Analysis and Simulation Demonstration of Pricing Rules for Construction Projects

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Abstract: By comparing the characteristics of domestic and foreign construction project bidding transaction pricing rules, this paper analyzes the weakness of the current domestic construction project list pricing model. Combined with the national construction project pricing reform direction, this paper puts forward the bidding control price pricing model based on the market price, and takes the actual construction project as the blueprint for simulation and quantitative checking. It is found that the pricing data is closer to the winning price, which verifies the rationality of pricing.

Keywords: Construction bidding. Pricing mode. Quantitative verification.

1 Instructions

The document on printing and distributing the work plan for project cost reform (jbb [2020] No. 38) issued by the general office of the Ministry of housing and urban rural development on July 24, 2020 mentioned that the pricing basis such as budget quota could not meet the needs of the market, and the cost formation mechanism was not scientific enough. The document puts forward the general idea of reform "implement the engineering pricing method of list measurement, market inquiry, independent quotation and competitive pricing, and further improve the formation mechanism of engineering cost market." It is clear to improve the engineering measurement and pricing rules from "revising the engineering quantity calculation specifications, unifying the engineering project division, feature description, measurement rules and calculation caliber, revising the engineering bill of quantities pricing specifications, and unifying the engineering cost composition and pricing rules". The core reform of the document is to cancel the maximum price pricing mode of issuing budget quota and quota pricing, and the pricing basis is formed by the market.

On December 23, 2020, the Department of construction of Zhejiang Province issued the opinions on the implementation of project cost reform in Zhejiang Province, and decided to carry out the cost reform pilot work of "canceling the maximum bidding price and pricing according to quota" in Zhoushan, Jinhua and Jiaxing. This work will innovate the market formation mechanism and the project cost database, determine the project cost in combination

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with the market situation or the market inquiry method, reform the cost basis, and explore the market inquiry mechanism to form the bidding control price.

This paper intends to compare the valuation models of construction projects at home and abroad, demonstrate the feasibility of market price method, and analyze the development trend of domestic valuation model.

2 Current situation of domestic pricing mode

The current pricing mode of China's construction system is the list pricing mode, and the pricing basis is the industry budget quota issued by the government. The bill of quantities refers to the code for valuation with bill of quantities of Construction Engineering (gb50500-2013) and the code for calculation of quantities of building construction and Decoration Engineering (gb50854-2013). The bill of quantities (BQ) originates from the service of product (subject matter) subdivision and measurement provided by quantity surveyors for the construction unit of construction products. All bidders shall bid based on the product (subject matter), make the bidding quotation comparable in market bidding and systematic in segment transaction on the basis of unified products (subject matter).

The state stipulates that for all large and medium-sized construction projects invested by state-owned funds or mainly invested by state-owned funds, it is required to implement the code for valuation of bill of quantities of construction projects, and quote in the form of bill of quantities. As a national standard, the bill of quantities pricing specification itself has mandatory requirements, which makes a unified agreement on the measurement rules and work contents in the bill of quantities. The bidding quotation of "safe and civilized construction measures, fees and taxes" shall not be used as competitive expenses, and the quotation shall be strictly made according to the provisions of the competent construction department. The implementation of the bill of quantities has objectively played a phased role in promoting the development of China's construction trading market. However, at present, the industry quota prepared by the government is still the basis for the owner's investment estimation, design estimate and bidding control price, and it is also the basis for the bidder's bidding quotation; Moreover, the measurement units between the sub items of the bill of quantities and the consumption quota are not unified, the calculation rules of the quantities are not unified, and the list does not realize the comprehensive unit price of the whole cost, so that the setting of the sub items of the bill of quantities at this stage is inconsistent with the rules of the building element trading market, and the flexibility of the sub items of the bill of quantities is low; The construction transaction price is distorted, resulting in prominent settlement contradictions.

3 Current situation of foreign pricing mode

At present, there are three types of international project cost pricing models: "quantity measurement model" mainly represents Hong Kong and the United Kingdom, "system decomposition model" mainly represents the United States, "project accumulation model" mainly represents Japan [5].

3.1 UK construction market pricing model

There is no quota issued by government departments in the UK. It carries out the preparation of bill of quantities and cost control according to the price information and cost index issued by relevant institutions and in combination with the national unified rules for the calculation of quantities. Internationally, the most widely used and highly recognized work quantity calculation rules are the standard measurement rules for Construction Engineering (SMM) jointly formulated and issued by the Royal Institute of Surveyors RICS and the British Federation of construction employers. Its project pricing bidding mode adopts the free mode, and the calculation rules of quantities are unified, but the price quota is not unified when the bid inviter adopts bill of quantities pricing [2], it will provide the bill of quantities of the whole project as a part of the bidding document and as the basis for the Contractor's bidding quotation, and the market price is the basis for the Contractor's price combination [1]. Therefore, both sides of construction transaction pay special attention to the sorting and accumulation of experience data of completed projects and the construction of construction product database to facilitate transaction evaluation.

3.2 Pricing model of American construction market

The construction resource trading market in the United States is highly developed, and its construction project quotation does not have the unified engineering quantity calculation rules and quota of the government, but it has a unified coding system for building elements to facilitate information collection and trading. The project cost valuation in the United States is mainly based on the consumption per unit building area formulated by various consulting institutions. The base price and cost estimation are determined by the contractor and the employer through market transactions. The cost of labor, materials and machinery can not only reflect the Contractor's construction technology level, but also reflect the Contractor's organization optimization of the construction process, that is, its various costs reflect the Contractor's competitiveness. More importantly, the cost information has a great reference value for subsequent project valuation. This form of quotation is more conducive to the accumulation of historical data, and the price in the pricing Manual issued by industry associations in several regions every year is also this form.

3.3 Japanese construction market pricing model

The project pricing in Japan adopts the mode similar to the bill of quantities. The workload and comprehensive unit price are separated from each other. The government department formulates the pricing quota, and the price is adjusted and determined according to the market. The project cost management in Japan is similar to the quota charging method in China, and the premise of project pricing is to determine the quantities. The construction province formulates a complete set of engineering valuation standards, such as construction engineering accumulation benchmark and civil engineering accumulation benchmark. For all projects, the construction accumulation personnel generally calculate the quantities according to this rule. The quantities calculation business is based on the design drawings and design documents, and the quantities are investigated, recorded and totaled. The economic survey society and the construction price survey society, which are subordinate to Japan's official institutions, are specially responsible for investigating various relevant economic data and indicators [4]. The Survey Committee is also entrusted to investigate the "building quantity accumulation benchmark" used by the

government, that is, to investigate the quota of civil engineering, construction, electrical and equipment engineering and the actual situation of various funds, and to report the project price, material price, printing fee, transportation fee and labor fee of various building materials in the market [3].

4 Experimental simulation

This paper takes the reconstruction project of Jintang storage and transportation base as the object, takes the market transaction price of production factors as the basis, combines the market factor method, empirical statistics method, case index method and other methods to compile the cost, and compares and analyzes the calculation results with the traditional quota pricing method as follows:

4.1 Market price survey

According to the actual trading habits, the price of manual labor (with auxiliary machinery) shall be determined through inquiry for masonry team (masonry, concrete pouring and tamping), reinforcement worker, scaffolder (outer frame) and carpenter; Including: masonry team: ¥ 130 Per sqm, steel worker: ¥ 1500 Per ton, scaffolder (outer frame): ¥20 Per sqm, Carpenter: ¥ 90 Per sqm, all of which are calculated according to the building area; Decoration labor is calculated according to the market price.

According to the actual cost information of Jinhua building block, the rest is included in the actual cost information of Jinhua building block according to the actual cost information of Jinhua building block, and the rest is included in the actual cost information of Jinhua building block according to the actual cost information of Jinhua building block;

The self-contained machinery of the team is included in the labor cost, and the tower crane and material hoist are included in the market price.

4.2 Cost rate setting

Quota basis: according to the valuation basis of construction projects in Zhejiang Province, the enterprise management fee is calculated by 16.57% of housing construction projects and the profit is calculated by 8.1%; The basic cost of safe and civilized construction of urban projects is calculated at 9.52%, and the additional cost of standardized construction site is calculated at 1.54% of the municipal standardized construction site standard; The fees are calculated at 12.89% (50% of the standard); The tax is calculated at 9%;

Market Research: according to the investigation and statistics of case indicators, the enterprise management fee is calculated at 5%, the profit is calculated at 3%, and the fee is calculated at 2%; The basic cost of safe and civilized construction is calculated at 2.2%, and the additional cost of standardized construction site is calculated at 0.5%; The tax is calculated at 9%.

4.3 Cost data comparison

The bidding control price of the project is calculated as 24.372 million yuan according to the current quota pricing method and 23.369 million yuan according to the market price. The project was opened in March 2022, with 15 bidders. After evaluation, the bid price was 23.1987 million.

The data shows that the market price is closer to the winning price than the quota pricing, which is in line with the reality. See Table 1-6 for details.

Table 1: Cost quota method

name	Amount of quota method (Unit: ¥10000)	Proportion of total cost
Direct fee	1967.98	
artificial	515.06	21.13%
Material Science	1389.33	57.01%
Mechanics	63.59	2.61%

Table2: Cost market method

name	Market price amount (Unit: ¥10000)	Proportion of total cost
Total cost	2336.91	
Cost of divisional and subdivisional works	1860.73	79.62%
measure cost	283.22	12.12%
Taxes	192.96	8.26%

Table3: Direct cost quota method

name	Amount of quota method (Unit: ¥10000)	Proportion of total cost
Total cost	2437.20	
Cost of divisional and subdivisional works	1978.52	81.18%
measure cost	257.44	10.56%
Taxes	201.24	8.26%

Table4: Direct cost market method

name	Market price amount (Unit: ¥10000)	Proportion of total cost
Direct fee	1907.21	
artificial	655.94	28.07%
Material Science	1179.62	50.48%
Mechanics	71.65	3.07%

Table 5: Administrative expenses quota method

name	Amount of quota method (Unit: ¥10000)	Proportion of total cost
Enterprise management fee	94.12	3.86%
profit	46.43	1.91%
Fees	70.32	2.89%

Table 6: Administrative expenses market method

name	Market price amount (Unit: ¥10000)	Proportion of total cost
Enterprise management fee	91.76	3.93%
profit	57.21	2.45%
Fees	36.36	1.56%

4.4 Cause analysis of difference

The cost of masonry works is about 390000 yuan according to the quota method and 98000 yuan according to the market price, which is 60% higher than the quota method. The main reason is that the labor cost of masonry is higher than the quota.

The cost of reinforcement works is about 140000 yuan according to the quota method and 300000 yuan according to the market price, which is 53% higher than the quota method. The main reason is that the project is of brick concrete structure, with low reinforcement content and high labor cost.

The cost of decoration works is about 1.38 million according to the quota method and about 950000 according to the market price, which is 30% higher than the quota method. The main reason is that the labor cost of masonry is higher than the quota.

The cost of the measure project is about 2.29 million according to the quota method and about 2.65 million according to the market price, which is 14% higher than the quota price. The main reason is that the unit price of scaffold and formwork is higher than the fixed price.

5 Conclusions

The method of preparing bidding control price based on market factor price has the advantages of accurate data, flexible form and timely reflecting market changes; The disadvantage of this method is that there are few market data for special and advanced projects.

The empirical simulation shows that the current pricing basis can adjust the list pricing rules in combination with the market trading habits. The adjustment includes the consolidation or splitting of the items listed in the list, the inclusion of the description of the characteristics of the list into the content of labor subcontracting, the lease form of revolving materials, the market unit price of factor prices, and the market subcontracting data of consumption.

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