Research on Forecasting Technology of Single Base Tower Cost in Transmission Line Engineering

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Abstract. For a long time, the overhead transmission line project budget, completion settlement and financial final accounts are all valued according to the entire line. The project construction management and asset collection have not yet been refined. The management is not separately calculated according to the actual investment of different towers, and cannot be reflected in each base tower. The actual cost level and the accuracy of the cost need to be further improved. Therefore, this paper combines the actual pain points and difficulties of overhead line engineering cost management, and innovatively builds a pricing model based on a single base tower. When the company strengthens the construction drawing budget management, improves the project settlement level, accurately controls risks, and realizes high-quality management of cost management. The level of leanness is of great practical significance.

1. Introduction

With the development of economy and society, the development of power grid enterprises faces a new form, and investment management faces new requirements. It is urgent to implement a precise investment strategy for power grids to comprehensively improve the efficiency and efficiency level [1]. At the same time, in the context of power system reform, the power grid Enterprises will face cash flow reduction, investment capacity weakened, and grid investment is subject to government control, so investment accuracy needs to be further improved [2]. The overhead transmission line project is a type of engineering with long space continuity. It is affected by factors such as topography, geology, meteorology and transportation conditions. The actual value between tower and tower is very different [3-4]. In the current industry standards, whether it is the "Power System Construction Budgeting and Calculation Regulations (2013 Edition)" or "DL/T5205-2011 Power Construction Engineering Quantity List Pricing Specification-Transmission Line", it cannot solve the single-base of overhead transmission line engineering[5]. The problem of distinguishing tower unit values. Therefore, how to determine the actual value of the tower unit and calculate the value of each base tower requires an urgent study of the pricing method in the single base tower mode.
2. Analysis of the status quo and problems of overhead line pricing

2.1. Existing pricing model for overhead lines

From the perspective of the formation of engineering cost, the overhead line engineering body is divided into basic engineering, pole tower engineering, grounding engineering, wiring engineering, accessory engineering and auxiliary engineering according to the unit project, based on the cost of the sub-project of each unit project. In combination with quotas, pre-regulations, standards, and policy documents, certain scientific pricing methods are used for pricing, and the total cost of overhead line projects is formed by combining the cumulative stacking of different cost types [6].

Combined with the actual situation of the current overhead line engineering pricing, the main factors that constitute the cost include “quantity”, “price” and “fee”. That is, all the engineering quantities required for the completion of the project, the required quota system, the price of equipment materials, and the rates of fees for different regions and different conditions. Combined with the different stages of project cost, the pricing model is mainly adopted in the design stage (feasibility study estimation, preliminary design budget calculation, construction drawing budget stage), and the list pricing model is mainly adopted in the bidding stage and construction stage.

2.2. Analysis of the valuation of overhead line pricing

At present, the overhead line engineering pricing system relies on the 2013 version of the pre-regulation and quota system. With the passage of time, new technologies, new materials and new processes are continuously applied in the project, and the precision, refinement and precision of the cost control are continuously deepened. The applicability and accuracy of the overhead line engineering pricing system will gradually fail to meet the needs of the construction and management of overhead line projects in the new era.

(1) Applicability of pricing quota

With the continuous development of overhead line engineering construction technology, new technologies, new materials and new processes are continuously applied in overhead line engineering. The construction organization design, construction methods and construction techniques in the existing overhead line engineering pricing system are to some extent. It has been out of touch with the actual construction process, and the relatively lagging pricing system can no longer meet the needs of overhead line engineering cost management.

(2) Accuracy of the pricing system

The process of completion and settlement of overhead line project mainly depends on the bill of quantities calculation. According to the specific requirements of the contract, the unit implementation price is measured and valued by the unit price or total price model. The progress payment is paid according to the contract, and finally the completion settlement is carried out. The basis of the compilation of the engineering quantity list pricing and the construction drawing budget, the terrain ratio of the construction drawing budget, geological conditions, transportation distance and other parameters directly affect the comprehensive unit price of the project quantity list. Therefore, the pricing process in the settlement stage and the quality of the construction drawing budget are directly related. Controlling the basic parameters of the project is the key and key to control the settlement costs.

(3) Real-time performance of the pricing system

The overhead line engineering price mainly includes the fixed base price and the unit price of equipment materials. The current unit price of the device material is based on the information price of the State Grid. The price level has a certain lag with the actual market level. In some projects, the material cost is excessive. The pricing system cannot change in real time in response to market volatility.
3. Construction of single base tower pricing system

3.1. Single base tower pricing system construction framework
In this paper, the transportation parameters and terrain ratio parameters of overhead line engineering are taken as the entry point, and the transportation parameters and terrain ratio are transferred from the perspective of the whole project to the single base tower, the main engineering quantities such as excavation, foundation, group tower, grounding, insulation and metal string. The material fee and the installation fee can be attributed to the single-base tower naturally. The cost of the line and the cost of the fittings in the file can be collected and collected in a distributed manner, and the cost of the single base and the cost of the share are aggregated to form a “oriented "innovation system for the pricing model of overhead transmission lines".

The innovative system of the overhead line engineering pricing model for “pole tower” can distinguish the cost difference between different towers of the whole project, better realize the collection of asset values, and better clarify the value difference between different towers, which is an overhead line. The innovative model of engineering pricing provides a basis for the precise management of overhead line engineering assets.

3.2. Construction of single base tower pricing system
The cost structure of the overhead line engineering pricing model for “pole tower” is basically the same as the cost structure of the traditional construction budget. The difference is that in the form of expression, the former is represented by a single base tower, which represents the cost of each base tower. Expressed as the cost of a single project.

In the project division, the basic engineering of overhead transmission line engineering, pole tower engineering, grounding engineering, accessory engineering, insulator string, jumper string production and installation, heavy hammer, pressure equalizing ring, clamp installation, auxiliary engineering, slope protection, retaining wall, the drainage ditch and the basic permanent cofferdam can calculate the body cost according to each base tower; the transportation cost and comprehensive terrain increase fee of these unit projects can also be calculated on a base-to-base basis. In the wire-laying project and the attachment project, the shock-proof hammer and the spacer bar calculate the single-base cost according to the apportionment method.

The evaluation layer of the overhead line engineering pricing model for “rocket tower” mainly specifies the calculation method of the cost. The research group proposes the method according to the cost collection, according to the actual calculation and the number of towers. The equipment material according to the actual calculation can be directly attributed to the single base tower and directly calculated according to the actual value of the equipment materials. The calculation of the number of towers is based on the fact that the equipment materials that cannot be directly attributed to the single base tower and their installation costs are evenly distributed by the number of towers. The weighted average calculation refers to the calculation of the collection of the costs that cannot be directly attributed to the single base tower according to the weight between the different towers in a weighted average manner.

3.3. Single base tower pricing application case
The line project of a certain place is newly built with a total length of 2.7kM (overhead 2.5kM, cable 0.2kM). The terrain ratio is 100% in the hills, and the geological division is 40% for rocks, 50% for loose sands, and 10% for ordinary soils.

The construction simulation of the example project, the main parameters of the measured project are shown in the following table. The price of the quota and equipment materials used in the study is the same as that of the existing pricing system.
Table 1. sample data.

| Serial number | Tower type     | Human transport (km) | Car transport (km) | terrain |
|---------------|----------------|----------------------|--------------------|---------|
| 1             | 1GGD2_24       | 0.45                 |                    | hills   |
| 2             | 1GGD2_33       | 0.4                  |                    | hills   |
| 3             | 1D2-SJC2/23    | 0.4                  |                    | hills   |
| 4             | 1D2-SJC2/20    | 0.5                  |                    | hills   |
| 5             | 1D2-SJC3/24    | 0.24                 |                    | hills   |
| 6             | 1D2-SJC4/18    | 0.35                 |                    | hills   |
| 7             | 1D2-SJC4/22    | 0.3                  |                    | hills   |
| 8             | 1D2-SJC4/26    | 0.15                 |                    | hills   |

(1) Cost calculations that cannot be directly attributed to a single base tower
1) Wire-laying project: The cost of the overhead line project under the existing pricing system is 61,142.00 yuan.
2) Attachment project: For the cost of the installation of the anti-vibration hammer, refer to the 13 version of the fixed terrain increase factor table. The attachment project hill terrain increase factor is 5% and the mountain increase coefficient is 20%. The proportion of hilly terrain in the example project is 5%*6/(5%*6+2*20%)=43%, and the proportion of mountain topography is 2*20%/(5%*6+2*20%)= 57%.

(2) Cost calculation directly attributable to a single tower
The cost of calculating the 1# tower is shown in the table below.
Table 2. Cost of 1# tower

| Serial number | Project or expense name                        | Calculation method                                                                 | Amount of expenses (yuan) |
|---------------|-----------------------------------------------|-----------------------------------------------------------------------------------|--------------------------|
| 1             | Basic engineering                            | Calculated by calculation                                                         | 22.0358                  |
| 2             | Tower engineering                            | Calculated by calculation                                                         | 14.8145                  |
| 3             | Grounding engineering                        | Calculated by calculation                                                         | 1.1725                   |
| 4             | Attachment engineering                       | Materials and fittings that can be directly attributed to a single base tower are calculated on a real basis | 3.0119                   |
| 5             | Auxiliary engineering                        | Materials that cannot be directly attributed to a single base tower are calculated according to the terrain of the tower | 0.0831                   |
| 6             | Calculated by calculation                    | Calculated by calculation                                                         | 0.1354                   |
| total         |                                               |                                                                                   | 41.2532                  |

Similarly, the single base cost of other towers can be calculated, as summarized in the table below.
Table 3. Budget investment under the innovative pricing model.

| Serial number | Tower type      | Amount of expenses (yuan) |
|---------------|-----------------|---------------------------|
| 1             | 1GGD2_24        | 41.2532                   |
| 2             | 1GGD2_33        | 38.3352                   |
| 3             | 1D2-SJC2/23     | 45.3531                   |
| 4             | 1D2-SJC2/20     | 44.3221                   |
| 5             | 1D2-SJC3/24     | 48.6553                   |
| 6             | 1D2-SJC4/18     | 44.2312                   |
| 7             | 1D2-SJC4/22     | 36.8432                   |
| 8             | 1D2-SJC4/26     | 31.5835                   |
| total         |                 | 330.5768                  |

Compared with the existing pricing system, the accuracy of the ontology investment of the innovative pricing system is increased, and the accuracy ratio is increased by 4.06%.

4. Conclusion
Although the single-base tower pricing method will increase the working time of preparation, review and evaluation to a certain extent, with the improvement of the cost software and the skilled application of relevant personnel, the compilation efficiency can be further improved. Moreover, the depth of the single-base budget is more detailed and closer to the actual situation of the project, which helps to strengthen the cost management of infrastructure projects, standardize the management process, refine the management system, effectively control the project cost, improve the investment efficiency, and promote the scientific management of infrastructure projects. Standardization.

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