the equipment and installation project, and other costs of the construction project.

#### 2.2.3. Total budget estimate of the construction project

A construction project is the sum of one or more individual projects that are built according to a master plan or design.

The contents of the preparation of the total budget estimate of the project include the preparation description, the total budget estimate table, the comprehensive budget estimate table of a single project, the other cost estimate table, and the summary table of the main construction equipment and materials. The main contents are engineering expenses, other expenses of engineering construction, reserve expenses, interest on construction loans, and working capital.

### 2.3. Principles and basis for the preparation of design budget estimates

The principles and basis for the preparation of the design budget estimate are as follows [9].

(1) Laws, regulations, and provisions of the state, industry, and local government on construction and cost management.

(2) Relevant documents and fee information, including the following.

(i) Preliminary design or expansion of preliminary design drawings, design specifications, equipment lists, and material lists.

(ii) The approved construction project design plan (or the approved feasibility study report) and the relevant provisions of the competent authorities.

(iii) the current budget estimates and budget quotas of the state or provinces, cities, and autonomous regions.

(iv) Labor wage standards, material prices, construction machinery class prices, standard equipment, and non-standard equipment price information, the current equipment price and transportation and miscellaneous costs, and all kinds of cost information and indexes in the construction project area.

(v) Other information involved in the project.

(3) Construction site information, including the following.

(i) Construction site, terrain, local project construction, and construction costs.

(ii) Natural conditions such as climate, hydrology, geology, and geomorphology of the area where the project is located.

(iii) Other information involved in the project.

## 3. Analysis of influencing factors and control points of design budget of landscaping engineering

### 3.1. Analysis of influencing factors of landscaping engineering design budget

Currently, the budget estimate of landscaping engineering design is based on the budget quota, which is analyzed to determine the overall budget. According to the content of "Code for Calculation of Engineering Quantity of Landscaping Engineering," combined with the method of engineering quantity list, it can be divided into earth and rock engineering, greening engineering, garden road and bridge engineering, garden landscape engineering, installation engineering, etc. The construction content of landscaping engineering is diverse, the budget subitems are more and do not repeat each other, and the setting of sub-purposes can cover the whole project content [10]. In this paper, the analysis principle of influencing factors is illustrated by taking pavement subitems and greening subitems of garden road as examples.

#### 3.1.1. Analysis of influencing factors of the subhead of pavement budget

The subproject cost of garden road pavement accounts for about 20% to 40% of the cost of the entire landscaping project, of which the grass-roots approach of pavement subproject and the choice of surface paving material will affect the project cost.

Different load requirements directly affect the selection of material and thickness of the garden base. To prevent road damage and reduce the maintenance cost in the later period, a reinforced concrete cushion layer is usually added to the road base based on pond slag backfilling. For non-motor vehicle pavement, because of its small bearing capacity, usually adds gravel cushion or plain concrete cushion after plain soil backfill. Under the condition of satisfying the load, reducing the thickness of the base appropriately will reduce the cost.

Using the base of a park road in Shijiazhuang as an example, during the preliminary design estimate stage, the base design included 300 mm thick graded gravel and 180 mm thick plain concrete. The cost for one square meter of the base was 146.2 yuan. In the later stage, the designer optimized the construction drawings, adjusting the base to 200 mm thick gray soil (3:7 ratio) and 150 mm thick plain concrete. The cost for one square meter of the base was 112.64 yuan. With a park area of 9,016 $m^2$, this adjustment reduced the total cost by 302,600 yuan. For example, the comprehensive unit price of plain soil backfill is 17 yuan/$m^3$, while the comprehensive unit price for pond slag backfill is 68 yuan/$m^3$. This results in a difference of 51 yuan/$m^3$. Therefore, the choice of material and thickness of the garden road base is a major factor affecting the cost of paving in landscape greening projects [11].

Different surface materials and thicknesses have a direct impact on the price of surface materials. The material cost of square bricks and embedded grass bricks is lower than that of granite. For the same type of material, the cost of the surface layer increases with thickness. For example, for granite with a thickness of less than 80 mm, and with other parameters unchanged, every 10 mm increase in thickness results in a 10% to 30% rise in material cost.

Using Wenjingshan Park as an example, granite was used for the pavement and parking lot in the preliminary design stage, with a cost of 380 yuan/$m^2$. In the construction drawing stage, designers incorporated the concept of a sponge city, changing the parking lot pavement to inlaid grass bricks and the sidewalk to permeable concrete. Both inlaid grass bricks and permeable concrete are effective 9garden pavement materials that are permeable and breathable, which can reduce the burden on urban drainage systems, and they have lower costs. The sidewalk area in Wenjingshan Park is 49,412 $m^2$, and the parking lot area is 3,440 $m^2$. The total cost for paving with granite is 18,601,400 yuan. In contrast, using permeable concrete and inlaid grass bricks results in a total cost of 11,489,800 yuan, leading to savings of 7,111,600 yuan in construction funds [12]. The factors influencing pavement engineering characteristics include the base material and thickness, surface material thickness, and the area of the garden road.

### 3.1.2. Analysis of influencing factors in greening budget

Greening engineering is a core component of landscaping projects, and the types and specifications of seedlings used in greening subitems can significantly affect the cost [13].

Seedling varieties in landscaping projects can be categorized into trees, shrubs, flowers, lawns, etc., and the costs of these seedlings vary significantly. For example, large trees generally cost over 1,000 yuan each, with prices potentially reaching nearly 10,000 yuan. Small shrubs, such as hibiscus trees, are priced at around 100 yuan each, typically between 30 to 100 yuan. When selecting seedling varieties, it is important to consider aesthetics, achieve the desired effect, and manage costs effectively.

Within the same seedling variety, prices can differ based on specifications. For trees, the diameter at breast height (DBH) is a key factor affecting cost. For instance, when the DBH exceeds 40 cm, each additional 5 cm can increase the price by about 30%. For example, a Fadong tree with a 25cm DBH costs approximately 3,600 yuan, while a tree with a 40 cm DBH can cost around 10,000 yuan.

Additionally, the cost of maintaining seedlings varies with different aintenance periods. For instance, the

annual management fee for trees with a DBH below 80 cm is 39.52 yuan per plant. Extending the maintenance period to two years increases the cost to 79.04 yuan per plant. Thus, each additional year of maintenance adds 39.52 yuan to the cost per plant.

In summary, the key influencing factors for greening engineering costs are seedling varieties, seedling specifications, maintenance cycles, and seedling quantity. Other budget subitems in landscaping projects are influenced by similar factors and will not be repeated here.

### 3.2. Analysis of key points of cost control of landscaping engineering during the design stage

To effectively manage the cost of landscaping engineering, it is important to analyze the influencing factors in the design and identify key points for cost control. Currently, the main aspects of cost control during the design stage of landscaping engineering include limit design and life cycle cost analysis.

#### 3.2.1. Limit design

The quota design of a landscaping project is to complete the design to meet the function of garden construction under a certain investment quota. It divides the investment quota and engineering quantity into each unit project and division project and strictly controls the allocation quota. Investment decomposition and engineering quantity control are the basic means of quota design. The main measure of the quota in the design is to control the engineering quantity of the design content and to choose the scheme according to the influence factors analyzed above, which can effectively control the project cost [14].

#### 3.2.2. Life cycle cost analysis

The life cycle cost analysis of landscape engineering refers to the process of selecting the best design scheme through the in-depth analysis of the start-up cost, construction cost, and late operation and maintenance cost of different schemes of landscape projects [15].

## 4. Conclusion

Combining the characteristics of complex construction content and diversified quota subitems, this paper analyzes the landscaping project based on the design estimate and engineering quantity calculation standard of the landscaping project and obtains the main influencing factors and control points that affect the design estimate of the landscaping project by typical case analysis. The main conclusions are as follows.

(1) Taking the design estimate of landscaping engineering as the research object, through literature collection and data analysis, the main influencing factors affecting the pricing unit with research value are finally determined.

(2) According to the excavated main factors affecting the design budget estimate and the analysis of a large number of historical cases, the control points of the design budget estimate of landscaping engineering are obtained. It provides the theoretical direction for pre-project decision-making and cost control.

## Disclosure statement

The authors declare no conflict of interest.

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