# TECHNICAL PROPOSAL BASED COST REDUCTION BIDDING SYSTEM FOR SUPPLYING AFFODABLE HOUSING

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**ABSTRACT:**, Best value is the ultimate goal of the owner and can thus have diverse meanings according to the project characteristic, owner's purpose, user groups' payment capability, etc.. Recently, resettlement problems of the marginalized members in the urban regeneration area have been issued in Korea because they have no capability to purchase (or lease) redeveloped housing (or apartment). It means that a minimized production cost for reducing supply price of housing is a key factor in establishing the best value of the marginalized members. The lowest-price bidding system serves the purpose of ensuring a minimized production cost, but due to the low-cost investments, it creates various problems, such as sloppy construction, lowered quality, an increased LCC, and worsening profitability for builders. Thus, to help them resettle, it is necessary to supply affordable housing geared towards a certain appropriate quality and minimum construction costs. Towards this end, this study aimed to propose a cost reduction bidding system based on a technical proposal. The proposed technical-proposal-based cost reduction bidding system consists of the following components: work-unit-based, project-unit-based, and construction-period-reducing technical proposals. These components are evaluated to select the best bidder for a given project. The technical proposal based cost reduction bidding system proposed herein is expected to provide facilities with appropriate supply prices and appropriate quality levels, to bolster the technological competitiveness of builders.

*Keywords: Urban Regeneration, Bidding System, Affordable Housing, Technical Proposal*

## 1. INTRODUCTION

Since recently, Korea has been undergoing an urban regeneration process, especially in impoverished areas with dilapidated urban infrastructures. In this process of redevelopment, the marginalized, including the low-income people and the poor urban citizens, are not financially capable of resettling, thereby creating a social issue. Thus, to make it feasible for such marginalized members to acquire or rent their houses in this process of urban regeneration, it is necessary to develop an integrated housing technology geared towards cost reduction, ranging from design to production, supply, management, and operation.

As part of the methods for supplying affordable housing to help the marginalized people resettle, this study proposed a cost reduction bidding system aimed at reducing the production cost of housing at the stage of ordering and bidding, and meeting an appropriate quality.

The lowest price bidding system serves the purpose of ensuring a minimized production cost and supply price of housing, but due to the dump bid prices, it creates various problems, such as sloppy construction, lowered quality, an increased LCC, and worsening profitability for builders. Due to these problems, the concept of a bidding system is increasingly shifting from the lowest-price concept to the best value concept.

Best value means the owner's (user's) ultimate goal or value and can thus have diverse meanings according to the owners' purposes, the user groups' characteristics (e.g., payment capability), etc.

For instance, the best value will be differently defined according to the housing supply types (lease or sale). In the case of lease, the reduction of the maintenance costs is a key factor in the establishment of the best value on the part of the owners, and in the case of sale, the reduction of the construction costs is a key factor in the same.

Moreover, in line with the user groups' characteristics, in the case of low-income people with a limited payment capability, it is a key factor in establishing the best value to ensure an appropriate level of quality and to minimize the construction costs. On the other hand, in the case of high-income people, it is a key factor in establishing the best value to ensure an enhanced quality through the use of premium finishing materials, eco-friendly materials, etc.

As mentioned above, this study targeted the marginalized members of the Korean society who, in the process of urban regeneration, have difficulty resettling due to their limited payment capability. Thus, to help them resettle, it is necessary to supply affordable housing

geared towards a certain appropriate quality and minimum construction costs.

Towards this end, this study aimed to propose a cost reduction bidding system based on a technical proposal. The proposed technical-proposal-based cost reduction bidding system consists of the following components: work-unit-based, project-unit-based, and construction-period-reducing technical proposals. These components are evaluated to select the best bidder for a given project.

It aims to ensure construction cost reduction and construction period reducing, thereby reducing the owner's administrative and financial costs and maintaining a minimum appropriate quality level.

The technical proposal based cost reduction bidding system proposed herein is expected to provide facilities with appropriate supply prices and appropriate quality levels, to bolster the technological competitiveness of builders.

## 2. A REVIEW OF THE BIDDING SYSTEM

In this study, a construction bidding system geared towards the lowest prices, the best value, and cost plus time was examined. It presents a concept of a technical-proposal-based cost reduction bidding system.

### 2.1 Lowest Price Bidding System

The lowest-price bidding system, geared towards the market economy principle, can be said to best serve the purpose of minimizing the production cost of multi-family housing in terms of prices. The lowest-price bidding system determined the best-preferred bidder by reviewing the adequacy of the lowest-price bidder's bid price, with the aim of selecting the lowest-qualified bidder.

In Korea, however, although bid prices are reviewed for their adequacy, dump bid prices continue to lead to sloppy construction, low quality, and worsening profitability for builders. This, in turn, creates various problems, such as losses on the part of the subcontractors and product suppliers.

According to a survey conducted by CERIK [1], 50% of the respondents (43 of 87 respondents) said that they won orders at a cost below the site execution budget, and 27% (24 respondents) said that they incurred an over 10% loss compared with the contract price.

The problem with the lowest price bidding system is that bidders win projects even at a cost below the execution budget. This means that a proper review of the adequacy of bid prices is not being conducted to prevent wildly low-price bids.

To address these problems in the lowest-price bidding system, measures are required to prevent wildly low bid prices. One such measure involves the review of the adequacy of the technical proposal based bid prices.

### 2.2 Best Value

Best value is defined as the owner's ideal goal or value, and the best value in the procurement policy is defined in two ways: (1) to ensure a maximum holistic profit of an output procured by the government as the owner requires; and (2) to minimize the owner's total cost in association with the whole life cycle [2].

Table 1 shows an outline of the best-value-oriented bidding systems of related agencies in various nations.

**Table 1.** Outline of Best Value Bidding Systems

| Agency | Best-Bidder Selection Procedure | Evaluation Items |
|---|---|---|
| UK HM Treasury | ▪ 1st step (selection)<br>-Select 3-4 proposers.<br>▪ 2nd step (awarding)<br>-Multiply a score by the quality criteria by weighted value, and add the scores to determine a quality score.<br>▪ Selection method of the bidder (example)<br>-Quality Score×0.6 + Price Score×0.4 | ▪ 1st step evaluation items<br>- Personal position, economic standing, technical capacity<br>▪ 2nd step evaluation items<br>- Innovative, partnering, risk mgmt., project org., aesthetic, programme, CDM, functionality, qualification, maintainability |
| USA WSDOT | ▪ 1st step (RFQ evaluation)<br>-Conduct RFQ evaluation to select 3-5 proposers.<br>▪ 2nd step (RFP evaluation)<br>-Conduct RFP evaluation to determine a technical-proposal score.<br>▪ Selection method of the bidder.(example)<br>-Technical Proposal Score×$10^6$/ Proposal Price | ▪ 1st step evaluation items<br>- Project understanding, project org., past performance, quality control program, safety program<br>▪ 2nd step evaluation items<br>- Mgmt. & org., schedule, technical solutions |
| USA DGS | ▪ RFP evaluation<br>-Conduct RFP evaluation to determine the score of the evaluation items.<br>▪ Selection method of the bidder.(example)<br>-Cost Submittal Score×0.6 + Technical Submittal Score× 0.3 + Disadvantaged Business Submittal Score×0.1 | ▪ Evaluation items<br>-Technical submittal, cost submittal, disadvantaged business submittal |
| Japan MLIT | ▪ RFP evaluation<br>-RFP is classified into the simple, standard, and high-technology types and is then evaluated.<br>▪ Selection method of the bidder<br>-Technical score/bid price or price score + technical score | ▪ Evaluation items<br>-Construction plan, bidder's business results, bidder's technological ability and hearing, and technical proposal |
| Korea PPS | ▪ PQ review<br>-Selectively review the bidders.<br>▪ Evaluate the technical proposal.<br>-Select up to six proposers.<br>▪ Selection method of the bidder<br>- Lowest price, technical-evaluation score/price score, price score/technical-evaluation score, or technical-evaluation score × 0.6 + price score × 0.4 | ▪ Evaluation items<br>-Measures of the construction costs, improving the life cycle costs, reducing the construction period, and managing the construction work; and cost statement |

The best-value-oriented bid (although it may not pick up the lowest-price bidder) comprehensively evaluates diverse technical factors, such as the construction cost, construction period, LCC, quality, technology development, and construction management, in an effort to select a bidder who is considered a potential best-value provider in view of a whole life cycle, and to help strengthen the technological competitiveness of the construction industry by accumulated technologies. The bidding system is gradually shifting from the lowest-price concept to the best-value concept.

Although best value bidding system provides such diverse affirmative effects, under this system, the lowest-price bidder, who sufficiently meets a reduction in increasing the initial construction costs and quality standards, may fail in the technical-evaluation score.

### 2.3 Cost plus Time

KDI and CERIK (2000) surveyed a total of 180 large-scale facility construction projects under five government ministries, and found that the number of projects completed or likely to be so as planned was only 37 (20.6%). Due to such delayed construction periods, the costs rose, additional civil complaints were filed, and unnecessary design changes were made. Thus, the owner ministries increased their budgets by 10-15% (Ministry of Construction and Transportation 2002).

Thus, it is necessary to work out measures to address the problem of increasing project costs due to procrastination in construction periods. In particular, reducing construction periods is a key goal of urban regeneration projects, which call for the reducing of construction periods so that the original residents could resettle.

In this vein, the cost-plus-time bidding system was used in this study. The cost-plus-time bidding system is a method that involves selecting a bidder whose total combined bid price (the sum of the proposed construction cost and the proposed construction period translated into the construction cost) is the lowest.

A key factor of the system is the conversion of the bidder's proposed construction period into a monetary amount, a conversion standard that constitutes a Unit Time Value (UTV). Cost-plus-time contracting calls for the calculation of the UTV that is applicable for housing projects. The UTV can be calculated on the basis of the owner's administrative and financial costs, which he (or she) can reduce by shortening the project period.

## 3. COMPONENTS OF THE TECHNICAL-PROPOSAL-BASED COST REDUCTION BIDDING SYSTEM

In the case of the marginalized members of the Korean society, minimizing the housing supply price and meeting the appropriate quality are key to the best-value establishment. Thus, a technical-proposal-based cost reduction bidding system that embraces the best value and the cost-plus-time concept on the basis of an improved lowest-price bidding system was proposed in this study.

Specifically, the proposed bidding system aims to select a bidder who offers the total lowest combined bid price and meets the minimum appropriate quality levels. The concept of the technical-proposal-based cost reduction bidding system and its considerations are as follows.

First, a key problem of the lowest-price bidding system is that the current review of the adequacy of bid prices does not properly control those bid prices that are even below the cost of the execution budget (wild dump price bids).

To address the problems brought about by the lowest-price bidding system, first of all, it is necessary to improve the current review of the adequacy of bid prices. In this study, a method of evaluating the adequacy of inappropriate work types using a work-unit-based technical proposal was suggested.

An inappropriate work type is a work type whose bid price is far lower or higher than the owner's related standard price or the average bid price.

Likewise, the proposal offers technical and objective evaluation factors and methods with regard to inappropriate work types, thereby preventing the lowering of the construction quality and sloppy construction due to the placement of low-price orders.

Second, to ensure a successful, efficient project, it is necessary to select a bidder who offers the possible proposals of quality management, safety management, project organization plan, etc.

A method of evaluating the bidder's project performance ability using a project-unit-based technical proposal was proposed in this study.

Lastly, reducing the construction period is a key goal of urban regeneration projects. They aim to shorten the resettlement period for the original residents, to reduce the financial components of the project costs, and to reduce the owners' administrative costs.

Thus, a method of evaluating the plan for construction period reducing and the adequacy of the calculation of the project period on the basis of the technical proposal for shortening the construction period was proposed in this study.

Using the cost-plus-time concept, this study converted the construction period into a monetary amount by multiplying it by the UTV, and reflected it in the price evaluation for selecting the best bidders.

The proposed technical-proposal-based cost reduction bidding system consists of the following components: work-unit-based, project-unit-based, and construction-period-reducing technical proposals. These components are evaluated to select the best bidder for a given project.

## 4. TECHNICAL-PROPOSAL EVALUATION METHODS AND FACTORS

In this study, evaluation items or factors of the work-unit-based, project-unit-based, and construction-period-reducing technical proposals were induced by studying the existing best-value evaluation factors (Table 1), surveying and interviewing 13 experts (four university professors, three officials in public agencies, four

researchers in research institutes, and two related people in the industry).

### 4.1 Evaluation Factors of a Technical Proposal

In this study, three technical-proposal evaluation items or factors were determined in two steps.

In the first step, the existing best value was examined, and the items and factors that are suitable for evaluating each technical proposal were determined. In the second step, the evaluation items and factors obtained from the first step were verified by interviewing and surveying experts, thereby determining the final evaluation items and factors. Fourteen experts were interviewed, and nine of them participated in the survey.

First, the work-unit-based technical proposal was designed to enable an owner to evaluate the adequacy of the bid prices of each work type unit in comparison with the prescribed standard prices. As such, it contains a cost-reducing proposal using new technologies, a cost-reducing proposal using improved management techniques, and a cost-reducing proposal through the change and injection of equipment items, the replacement of temporary materials, etc.

In the case of the work-unit-based technical proposal, 10 evaluation factors were induced from an examination of previous researches (1st step), and these factors were made to be examined by nine experts. Then eight evaluation factors were finally selected, which were chosen by majority (5) of the experts (Table 2).

Second, the project-unit-based proposal was designed to evaluate the project performance ability of the bidder.

In the case of the project-unit-based technical proposal, three evaluation items were determined (1st step), and they were verified by nine experts. Two evaluation items, which were chosen by a majority (5) of the experts , were finally selected (Table 2).

Further, evaluation factors were selected for each of the three evaluation items of the project-unit-based technical proposal, and the final evaluation factors were also determined on the basis of the examination results and the choice of nine experts (Table 2).

Lastly, the construction-period-reducing technical proposal was designed to enable an owner to evaluate the adequacy of a bidder's proposed shortened construction period, in comparison with his planned construction period.

In the case of the construction-period-reducing technical proposal, four evaluation items were determined on the basis of the examination results (1st step), and they were verified by nine experts. The final three evaluation factors, which were chosen by majority (5) of the experts, were selected (Table 2).

### 4.2 Technical-Proposal Evaluation Methods

Each technical proposal is evaluated by calculating the sum of each evaluation factor's score multiplied by the related weighted value, and comparing the sum with the standard score.

**Table 2.** Selection of Evaluation Items and Factors for Evaluating Each Technical Proposal

| Technical Proposal (TP) | Evaluation Item | | | Evaluation Factor | | |
|---|---|---|---|---|---|---|
| | Selection Item (1Step) | # of Experts Choosing | Final Evaluation Item(2Step) | Selection Factor (1Step) | # of Experts Choosing | Final Evaluation Factor(2Step) |
| Work-Unit -based TP | Proposal for reducing cost by new technique, engineering method, etc. | 7 | O | ▪ Possibility of implementation | 6 | O |
| | | | | ▪ Quality adequacy | 7 | O |
| | | | | ▪ Civil complaints prevention | 3 | X |
| | | | | ▪ Safety adequacy | 6 | O |
| | | | | ▪ Environmental adequacy | 5 | O |
| | | | | ▪ Risk adequacy | 3 | X |
| | | | | ▪ Extending the construction period | 5 | O |
| | | | | ▪ Increasing the maintenance costs | 6 | O |
| | | | | ▪ Adequacy of the calculated-cost details | 7 | O |
| | | | | ▪ Reliability of the evidential documents | 5 | O |
| Project-Unit -based TP | Construction Plan | 8 | O | ▪ Plan for quality management | 8 | O |
| | | | | ▪ Plan for safety management | 8 | O |
| | | | | ▪Plan for civil complaint prevention | 6 | O |
| | | | | ▪Plan for environmental management | 7 | O |
| | | | | ▪Plan for risk management | 5 | O |
| | Project organization plan | 8 | O | ▪Adequacy of the plan for the project team | 7 | O |
| | | | | ▪Adequacy of the subcontractor control plan | 6 | O |
| | LCC reduction plan | 4 | X | Omission | - | - |
| Construction Period Reducing TP | Construction period | 8 | O | ▪Plan for reducing the construction period | 7 | O |
| | | | | ▪Plan for the procurement of equipment, labor, and materials | 8 | O |
| | | | | ▪Identify the critical path | 4 | X |
| | | | | ▪Adequacy of constr. period establishment | 9 | O |

**Table 3.** Evaluation Method for Technical Proposal (Example)

| Technical Proposal (TP) | Evaluation Item | Evaluation Factor | Evaluation Method[1] | | Weighted Value[2] (B) | Score (A×B) |
|---|---|---|---|---|---|---|
| | | | Grade | Score (A) | | |
| Work-Unit -based TP | Proposal for reducing cost by new technique, engineering method, etc. | Possibility of implementation | A | 10 | 15% | 15 |
| | | Quality adequacy | B | 8 | 15% | 12 |
| | | Safety adequacy | B | 8 | 15% | 12 |
| | | Environmental adequacy | B | 8 | 15% | 12 |
| | | Extending the construction period | A | 10 | 10% | 10 |
| | | Increasing the maintenance costs | B | 8 | 10% | 8 |
| | | Adequacy of the calculated-cost details | C | 6 | 10% | 6 |
| | | Reliability of the evidential documents | B | 8 | 10% | 8 |
| | *Score as a result of the work-unit-based TP evaluation (standard score: 80 points[2])* | | | | | ***83*** |
| Project-Unit -based TP | Constr. Plan | Plan for quality management | A | 10 | 20% | 20 |
| | | Plan for safety management | B | 8 | 20% | 16 |
| | | Plan for civil complaint prevention | C | 6 | 10% | 6 |
| | | Plan for environmental management | B | 8 | 15% | 12 |
| | | Plan for risk management | A | 10 | 15% | 15 |
| | Project org. plan | Adequacy of the plan for the project team | A | 10 | 10% | 10 |
| | | Adequacy of the subcontractor control plan | B | 8 | 10% | 8 |
| | *Score as a result of the project unit-based TP evaluation (standard score: 75 points[2])* | | | | | ***87*** |
| Constr. Period Reducing TP | Constr. period | Plan for reducing the construction period | B | 8 | 50% | 40 |
| | | Plan for the procurement of equipment, labor, and materials - | C | 6 | 30% | 18 |
| | | Adequacy of constr. period establishment | A | 10 | 20% | 20 |
| | *Score as a result of the construction-period-cutting technical-proposal evaluation (standard score: 75 points[2])* | | | | | ***78*** |

[1] Each evaluation factor score is an imaginary value aimed at explaining the evaluation method.
[2] The weighted value of each evaluation factor and the standard score for passing a technical proposal are just examples, and they are established by reflecting the characteristics of a project.

The technical-proposal evaluation factor score is given any one of three grades (A, B, and C). A is superior (10 points), B is average (8 points), and C is poor (6 points).

The weighted value of each evaluation factor is determined by the owner in association with the characteristics of the project.

A standard score is also determined according to the characteristics of the project. If the sum of the evaluated scores (the scores of the evaluation factors × the weighted value) is below the standard score, the bidder will fail.

Likewise, in the case of a project calling for high quality, a high standard score can be set, and in the case of a project that needs a minimum appropriate quality, a low standard score can be set, making it possible to reflect the characteristics of various projects.

In addition, in case the proposed technology fails in any of the evaluation factors, the proposal will fail subject to the agreement of over two-thirds of the evaluation committee.

Table 3 shows a summary of the aforementioned evaluation methods for technical proposals.

## 5. MODELS FOR DETERMINING THE BIDDERS

Models for determining bidders were proposed in this study through the combination of the three proposed technical proposals, using the diverse characteristics of projects, such as the number of bidders, the importance of reducing the construction periods, and a demand for high quality.

Diverse models for determining bidders can be induced according to the combination of the three suggested technical proposals, but three major alternatives were examined in this study (Fig. 1).

Alternative 1 determines the priority of evaluation in the order of the combined minimum price (A+B×UTV), evaluates the adequacy of the project-unit-based, work-unit-based, and construction-period-reducing technical proposals, thereby selecting the top-ranked bidder. If the bidder fails, the next-ranked bidder's technical proposal is evaluated.

Likewise, alternative 1 applies all the three suggested technical proposals, converts the construction period into a monetary amount, and reflects the amount in the selection of bidders, thus allowing it to be applied to projects where reducing the construction period is important.

Alternative 2 determines the priority of evaluation in the order of the lowest bid prices, and evaluates the adequacy of the project- and work-unit-based technical proposals, thus selecting the top-ranked bidder. If the bidder fails, the next-ranked bidder's technical proposal is evaluated.

Likewise, alternative 2 applies two technical proposals, except for the construction-period-reducing technical proposal, allowing it to be applied to projects where reducing the construction period is less important.

Alternative 3 determines the priority of evaluation in the descending order of the combined price (technical evaluation score + price score), and evaluates the adequacy of the work-unit-based and construction-period-reducing technical proposals, thus selecting the most preferred bidder.

The technical-evaluation score refers to the score of the project-unit-based technical proposal, and the price score refers to the bid- or combined-price-converted score.

Alternative 3 is effective in selecting bidders for projects requiring high quality, but has to evaluate all the bidders' project-unit-based technical proposals, thus increasing the owner's workload.

Alternative 3 should thus conduct a PQ examination and select a few bidders (for example, less than six) before selecting the final bidders.

As mentioned earlier, this study aimed to suggest a technical-proposal cost reduction bidding system to help the marginalized members of the Korean society resettle, with the major objective of reducing the construction costs and construction periods, and ensuring an appropriate quality. Thus, alternative 1 was selected as a model for determining bidders in an attempt to help the marginalized members of the Korean society resettle.

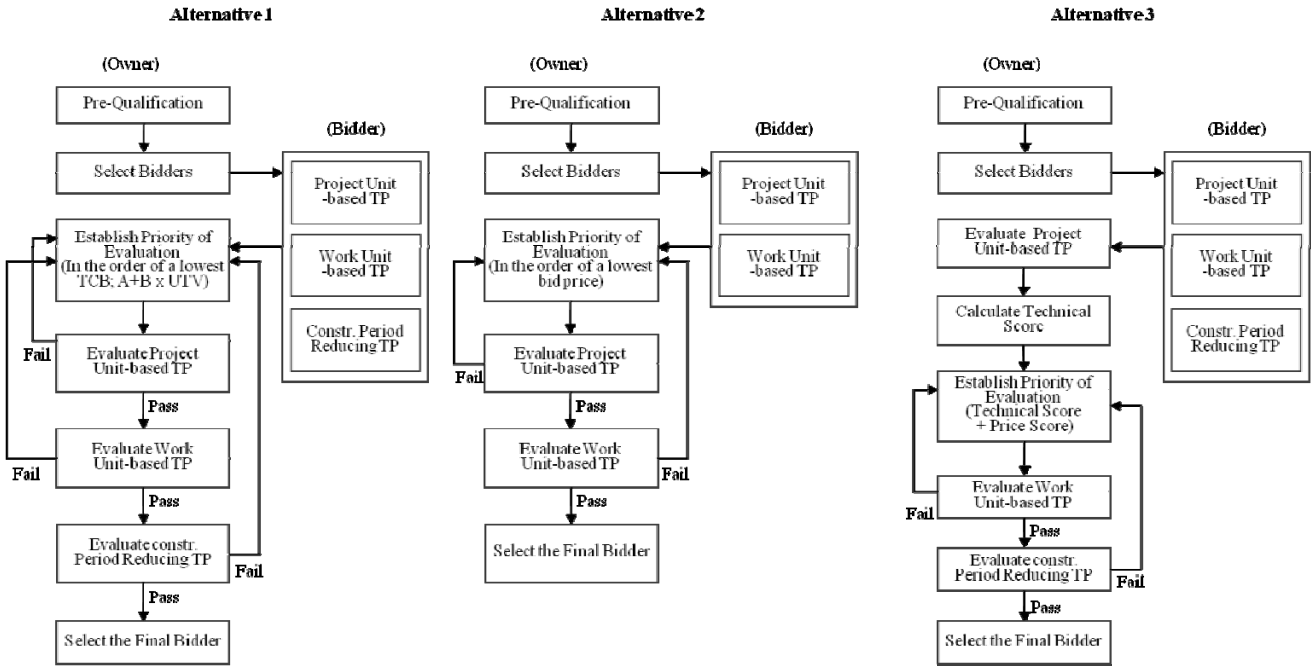


**Figure 1.** Determining Bidders Process for Each Alternative Model

## 6. CONCLUSION

As part of the methods for supplying affordable housing to help the marginalized members of the Korean society resettle, a technical-proposal-based cost reduction bidding system aimed at minimizing the production costs of multi-family residential units was proposed in this study. This system is based on the project-unit-based, work-unit-based, and construction-period-reducing technical proposals.

The proposed models for determining bidders are designed to evaluate the adequacy of each technical proposal in the order of the combined minimum price (A+B×UTV) in an effort to effectively optimize bid prices and reduce the construction periods, as well as to maintain a minimum appropriate quality.

Accumulated technologies for reducing construction periods and construction costs can help optimize project costs and periods as well as bolster the technical competitiveness of the construction industry.

Further, the models for determining bidders through the combination of the three suggested technical proposals can reflect the characteristics of projects, such as the importance of reducing the construction periods and a demand for high quality.

To propose a specific operation method for the technical-proposal-based cost reduction bidding system, further research on the criteria for pinpointing the inappropriate work units of the work-unit-based technical proposal, the UTV calculation method for applying the cost-plus-time concept, disincentive/incentive regulations, regulations on technical compensation in association with the drawing up of technical proposals, etc. should be conducted.

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