

CHANCES AND RISKS OF COMBINED PRICING

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Appropriate costing creates a plausible, reliable basis for determining the bid price. One of the key requirements that applicable laws, standards, and guidelines stipulate for (structural) specifications is that works should be specified clearly, completely and objectively so as to ensure bid comparability. Furthermore, cost estimates should be possible for the specified works (excluding non-quantifiable risks). The specifying party usually requires combined pricing because works related to various structural components, construction trades, subsoil types, rebar diameters etc. that necessitate a variety of types and combinations of production factors are merged into a single item. Combined pricing occurs whenever a unit price is to be derived from different cost estimates with respect to the utilization of production factors. This means that bidders intending to develop an activity-based costing model would have to know the type of work or service, the underlying conditions for performing the work, and the associated timeframe (i.e. project start, binding milestones, project end). This paper investigates if combined pricing items meet these requirements whilst putting a particular focus on the relevance of combined pricing to construction management and economics, including construction expert opinions on the chances and risks of this approach. For this purpose, this paper primarily deals with reinforcing works.

Keywords: Expert survey, Management of chances and risks, Reinforcing works, Reinforcement ratio, Building specification.

1 INTRODUCTION

Construction management is characterized by a combination of production factors. Pricing is essentially the result of how and when which production factors are combined (Hofstadler 2014). Only production factors of an identical type and pricing may be merged into a single item as part of a structural work specification. This principle provides the basis for appropriate costing. In practice, however, deviations occur relatively frequently and inevitably necessitate a combined pricing approach.

The client can create the prerequisites for appropriate pricing by disclosing its bases of costing, which enables appropriate costing/pricing by the contractor. Furthermore, such a pricing exercise can also be supported and made plausible by the contractor disclosing its own pricing assumptions. As a matter of course, the client's position will also depend on the degree of design detail reached at the time of preparing the specification. If detailing has progressed only to a limited extent, no reinforcement plans or drawings will usually be available for specifying reinforcing works, which forces the client to start from its own assumptions. Nonetheless, at this project stage, the client will be in a better position than the bidder(s) to come up with fairly accurate assumptions, for instance on the basis of a preliminary structural analysis.

The client has much more detailed project knowledge and will have analyzed the project more thoroughly at this stage. It is worthy of note that the client is in possession of a larger amount of information than the contractor with respect to project timing and planning. No bidder would be in a position to overcome this deficit within the specified submission period; nor are bidders under the obligation to do so.

Clients can protect themselves against speculative bids by preparing an appropriate quantity survey on the basis of a sufficiently accurate and detailed planning status. If, however, the client discloses its bases for pricing only partially or not at all, the bidder (and future contractor) is bound to make own assumptions to be able to conduct a pricing exercise at all. If the bidder also fails to disclose its assumptions as part of the submission process, this will very likely give rise to disputes over any changes in quantities or the allocation of combined pricing components.

The contractor cannot know or derive the quantity structure that the client used for its specification or request for proposals. Conversely, the client is not in possession of any information with respect to the assumptions made by the contractor for the purpose of costing and pricing.

Yet another distinction needs to be made regarding the bidder's disclosure, namely if its disclosure is based on its own assumptions or assumptions made by a subcontractor, which may result in different mean wage costs, for example. If the bidder discloses its assumptions, the client will know the bases of pricing.

If these are not disclosed, however, they will subsequently be submitted by the bidder in the event of a dispute, and will then have to be checked for plausibility and, if and when required, critically compared with relevant information provided in the literature or, as far as reasonably possible, recalculated from the bid price.

Generally speaking, however, the contractor is forced to come up with free pricing assumptions if the client fails to supply related detailed information in its specification. It should be noted, though, that such free assumptions must not be unrealistic whilst also taking account of any applicable legislation, such as on minimum wages to prevent dumping (Hofstadler and Kummer 2015).

The following sections of this paper outline the relevance of combined pricing for construction management and economics in the context of structural building specifications.

1.1 Relevance for Construction Economics

For the bidder (and future contractor), the bill of quantities forming part of the structural building specification is the most important basis upon which to proceed with costing and pricing. In this document, the client must describe all circumstances and conditions for works to be performed so as to enable the bidder to prepare its proposal in accordance with the objective explanatory content of the bid documents. This means that it is the client's responsibility to describe the works to be performed in sufficient detail.

If the client merges several types of work into single items and if the bases for costing (quantity structure, work proportions etc.) of such merged items are not disclosed, the bidder will be forced to come up with free cost assumptions to be in a position to proceed with the pricing exercise at all. Bidders that do not, or only partially, realize the complexity of the work to be performed will usually be more inclined to take risks than other bidders with prior experience in performing complicated or complex works.

Any change in the proportions of the works included in the merged item compared to the bidder's original pricing assumptions will lead to a changed pricing structure associated with potentially higher or lower costs compared to the bid price.

If the bidder's (realistic) costing assumptions are disclosed in the bid submission process, they can be used for updating the construction contract accordingly if and when required. If, on the other hand, no such disclosures were made, and if additional costs are claimed, contractors are always confronted with the issue of having to prove on which assumptions they have based their pricing or if they have conducted a costing/pricing exercise at all (or rather resorted to mere price estimates).

1.2 Relevance for Construction Management

In addition to construction economics, combined pricing is also relevant to some aspects of construction management. Free pricing assumptions made by the bidder or contractor are also used as a basis for process planning, for instance for the scheduling and utilization of production factors. Related tasks include the preparation of high-level and detailed timelines as well as the allocation of construction equipment required on-site, such as defining the number of cranes as one of the key equipment categories for building construction, and of the number of required workers. In the event of any changes to quantity proportions within a combined pricing item, such as varying proportions of different soil or contamination classes in the case of earthworks or merging various rebar diameters and/or bend shapes when pricing reinforcing works, these will inevitably also lead to modifications of combined labor consumption rates or outputs. If the same timeframe is specified for the related works despite these changes, such a scenario may result in acceleration measures including, for example, the use of additional workers or pieces of equipment. Such measures may result in losses of productivity due to suboptimal team sizes, underrunning the minimum required workspace, or increased daily working hours.

2 COMBINED PRICING FOR REINFORCING WORKS

For reinforcing works, bidders are requested to apply combined pricing whenever no individual rebar diameters are specified and/or no details regarding reinforcement ratios and/or bend shape complexity and/or allocation to specific structural components (such as columns, walls, floors) are provided. Any source-based costing would at least require knowledge of the type of work or service, the conditions or circumstances under which work is to be performed, the prevailing site conditions, and the timeframe for work completion.

In Austria, for example, the standard specification or bill of quantities relating to building construction works includes one item for rebar and another for mesh reinforcement. Unit prices must be stated per kilogram or tonne of reinforcement and broken down to individual structural components. Furthermore, the standard specification may include connecting elements. Thus, the standard bill of quantities makes it very difficult for bidders to arrive at accurate reinforcement ratios, mean rebar diameters, and bend shapes, particularly in the case of engineering structures. Accurate information can only be taken from comparisons with similar, previously completed projects and/or from details provided in the literature. Bidders (or the future contractor) thus tend to be exposed to a high risk of stating "exceedingly optimistic" labor consumption rates, i.e., rates that are too low.

If the client does not provide additional details, such as on the distribution of rebar diameters or bend shapes, the bidder is again bound to make free pricing assumptions for the purpose of performing its pricing exercise. Such assumptions also include diameter and bend shape distributions. As a result, the following cost and price components of reinforcing works are interrelated: cost of materials (including costs of various specified dimensions), costs of rebar cutting and bending, and costs of installing the reinforcement.

An expert survey was conducted in 2015/16 at Graz University of Technology to determine the various types of information required for reinforcing works (specified as a combined pricing item) in order to perform a source-based costing exercise.

Respondents were given the following variables in the survey:

- Mean rebar diameter
- Diameter distribution
- Bend shape distribution
- Number of different reinforcement items
- Rebar lengths
- Reinforcement ratio
- Details regarding threaded connection bars
- Details regarding rebend connections
- Number and position of construction joints
- Number and position of expansion joints

A sound basis for the comparability of bids exists only if sufficient details are provided with respect to the reinforcement. The larger the related information gaps in the specification, the more significant the need for free pricing assumptions, with an associated adverse effect on the comparability of bids.

3 EXPERT SURVEY

Experts are defined as individuals who possess specific knowledge and intellectual skills and competencies in a clearly delineated field and who serve as a source of specific knowledge for the purpose of a survey. Expert knowledge usually comprises exceedingly large amounts of information, including simplifications, lesser-known facts, rules of thumb, and smart practices (i.e., heuristics) that enable efficient problem solving (Gläser and Laudel 2010, Springer Gabler 2017). In a preselection process, a total of about 130 experts from Austria and Germany with experience in the fields of costing, process planning, construction, final costing, and invoicing were contacted in writing and asked to participate in the survey. In total, 29 experts were recruited for the survey. They provided 28 responses with respect to details that must be stated for appropriate pricing of reinforcing works.

The majority of respondents (i.e., approx. 66%) worked for large companies with more than 250 employees, about 24% worked for medium-sized businesses (50 to 249 employees), and about 10% came from small businesses (10 to 49 employees). In the survey presented in this paper, experts had an average professional experience of 17.4 years; this experience ranged from 5 to 41 years. Questions were designed and developed together with social researchers (i.e., sociologists) in several revision steps, applying the principles of simplicity, clarity, impartiality, and specificity. On average, each respondent was interviewed for about 45 minutes either on the phone or in a face-to-face session to overcome ambiguities, collect missing information, or obtain background information and justifications of responses (Hofstadler and Kummer 2017).

4 ANALYSIS

Figure 1 shows the analysis of the relevance of individual details pertaining to reinforcing works. This diagram reveals that the reinforcement ratio is by far the most important factor to enable source-based costing. This variable describes the amount of reinforcement to be installed per cubic meter of concrete, thus indirectly providing information on how tight the spacing of the

reinforcement should be. For instance, installing rebar in a wall at a reinforcement ratio of 215 kg/m³ is much easier than at a reinforcement ratio of 510 kg/m³ (see Figure 2).

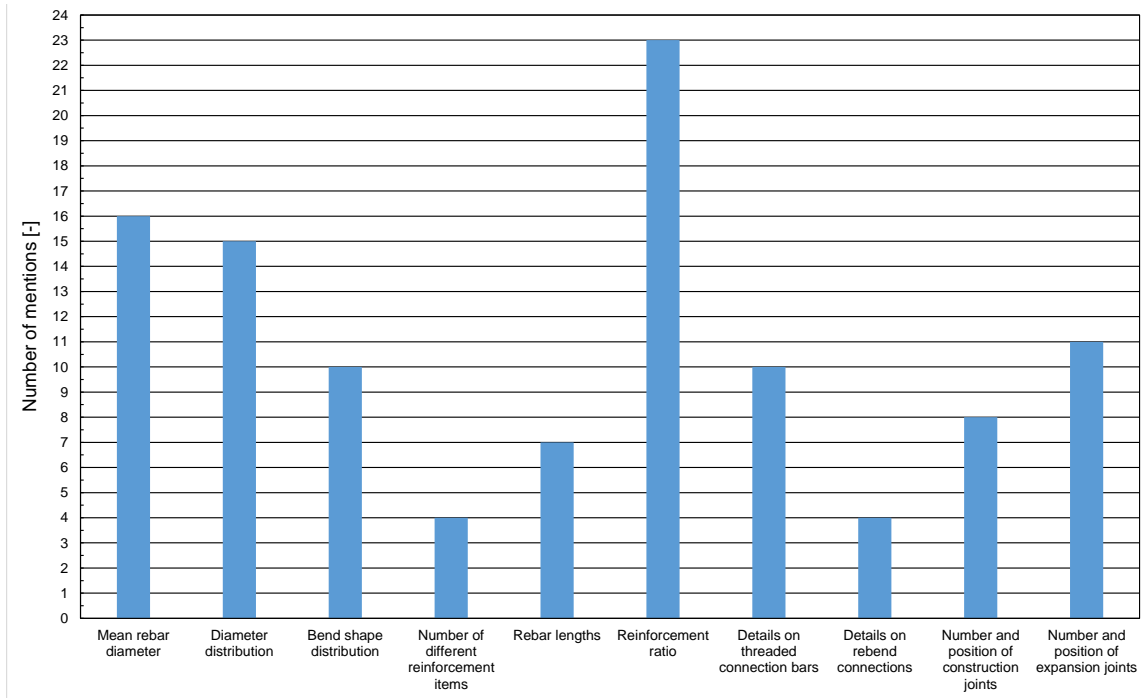


Figure 1. Number of mentions of details that must be stated for appropriate pricing.



approx. 215 kg/m³



approx. 510 kg/m³

Figure 2. Different reinforcement ratios for core walls of a high-rise building.

Other significant factors for performing a comparable, source-based costing exercise include the mean rebar diameter (i.e., the weighted average of different rebar diameters and quantity proportions) and diameter distribution. Together with the distribution of bend shapes, these factors relate to the quantity structure of the combined pricing item and are thus crucial for costing and pricing (Wanninger 2014).

Any change in the quantity structure on which costing is based will have a direct effect on the assumed labor consumption rates and costs and will subsequently lead to cost over- or underruns. Experts also considered the number and position of construction and expansion joints as well as

details regarding threaded connection bars to be significant, whereas rebar lengths, details on rebend connections, and the number of different reinforcement items were considered to be less significant.

5 CONCLUSIONS

This paper described the issues that may arise from structural building specifications if the client does not disclose accurate details regarding the reinforcement. In such as case, it is difficult to prove if additional cost claims are justified on their merits alone; yet it is equally difficult to determine the correctness of the claimed amount. The fewer the details provided by the client in its structural specifications, the greater the freedom for bidders at the submission stage. However, the question arises if bidders are actually comfortable with such a large room to maneuver in terms of pricing. Ways and means to reduce or prevent uncertainties in costing and pricing as well as in the related handling and invoicing processes are highly relevant to construction management and economics, far beyond reinforcing works. These issues can be resolved by preparing a clearer, more comprehensive specification combined with provisions that stipulate how to proceed in the event of any changes to quantities, the reinforcement ratio, or distributions at the detailed design stage.

The client's specification should include designated items for component groups that belong together, such as foundations, columns, walls, or floors, and specify separate items for individual rebar diameters. These are necessary to describe the work clearly, completely and objectively, to ensure price comparability, and, ultimately, to prevent non-quantifiable risks from being shifted to the bidder(s). Moreover, further items would have to be created for additional costs of different reinforcement ratios, quantity over- or underruns, or bend shape distributions. This approach would enhance the quality of the specification, thus promoting the plausibility and comparability of bids, whilst also making a major contribution to reducing conflicts in the course of managing and completing the project.

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