Discussion of "Electronic-Based Procedure for Managing Unbalanced Bids" by Wei-Chih Wang

June 2004, Vol. 130, No. 3, pp. 455–460.
DOI: 10.1061/(ASCE)0733-9364(2004)130:3(455)

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The author indicates he presents a unique electronic spreadsheet method for reviewing unbalanced unit prices based on unit price data from all bidders on a lump sum bid. This contracting strategy and bid model are from the public market and the building construction sectors in Taiwan.

There are three points of interest in the paper: the bid model, the electronic spreadsheet, and the timing and method of selecting the owner's unit price basis for use in negotiating unbalanced unit prices.

Bid Model Definition: Lump Sum and Unit Price Bids

Lump sum and unit price are two separate bid models. The discusser defines them as follows:

Unit price bid: A bid model where the cost item price is built up from "contractor provided" unit prices with "owner provided" quantities. The "bid price" is then the sum of the cost items—that is, the sum of the quantities times the unit prices. Any changes to the quantities (plus or minus) would constitute a change to the contract price. In this bidding model the owner takes the risk on basic quantities.

Lump sum bid: A bid model where the contractor uses the bid documents to develop pricing for specific cost items. The contractor is responsible for all work within the scope of that cost item, notwithstanding the quantities of various units involved. Without a change in the scope documents any variance in materials and labor required to do the basic work scope is at the contractor's account. Although the contractor may provide quantities for use in payments and/or for addition or deletion of work scope, the lump sum price is not built up from the unit prices times the quantities. In this bidding model the contractor takes the risk on basic quantities.

Based on the above, the paper bid model is a unit price bid, not a lump sum, as even after the "adjustment" of the unit prices, the method of compensation is still by unit prices times quantities.

Electronic Format Use in Construction Bid Review

The discusser began both accepting bids and submitting bids in electronic format in 1987 (Lotus 123 back then!). Instead of the traditional bid books, current bid documents now come to the bidders on CDs and/or are located on an Internet site with access provided to the bidders. With the advent of computer spreadsheets, typical required unit prices on a unit price or lump sum bid will exceed 2,000. The discusser hasn't seen a project since 1995 that didn't require an electronic bid submittal. The discusser would note that although the bid data is submitted on an electronic spreadsheet (disk or CD), the *official bid* is always a *hard copy*.

Bid Model: Paper versus U.S. Practice

The paper indicates that in the "U.S. practice" of lump sum bidding, the bidder's submitted unit prices are typically taken as the contractual ones, any review is usually done by eye, and since lump sum contracts are awarded to the low bidder, low bidders cannot easily be challenged.

Those assumptions are incorrect for U.S. practice on *either* lump sum or unit price contract strategies. In both instances, the unit prices are reviewed using an electronic spreadsheet, generally against the owner's historical database or a database developed for the owner rather than using the other bidders as proposed in the paper.

However, there are two major differences when comparing the paper and the common U.S. practice contracting strategy:

1. Bid award timing. The first difference is enormous—in the "U.S. practice" unit price and lump sum bid model the contract is *never awarded* until an agreement has been reached on the unit prices. This occurs because any changes to unit prices directly affect the low "price" or "bid." Bidders on U.S. or international work under a lump sum or unit price bid model expect a cycle of bid "clarifications" and "discussions" during which unbalanced unit prices are "corrected" before any award. And they don't anticipate negotiating contract unit prices after bid award.
2. Unit price review. The second difference is unique. In the U.S. practice, changes to the unit prices in a unit price bid change the bid price, whereas in the model presented in the paper, when the unbalanced unit prices are changed, other unit prices have to be changed to keep the bid "price" that has already been signed into the contract.

Review of Unit Prices

While the U.S. practice generally uses the owner unit price data as the basis for screening unit prices, the discusser has seen bid models that used variations, including averaging the other bidders or throwing out the high bidder and averaging the others. With the advent of the electronic spreadsheet, the discusser doubts there are any logical methods of selecting a "base" unit price for comparison to the bid unit price that haven't been tried.

Problems with Use of Other Bidder Data in Reviewing Unbalanced Bids

From experience, the discusser has found there are usually six reasons why bidder unit prices will differ from the owner's his-

J. Constr. Eng. Manage., 2005, 131(9): 1038-1041

torical unit prices by any appreciable amount. In order of general occurrence, these are:

1. misunderstanding the cost item with respect to scope, specifications, and/or timing;
2. contractor's market strategic conditions;
3. very small quantities of work in the cost item;
4. method or sequence of work chosen by contractor;
5. errors or omissions in bidder response; and
6. contractor-anticipated high risk on the item.

With the exception of reason one above (usually owner-caused), these reasons are frequently unique to each bidder and must be addressed prior to any contract award. The most difficult to forecast is the contractor's market strategic condition. This can distort unit prices, higher or lower, and is a deterrent in using other bidders' data in a review.

Unit Prices for Lump Sum Bids

As the paper indicates (p. 459, bullet 6), in the discusser's experience with lump sum bids, the owner normally asks for unit prices for addition or deletion work. However, a cost item in a lump sum bid would not be expected to be the cost item quantity times the unit price. There are reasons for this: most obvious are that directs (such as mobilization) and indirects (such as risk, profit, and management) may significantly impact the unit price. Owners frequently ask for one set of unit prices for additions and another for deletions.

Unit Price in Lump Sum Bid Review

In the "U.S. practice" lump sum bid model in the private market, it is common for owners to use a contract price review method (developed beforehand) that includes the impact of change order(s). While the bidders are warned the review will involve use of submitted unit prices on hypothetical change order(s), the hypothetical change order(s) work scope is not released to the bidders. This is a common practice where the work is unique, complex, ill-defined, or dangerous, and typically is found in marine, petrochemical, or upstream oil and gas projects. The discusser has, several times, seen this hypothetical C.O. result in the second lowest bidder being awarded the work.

Conclusion

In over 30 years in lump sum and unit price work in international construction in several sectors and both the public and private markets, as owner and contractor, the discusser has seen many variations on the review and selection criteria and negotiation process for unbalanced unit prices. However, the discusser has never before seen a unit price contract wherein the contract is signed and then the unbalanced unit prices are adjusted!

There are many unusual or unique lump sum and unit price contracting strategies in the various markets and sectors, and they sometimes have unique and unusual methods of unit price review. The discusser offers the following observations on the paper and lump sum or unit price contracting strategies:

1. lump sum and unit price are two different contracting strategies and one would expect to have different unit prices from the same contractor due to the pricing structure;
2. signing any contract prior to negotiating and/or adjusting the unit prices is an unusual contracting strategy;
3. probably every method of data manipulation to support reviewing of unit price bid data has been tried; that any logical process is unique in this day and age of the computer spreadsheet is debatable; and
4. any paper with a new contracting strategy, bid model, method, or process should include surveys of the applicable construction market and sectors to verify it is actually new.

Closure to "Electronic-Based Procedure for Managing Unbalanced Bids" by Wei-Chih Wang

June 2004, Vol. 130, No. 3, pp. 455–460.
DOI: 10.1061/(ASCE)0733-9364(2004)130:3(455)

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Overall, the discusser's comments on the paper are based on his belief that the proposed bid model presented in this paper is a unit price bid rather than a lump sum bid. However, the author stresses that the proposed bid model is lump sum-based. This reconfirmation is made primarily because a lump sum bid works differently in the United States than in Taiwan. The following responses are made to each of the points raised by the discusser.

Practice of Lump Sum and Unit Price Bids in Taiwan

The following practical examples from Taiwan should help to clarify the differences in the processes used for making a lump sum bid in Taiwan and in the United States.

- In Taiwan, most public construction projects are tendered by lump sum bids chiefly because of the need to meet governmental budgets. In such a lump sum lowest bid model, bidders must build up their total bid price based on the unit prices times quantities. If bidders do not include the proposed unit price of each cost item in their bid documents, they are generally disqualified. Notably however, the lowest bid is assessed according to the lowest total bid price instead of unit prices. This practice is determined by the belief that bidders should be able to submit a reasonable total bid price based on a careful estimation of the unit prices of cost items.
- In a lump sum lowest bid, the contractual total price equals the lowest total bid price; the contractual quantity of each cost item equals the owner-provided quantity, and the contractual unit price of each cost item equals the owner-provided unit price multiplied by a discounting ratio (see the introduction of the paper). Conventionally, no "clarification," "discussion," or "adjustment" is performed following the awarding of the project or signing of the contract. This practice is what the paper and Taiwanese practitioners term "owner-based" practice.
- Additionally, in Taiwan, a variation of the quantity of a cost item required to do the work scope is not all at the contractor's account, even when there is no change in the scope documents

for a lump sum bid. The owner also assumes the risk on basic quantities. For example, suppose that 120 units of a cost item are actually erected in the field, and the contractual quantity (owner-provided) is only 100 units. The contractor then is usually entitled to claim to the owner for the over-5% part (i.e., 15 units in this example). Consequently, the accuracy of the owner-provided quantities listed in tendering documents is also a concern for owners. Although most owners state that owner-provided quantities only represent a reference, this "5% rule" is still effective in current Taiwanese practice. If the owner-provided quantities are significantly underestimated (implying that high-cost compensations will be granted to the contractor), then the entrusted architect/engineer (A/E) is likely to be penalized as stated in the penalization article of the owner-A/E contract.

- What happens if owners omit cost items in the project cost estimate despite the work scope of such cost items being clearly displayed in tendering documents (such as design drawings or specifications)? In Taiwan, the contractor can claim cost compensation for that omission even in a lump sum contract. Notably however, if the cost of such omission is trivial, the contractor will likely absorb the cost. However, the contractor normally considers such cost absorption to be doing a favor to the owner. Moreover, if the cost is significant, the Complaint Review Board for Government Procurement, arbitrator, or court generally backs the contractor.

Thus, in Taiwan, the owner (or A/E) is still responsible for completely listing cost items and performing accurate quantity take-offs in a lump sum bid. The following examples can help to clarify why this practice is known as a lump sum bid in Taiwan:

- the contractor still must absorb an additional 5% quantity for each cost item;
- provided a cost item (e.g., slurry wall) can describe the corresponding work scope, then the contractor is responsible for all the materials (e.g., concrete, reinforced rebar, and wire), equipment (e.g., excavator and truck), labor, site management, government permits, etc., required for the work;
- the contractor is responsible for choosing his or her own construction methods provided the design drawings and specifications are followed;
- the contractor is responsible for meeting project deadline unless excusable delays are granted; and
- generally, in a lump sum bid, the contractor is responsible for almost all construction problems (such as safety, quality, etc.) arising.

The unit price bid model is rarely applied to construction projects in Taiwan, except for certain highway supplementary work (such as site preparation and slope protection) and some piping work conducted in water-supply factories. The contracting process of the unit price bid model used in Taiwan resembles that described by the discusser, but with the following differences:

1. Conventionally, like the U.S. practice, the contractual quantity for a cost item equals the owner-provided quantity. Any changes in the contractual quantities during construction lead to a change in the contract price. However, the contractual unit price equals the owner-provided unit price multiplied by a discounting ratio. (This ratio is calculated based on the same process described in a lump sum bid; see p. 455 of the paper.).
2. Recently, the National Expressway Engineering Bureau (NEEB) in Taiwan applied a bidder-based approach to a unit price bid. Namely, the contractual unit price equals the bidder-provided unit price, which must fall between 120% and 80% of the owner-provided unit price. Whenever some of the bidder-provided unit prices are changed, the other unit prices must also be adjusted to maintain the total bid price.

The term "unbalanced bidding" is generally considered in a unit price bid in U.S. practice (section 8.4 of Hendrickson and Au 1998). Therefore, the discusser doubts that the proposed model should be unit price-based. However, the term "unbalanced bidding" can be also used in a lump sum contract (Tong 1988; Tong and Lu 1992).

In the Taiwanese practice mentioned above, the conventional lump sum bid model uses an owner-based approach to determine the unit prices of cost items, based on the assumption that the owner-provided unit prices are all reasonable. No "unbalanced bidding problem" arises. Owing to the problems associated with such owner-based conventions (see the introduction section of the paper), this study proposes a bidder-based bid model of a lump sum construction project. However, this bidder-based approach may result in an "unbalanced bidding problem." The proposed model thus helps to assess the unit prices proposed by a winning bidder and adjust them to a reasonable level.

Electronic Format

Regarding the electronic format issues raised by the discusser, the writer provides the following facts concerning the "electronic" procurement of public projects in Taiwan.

- In 1999, Taiwan enacted a nationwide administrative order for governmental entities that demanded these entities include an electronic spreadsheet file (disk or CD) of project cost estimates in their bids for public construction projects with budgets exceeding US$1,666,667 (PCC 1999).
- Following the enactment of the Taiwanese Governmental Procurement Law (http://www.pcc.gov.tw/) for entering the World Trade Organization on May 27, 1999, the bid advertisement of any public procurement project (including construction work, purchase of property, retention of services, and so on) with a budget exceeding US$3,333 must be publicly announced via the Internet (http://www.geps.gov.tw/).
- Based on the data reported by Public Construction Commission (PCC) (http://www.geps.gov.tw/), approximately 80% of all public procurement projects of central government entities permitted bidders to purchase electronic tendering documents via the Internet in 2004. Simultaneously, only about 50% of these projects submitted their electronic bids via the Internet. Either the electronic tendering documents or the electronic bid documents refer to a complete set of tendering or bidding materials. Furthermore, if a bidder submits their electronically signed bidding documents via the Internet, then they will be officially eligible for bid competition without needing to further prepare another hard copy.
- Most procured construction projects do not belong to the aforementioned Internet purchasing and submitting categories. To date, the NEEB (the highest-computerized government entities in charge of transportation construction projects in Taiwan) only allows Internet purchasing and has not yet permitted Internet submissions. Namely, the writer has not heard of any Taiwanese public construction projects to which single bidders have submitted their bids (complete set of bid materials) via the Internet.

The discusser confidently states that he "hasn't seen a project since 1995 that didn't require an electronic bid submittal." However, based on a study by the PCC (2002), currently Taiwan should be one of the leading countries with highly electronic procurement environments for the public construction sector. There-

J. Constr. Eng. Manage., 2005, 131(9): 1038-1041

fore, the above facts seem not to support the comments of the discusser. Nevertheless, the discusser is very likely to define the term "electronic" differently in relation to the paper.

In the model proposed in this paper, "bidders are required to submit bids electronically;" namely, an electronic spreadsheet file containing project cost estimates should be included in the bid package document (p. 456). Furthermore, such an electronic spreadsheet file and its hard copy are enclosed in the bid documents, and this package of bid documents is submitted either by mail or in person. The writer expects that such a package of bid documents will be submitted via the Internet within a few years in Taiwan, just as is currently done for other types of procurement projects. However, no matter what computer media is used to submit the electronic spreadsheet file, the file is used to facilitate the execution of the model steps, which remain unchanged—namely, evaluating, explaining, and adjusting the unit prices for a lump-sum construction project.

Notably, the practice of using electronic spreadsheet outlined in this paper has enabled PCC to efficiently gather the unit price data of various types of cost items for public construction projects around Taiwan. The unit prices thus collected are reviewed and used to help generate reliable unit price data in a regular magazine, known as *Construction Cost Data* (http://www.tcri.org.tw/concost/pctd/pctd.asp). Presently, in Taiwan, the owner of a public entity must budget for public construction projects using this magazine's cost data.

Bid Awarding and Contract Signing Dates for a Lump Sum Bid

In Taiwan, bid awarding and contract signing for construction projects are two consecutive steps in procurement. The distinction between these two steps is explained in the Taiwanese Governmental Procurement Law.

In a lump sum lowest bid model for a construction project, that project is awarded to the bidder who proposes the lowest total bid price. Normally, this awarded (winning) bidder can be selected during the bid opening day because the bid evaluations are easy to process. However, this awarded bidder still is not the so-called "contractor" to this project because the bidder and the owner have not yet signed an official contract for the project. This official contract consists of necessary contractual materials, such as specifications, drawings, contractual quantity and unit price of each cost item, tendering documents, and the bid documents of the winning bidder. The period between bid awarding and contract signing generally exceeds seven days as set forth in the tendering document. Once the contractual documents are prepared by the winning bidder and reviewed by the owner in advance of the set-forth date, both parties then sign them. At this time, the awarded bidder officially becomes the contractor of the project and enters a contractual relationship with the owner. A delay in the contract signing date may result in the awarded bidder being disqualified for violating the tendering process. Should such a situation arise, the project is withdrawn and the tendering process must be repeated. Simultaneously, the awarded bidder is penalized by removal of his bid bond. In some real-life situations, the lowest bidder gives up their right to be awarded on the bid opening day, and the second-lowest bidder may be deemed the lowest bidder. (Notably, even in the unit price bid model, in Taiwanese practice there is a time period between bid awarding and contract signing.)

In the proposed model, the bidder-provided unit prices must be examined by proceeding through the evaluation, explanation, and adjustment steps during the aforementioned period. Eventually, each unit price is agreed upon and signed by both the awarded bidder and the owner. The signed unit prices then are included in the contractual document. Although the discusser thinks that "the first difference is enormous," the writer considers such a difference likely due to the different natures of the legal obligations of "bid awarding" and "contract signing" for which the project bidder and owner are liable, which are defined in Taiwanese and U.S. practices.

Owner and Bidder-Based Reviews of Unit Prices

The evaluation of unit prices in the proposed model is essentially bidder-based, primarily because of the problems associated with pricing change orders in the owner-based model (see the introduction section of the paper). Nevertheless, in the proposed model, the owner-provided unit prices are important during the modeling. Restated, the owner-provided unit prices are used to help identify suspicious cost items via a differential ratio (p. 457). Also, owner-direct identification is also allowed (p. 457). The proposed model does not prohibit the use of other criteria for identifying suspicious unit prices. For example, as noted by the discusser, using averaged unit pricing (that is, averaging other bidders or throwing out the high bidder and averaging the others) is also permitted provided this criterion is agreed upon by both parties during their evaluations.

The discusser indicates the problems with the use of other bidder data to review unbalanced bids. In the proposed model, the maximum, minimum, and average unit prices provided by other bidders (excluding the awarded unit prices; see Table 1 of the paper) primarily act as references in the explanation and adjustment steps. These "other bidder data" work like the "third party" in helping to clarify why a unit price provided by the awarded bidder deviates markedly from the owner-provided unit price. Again, this study proposes a bidder-based model that is more fair than the owner-based model currently used in Taiwan. Namely, the awarded bidder has the opportunity to defend the reasonableness of their proposed unit prices.

The discusser identifies six typical reasons why bidder unit prices differ from owner-provided unit prices. These reasons are similar to those classified in Table 2 of the paper (p. 458). For example, category five (mistakenly filled in data) and category six (bidding strategy) resemble the discusser's fifth and second reasons, respectively. Moreover, categories one, two, and three together resemble the discusser's reason four. Finally, categories seven (false interpretation of general or special conditions) and eight (ambiguous technical specifications) resemble the discusser's first reason. This investigation emphasizes that the deviation sometimes results from inaccurate owner estimates (i.e., category four).

Notably, the owner-based rule and maintaining total bid amount rule (p. 458, third and fourth bullets) used in the adjustment step are required if the model is to be feasible (p. 459, first bullet). The owner-based rule must be applied when the two parties fail to reach an agreed contractual unit price. Should such a situation arise, this contractual unit price equals the owner-provided unit price multiplied by a discounted ratio. The maintaining total bid amount rule must remain because the project is awarded using a lump sum bid. Additionally, some of the heuristic rules (p. 458, first and second bullets) can be replaced by

J. Constr. Eng. Manage., 2005, 131(9): 1038-1041

other proposed heuristic rules provided both parties agree upon the new rules.

Conclusion

The proposed electronic-based model has been applied to eight lump sum projects that were tendered based on a lowest bid model and two additional lump sum projects that were tendered using a multicriteria bid model. No litigation relating to the contractual unit prices arose either during their execution or after their completion. The author has made several presentations of this new model to various academies, governmental organizations, and contractors in Taiwan over the last few years. Every Taiwanese researcher or practitioner considers that the proposed model is a lump sum bid rather than a unit price bid. This is because such a lump sum definition has long been practiced in Taiwan. As was clarified by the writer earlier, this doubt raised by the discusser should result from a lump sum bid model (also a unit price bid model) being practiced differently in both the United States and Taiwan. The writer believes that the proposed model is a novel contracting strategy and its logical process should inspire other interested researchers and practitioners to create other new strategies to fit their particular procurement environments. The writer greatly appreciates for the discusser sharing his U.S. experience and so confirming the uniqueness of the proposed model.

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