

Investigation on Uncertainty in Construction Bid Documents

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● **Abstract:** Construction bid documents contain various errors or discrepancies giving rise to uncertainties. The errors/discrepancies/ambiguities in the bid document, if not identified and clarified before the bid, may cause dispute and conflict between the contracting parties. Given the fact that bid document is a major resource in estimating construction costs, inaccurate information in bid document can result in over/under estimating. Thus, any questions from bidders related to the errors in the bid document should be clarified by employers before bid submission. This study aims to examine the pre-bid queries, i.e., pre-bid request for information (RFI), from state DoTs of the United States to investigate error types most frequently encountered in bid documents. For the study, around 200 pre-bids RFI were collected from state DoTs and were classified into several error types (e.g., coordination error, errors in drawings). The analysis of the data showed that errors in bill of quantities is the most frequent error in the bid documents followed by errors in drawing. The study findings addressed uncertainty types in construction bid documents that should be checked during a bid process, and, in a broader sense, it will contribute to advancing the construction management body of knowledge by clarifying and classifying bid risk factors at an early stage of construction projects.

Key words: Construction uncertainty, Construction bid document, Pre-bid Request for Information (RFI), Document discrepancy

1. INTRODUCTION

Construction bid documents are documents issued by the owner to the interested bidders which describes all the elements of a construction project or any of the works being procured. It contains detailed information about the proposed construction project. Bid documents become a part of the contract document for the execution of the work after formal agreement between owner and selected contractor. It includes plans, specifications, conditions of contract, bidding procedure and bid forms [1] to describe scope of work of a specific project. Moreover, bid documents are used to communicate owner's design intent to bidders for the extraction of cost item quantities [2].

Although bid documents are significant in providing project cost estimations, they are not always clear or adequate [3], and many errors or discrepancies are encountered in the documents giving rise to uncertainties. Errors or uncertainties in the bid documents can be the consequences of poor quality management such as incomplete bid issuance [1], lack of adequate time to prepare the documents, wrong assumptions of standard practice and inexperience [4], client impatience, reluctance to invest more in good quality documents [3], poor communication between the professional and the client, and negligence of the professional and designer's error [5].

The errors and discrepancies in the bid document, if not identified and clarified before the bid, may lead to inaccurate estimates, higher margin in bids, claims, and dispute between the contracting parties [3]. According to the previous research, ‘poor bid documents’ has been identified as the second major cause of inaccurate cost estimates [3]. In addition, Liu and Ling (2005) pointed out ‘completeness of bid documents’ as a significant factor affecting contractor’s markup estimation. Contractor’s bid decisions are also significantly affected by quality of bid documentation [7]. Errors in bid documents get transformed as errors in the contract, which is one of the reasons for the construction projects not being completed within planned time, cost, and quality.

To reduce the uncertainty in the bid document, any discrepancies or errors prevailing in the bid document should be identified beforehand. During the construction bidding process, bidders are required to ask for clarification of any ambiguous or incomplete information arising from reviewing bid documents, and the owner should respond to all bid inquires and clarification request unless such requests are timely submitted. Thus, frequently occurring errors or discrepancies in the bid documents can be understood by analyzing the pre-bid request for information (RFI), i.e., bid inquiries or clarification requests, and responses. The RFI is a document used during the bidding or construction process to get clarification of the necessary details of the project. During the bidding process, a contractor may submit RFI to get clarification or rectification of project’s detail and the owner either clarifies the detail or develops an addendum to rectify the error/problem in the original bid document. RFIs normally address ambiguities or uncertainties arising from all kinds of bid documents [8] which may ultimately impact the project pricing [1]. Therefore, pre-bid RFIs and their responses can help identify uncertainties, errors, or discrepancies in the bid document.

Various studies have been carried out to identify errors in the bid documents such as exploring uncertainties from bid document [2], identifying prevalent errors from contract documents [4], identifying causes, effects and remedies of errors in construction documents [5] and assessment of deficiencies in design documents [9]. Previous studies have identified the errors or uncertainties in the bid/contract documents based upon questionnaire survey or case studies. However, the use of pre-bid RFI documents for error identification in construction bid documents have been rarely explored.

This study aims at identifying uncertainties such as incompleteness and imprecision in the construction bid-document through the analysis of pre-bid RFIs and investigating frequent error types occurring in the bid document. This study addresses the major uncertainty type in the construction bid documents that can lead to inaccurate cost estimates, claims and disputes. This study can contribute to the construction project management body of knowledge in term of building knowledge about the likelihood of the errors and the frequent error types that should be checked before bidding, thus preventing future design changes, claims, and dispute risks in advance.

2. RESEARCH METHODOLOGY

To understand uncertainties in construction bid document, this study examines pre-bid RFIs and classifies the types of uncertainty. Figure 1 shows the methodology flowchart to investigate the uncertainties in construction bid documents, including data collection and analysis procedure. Pre-bid RFIs, which may include errors in bid documents, are the primary data investigated in this study. Data were collected from the state Department of Transportation (DOT) (Oklohama DOT, Ohio DOT, Nevada DOT, Connecticut DOT) and bid express website (<https://www.bidx.com/>) for the period of 2017-2021. The pre-bid RFI data resulting in issuance of addendum were classified into various categories based on their characteristics. These uncertainty categories were then analyzed to obtain the frequency, percentage and ranking of the errors or uncertainty prevalent in construction bid documents.

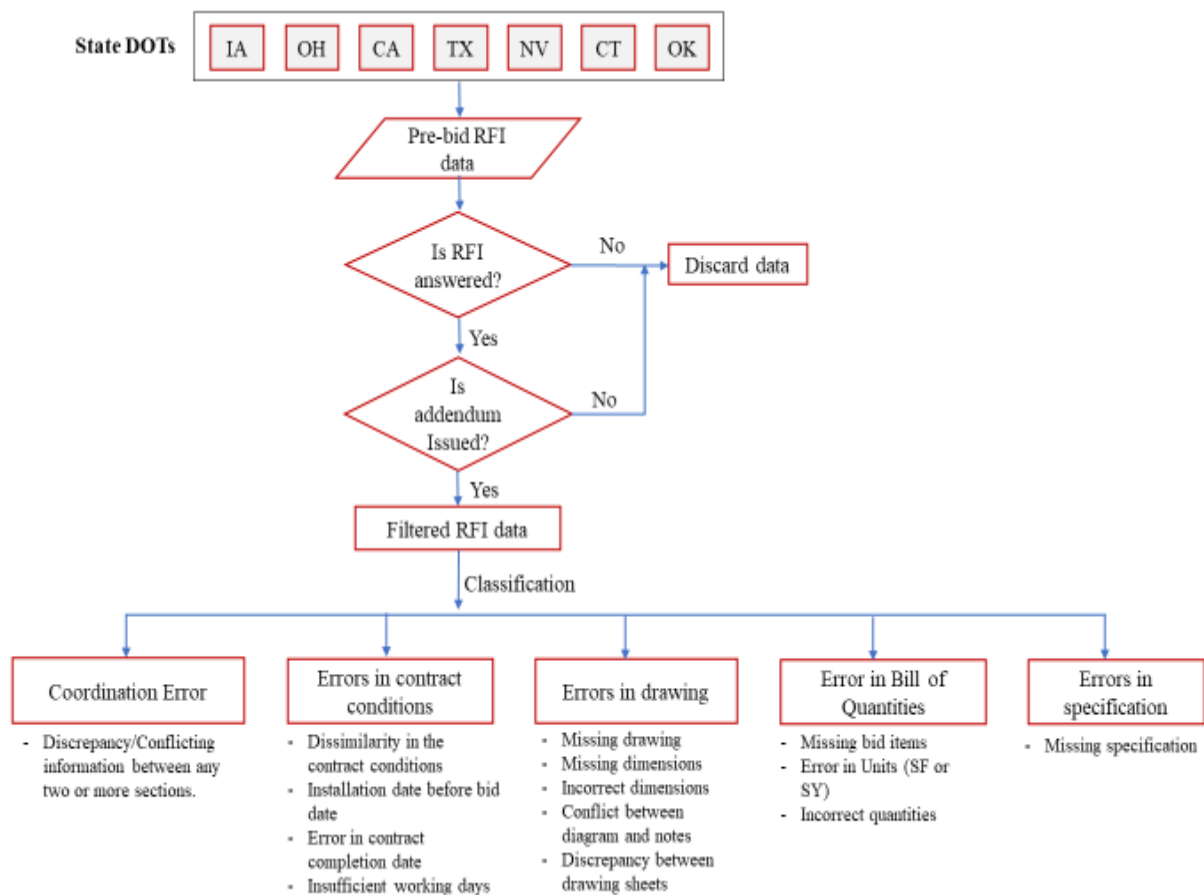


Figure 1. Flowchart of Uncertainty investigation

2.1. Data collection

Pre-bid RFIs and their corresponding responses from various US State DOTs were collected in the study. Supplementary data such as bid contract number, question number and name of DoTs were also collected for reference. The collected data are derived from various construction projects such as construction of roads, bridges, repair, and maintenance works etc. Generally, during the bidding phase of a project, a bidder may request for an information if there is any confusion in the bids and further clarification or rectification is required. In this process, RFI queries are answered by the owner’s team either clarifying the query or directing to a specific section for the clarification. However, if there are errors identified by the RFI queries to be addressed, the owner is bound to issue addendum to correct such errors. Since pre-bid RFIs resulting in the issuance of addendum represent the prevailing errors, only such RFI query that results in addendum are collected in this study. About 800 queries were collected to examine bid uncertainties, out of which 200 pre-bid RFIs representing errors or uncertainties were used in the study.

Figure 2 shows pre-bid query and its response for a new concrete pavement project. A bidder raised a question regarding the quantities of the crossovers, and the project owner responded “quantities for cross over pavement are correct”, demonstrating that the given bid documents are error-free. Since this study aims to investigate uncertainties in bid documents and such uncertainties are addressed through the issuance of addendum, bid queries that don’t result in addendum were excluded from the data analysis.

0130 12" PCCP

Could you check the quantities listed in Tab 100-24 for the Crossovers and Ramp Taper areas for item 0130 12" PCCP?

Asked at 12/29/2020 02:28:36 PM

In review of the paving tabulation **the quantities for cross over pavement are correct.** The ramp taper quantities may be different than expected as we included a portion of the ramp taper in the mainline tabulation.

Answered at 01/04/2021 10:49:22 AM

Figure 2. Pre-bid RFIs sample data

Figure 3 shows a pre-bid inquiry and its response related to Plain Cement Concrete (PCC) sidewalk construction work proposals issued by Iowa DoT in September 2019. The RFI was inquired by a bidder regarding the discrepancy in ‘detectable warning’ quantity between plan and bill of quantities, resulting in the publication of an addendum. This type of pre-bid inquiry is considered in the study for finding overall errors and uncertainties in the bid documents because uncertainty existing in the bid document can be understood through pre-bid inquiry information which results in issuance of addendum to rectify the prevailing errors.

Inquiry: Detectable Warning Quantity, **40sf** of warning panels are shown on sheet S.1. The bid item is only for **20sf**.

Response: See addendum 17SEP102A02.

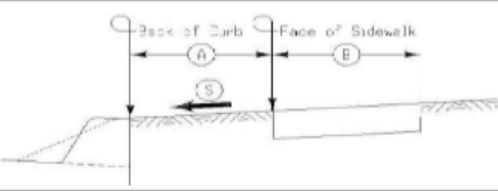
Proposal Schedule of Items Page 3 of 8

Proposal ID: 97-7057-686

SECTION: 0001 TRAIL ITEMS

Alt Set ID: **Alt Mbr ID:**

Proposal Line Number	Item Number Item Description	Item Quantity and Units	Unit Price		Bid Amount	
			Dollars	Cents	Dollars	Cents
0240	2511-0310100 SPECIAL COMPACTION OF SUBGRADE FOR RECREATIONAL TRAIL	70.000 STA				
0250	2511-7528101 DETECTABLE WARNINGS	20.000 SF				
0260	2519-1001000 FENCE, CHAIN LINK, VINYL COATED	1,430.000 LF				



Road Identification	Station to Station		Side	(A)	(B)	(S)	4" PCC Sidewalk	6" PCC Sidewalk	8" PCC Sidewalk	Detectable Warnings
				FT	FT	%				
Recreational Trail	100+00.00	103+94.11		0.00	10.00			437.9		
Recreational Trail	1+44.44	2+11.44		0.00	10.00			78.1		
Recreational Trail	2+11.44	2+74.50		0.00	12.5-15.0			89.8		
Recreational Trail	2+74.50	3+33.40		0.00	10.00			69.1		
Recreational Trail	7+40.99	29+72.48		0.00	10.00			2506.2		
Recreational Trail	29+99.48	35+80.17		0.00	8.00			516.2		20
Recreational Trail	35+80.17	37+37.63		0.00	8.0-10.0			166.7		20
Recreational Trail	37+37.63	38+66.05		0.00	10.00			142.7		

Figure 3. Example of pre-bid query and response

2.2. Classification of Uncertainties

To better understand what makes uncertainties in bidding or estimating and what types of documents are prone to errors, the data collected has been analyzed and grouped based on the common characteristics of errors or uncertainties. It resulted in the formation of five categories of uncertainties which are described as follows:

- **Co-ordination Error:** It refers to the error which shows the discrepancy/conflicting information between any two or more sections of bid document such as discrepancy between Bill of Quantities (BoQ) and drawing or discrepancy between drawing and specifications etc. The most likely error case in this category is the difference in quantities of the bid items such as subdrain, pavement removal, etc. between BoQ and drawings. The second most likely error case is the contradiction in the description of the bid items between BoQ and drawings. Example of this error category is “*Table 104-3 shows totaling 262 LF of pipes, which varies from the bid quantity of 212 LF.*” If this type of error is not addressed during the bidding phase, claims for time extension or cost increment can be encountered during construction execution, resulting in potential conflicts and disputes among the contracting parties.
- **Errors in contract conditions:** It refers to the error that shows overall error cases in contract conditions, such as dissimilarity in the contract conditions, installation date before bid date, error in contract completion date, insufficient working days etc. Although there are just a few error cases in this category, this type of error should not be ignored during the bidding phase because the successful bidder or contractor will have to pay a penalty if works are not carried out as per the contract provisions such as penalty for not completing the works within contract period etc. If there are unclear and adverse contract terms in bid document, then the bidders are likely to increase contingency markup in bids causing higher bids, which in turn results in losing the bid. From the owner’s point of view, the higher the risk of the contract conditions, the more likely the bidders may decide not to bid, leading to lesser competition in the bids. In this error category, the most likely error case is the insufficient working days for the completion of the work. An example for this error category is “*Is there a reason for the short contract period (35 Working Days) on this project? Seems extremely short for contract of this size/value*”.
- **Errors in drawing:** It refers to the error which shows overall error cases in drawing files such as missing drawing, missing dimensions in drawing, incorrect dimensions in drawing, conflicting information between diagram and notes, discrepancy between the drawing files etc. as shown with relevant example in Table 2. The most likely error case is the discrepancy of information between the drawing sheets or discrepancy between the drawing sections such as notes and diagram, diagram and tables, notes and notes etc. An example representing the error category is “*The Pile cap plate on plan view calls for the plate to be 1.5", but the cross section and notes calls it to be 5/8" Thick*”. Errors in drawing, if not addressed and resolved in bidding phase, may result in delays during construction, issuance of change orders causing increase in contract amount. The drawing errors may also lead to abortive works or defective works, which will require replacement or correction at a cost or result in a construction failure.

Table 1. Errors in drawing

No.	Errors in drawing	Case example
1	Missing drawing	No sections provided for sandy lane.
2	Missing dimensions in drawing	Missing the dimensions of base plate.
3	Incorrect dimensions in drawing	Two drawing sheet shows Generator fence height of 10 feet and 12 feet.
4	Conflicting information between diagram and notes	Diagram on B.1 for 9" paving 32' wide has 3 dowels while note on same page says no dowels in paved shoulder.
5	Discrepancy between the drawing files	Sheets I.10 and I.11 show turf areas to be lawn seed mix. Then on sheets RR.1-RR.4 show the same areas to be sodded. Can you advise on which one it is supposed to be?

- **Errors in Bill of Quantities:** This type refers to common error cases in bill of quantities such as missing bid items, error in units (square feet or square yard), incorrect quantities, etc. The most likely error case is the incorrect quantities of bid items. An example for this error category is “*It appears there is more 9" PCC than listed in bid item*”. This type of error, if not addressed and resolved in the bidding phase, can lead to claims, change orders and construction dispute which in turn adversely affects the project cost and schedule.
- **Errors in specification:** This type indicates errors occurring in specification such as missing specification of any item. There are few error cases of this category found in the study; however, if they are ignored in the bidding phase, it may cause claims, change orders and ultimately cost overruns and time extension of project. An example for this error category is “*Specifications of brick work is missing*”.

The findings of the study in terms of frequency count, percentage occurrence and ranking of error categories are presented in Table 2. It was found that the most frequent error or uncertainty prevailing in the construction bid document is “Error in Bill of Quantities (43.5%)” followed by “Errors in drawing (27.0%)” and “Coordination Error (20.5%)”. The result shows that errors in bill of quantities account to nearly half of the entire errors occurring in the bid documents. The result also shows that solving the bill of quantities and drawing errors could indicate overcoming 70% of the errors prevailing in the bid documents. Apart from bill of quantities and drawing errors, attention should be given to coordination error as it has 20.5% of error occurrence rate.

Table 2. Errors in construction bid documents

No.	Error categories	Frequency	Percentage	Ranking
1	Coordination Error	41	20.5%	3
2	Errors in contract conditions	13	6.5%	4
3	Errors in drawing	54	27.0%	2
4	Error in Bill of Quantities	87	43.5%	1
5	Errors in specification	5	2.5%	5
Total		200	100%	-

3. CONCLUSION

In this study, 200 pre-bid RFI cases representing errors in construction bid documents are collected, analyzed and are grouped into five error categories based upon the common features of

the error cases. The top three error categories that are frequent and should be checked during the bidding period are 'Error in bill of quantities', 'Errors in drawing' and 'Coordination Error'. Although the findings of this study demonstrate the main error types of bid documents that can affect project performance, potential limitation may exist as the study only relied on frequency of errors. Future research efforts would be directed towards investigating the impacts on each error in bid documents via interviews or surveys to better understand project uncertainty and its impacts on project performance.

The main contribution of this study is that it helps the bidders or contractors to be aware of the overall uncertainties and frequently occurring uncertainties in the bid document, thus helping them to make better decisions (bid/no-bid decision) within a limited bid timeframe and build better contingency plan considering the risks associated with uncertainties. In addition, this study also helps the owners to take appropriate actions such as reviewing the entire bid document in terms of uncertainties before the issuance of bid documents to improve the quality of documents, thus ultimately reducing the change orders, claims and dispute during construction.

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