

Developing a Fair And Reasonable (FAR) Price Reasonable Lowest Bid Model Using OR Technique

Kishan H Joshi¹, Prof. Amitkumar N Bhavsar² Prof. Dharmesh K Oza³

¹*Student of Final year M.Tech Construction Engineering and Management, B.V.M Engineering College, Vallabh Vidyanagar, Gujarat, India kishanjoshi2405@gmail.com*

²*Civil Engineering Department, B.V.M Engineering College, Vallabh Vidyanagar, Gujarat, India
anbhavsar@bvmengineering.ac.in*

³*Civil Engineering Department, L.D Engineering College, Ahmedabad, Gujarat, India
dharmeshoza24@gmail.com*

Abstract— Modern Construction projects often induce unbalance bidding by contractors which is not in the larger interest of the owner. Because of uncertainties within the project, contractor in order to pacify the effects encountered during project submits a bid price in an unbalance manner. One of the primary reasons for submitting an unbalanced bid is that contractor tries to have a competitive advantage thus by affecting the healthy competition between contractors. If the strategy of contractors turns out to be positive, contractor will earn higher profit which in turn puts a financial burden on the owner. On the other hand with uncertainties to be accompanied while executing project, if the said strategy has a negative impact than contractors has to suffer a loss. To avoid the loss to owner, loss to contractors or affecting quality of work, topic has been selected to propose a model which is fair and reasonable in nature to both contractors and owner executing the project and to find an alternative in order to mitigate the unbalance tendering

Keywords— *Unbalance Tendering, Tendering , Contractors*

I. INTRODUCTION

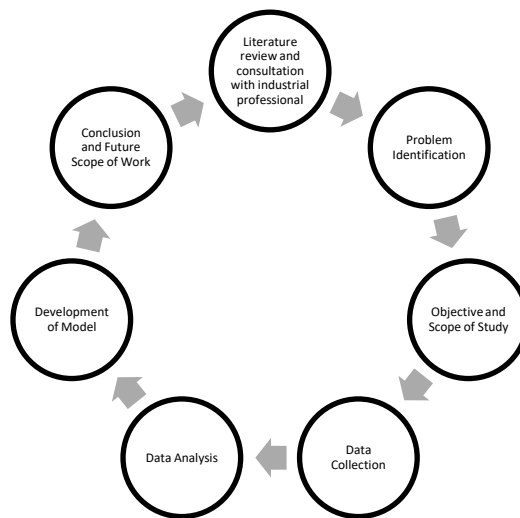
Construction industry is second largest industry in the world after the agriculture industry. In the Construction Industry especially in the Govt. Sector, in order execute the planned project for the development, competitive bidding with the lowest offer has been the method of selection of contractors. In process of completing the project at the lowest cost certain limitations in the system has its adversity at the longer run both financially and economically at the cost of life & quality of the people. Due to lack of effective system the true cost of the construction project is not known till the end of completion. Thus adverse selection is a major concern with the competition in the market. When a winner of the contract has underestimated the project's true cost he is most likely earn negative or at least below normal profits. The curse is when the winning bidder submits an underestimated bid which is difficult to execute with the specification and design on hand which ultimately leads to the upbringing of the adversities. Hence in order to balance the upheld risk it is essential that a methodology must be refined in such a way that work executed is according to the standards at the lowest cost.

II. PROBLEM IDENTIFICATION AND OBJECTIVES

In order to carry out the genuine study, a genuine problem in the industry needs to identify. For the same purpose different stake holders of the construction industry have been consulted to find the most curing problem in the industry. From the review of the stakeholders of the industry it has been observed that Unbalance Tendering is one of the major issues which both Government and Private sector has to face. It is an issue which is avoiding healthy competition in the industry as well not in the best interest of the owners. After collecting data from the consultant appointed for the industrial project. A careful study of the activities affecting tenders to unbalance has been observed. By analysing the data, it has been found that a careful study in the area of the unbalanced tender needs to be carried out in-order to solve the pressing problem affecting both the healthy competition and owners.

1. To study the existing Lowest Bid Award concept against the proposed concept
2. To study the limitation of the existing lowest bid award concept
3. To study the effects of unbalanced tender on the project
4. Tabulate the comparison of estimated value, Bidding value and actual value of construction projects executed

III. RESEARCH METHODOLOGY



IV. UNBALANCE TENDERING

Unbalanced bidding is where a bidder places a high price on some items and a low price on other items in a unit price contract. Unbalanced tendering can be classified into 3 types. 1) Front Loading 2) Back Loading 3) Quantity Exploitation. In the front loaded tender, contractors quote the too high rates in the items of the tender which is going to be executed early. So they can get enough money in the initial payments and they can use the same money for the rest of the work. In case of back loading, contractors quote the higher rate in the items which are going to be executed late. It can also be like loading those items which are expected to have high rate of escalation and in case of contractor quotes higher rates in some items which expected to exceed than the estimated quantities and inversely lower rates are submitted for items which are expected to decrease compared to estimated quantities.

V. DATA COLLECTION

For the purpose of study of unbalance tendering, data of a industrial project has been taken. Following are the details of the same. The industrial site is located in Jambusar taluka, which is approx 50 km from Vadodara city. Survey No.192/1, 192/3, 193 to 199 & 209 Village - Ankhi, Taluka: Jambusar, District: Bharuch, Gujarat, India. The Client of project was BTW Atlanta Ltd., Design consultant of the project was M/S Shah & Talati and Contractor was M/S Sandip Nanavati. It was a green field project. Project consists of building an industrial site for manufacturing of the transformers. The industrial shed consists of production building for the manufacturing of the transformers along with the essential amenities. The estimated cost of the project was INR 156,929,900. The planned duration of the project was 15 months.

Null Hypothesis H0: Contractor that bids as L1 remains the L1 after execution of work

Alternate Hypothesis H1: Contractor that bids as L1 does not remain L1 after execution of work

In order to validate the hypothesis activities of different entities were calculated along with estimated rate & quantity of each item along with the bid value of each participating contractor against the actual cost if the work had been given to the respective contractor. Following are results of the same.

Table 1 Estimated Cost Of Bid Submitted By Contractors

Activity Name	Estimated Value	C1	C2	C3	C4	C5
A	1,759,425	1,386,782	1,371,504	1,362,525	1,273,000	2,039,919
B	117,966,405	96,968,507	106,882,700	101,376,991	101,382,836	110,930,377
C	35,514,320	24,514,679	34,519,487	32,260,468	29,537,875	30,923,166
D	1,689,750	1,320,612	1,495,032	1,400,578	1,415,975	1,525,749
Total	155,240,150	122,869,968	142,773,691	134,999,984	132,193,711	143,893,462
Rankings		L1	L4	L3	L2	L5

Against the bid value of these 5 contractors; C1 contractor was awarded the work on being L1 at the estimated stage. After the execution of the work as per detail design drawings for the project, total costs of each activity were calculated. After calculating the bid value against the actual quantity it has been tabulated in table 2 which shows C1 contractor being awarded the work at the tender stage does not remain the L1 after the execution of the work. Table 3 shows the tabulated comparison of position of contractors at tender stage and after execution stage with their final value. From the study it is observed that contractor C1 at the time of tender stage does not remain L1 when actual quantities are calculated with reference to bid value of other contractors. Contractor C3 which was L3 at tender stage becomes L1 after calculating the bid value for the actual quantities. Thus the null hypothesis which is assumed is false and proves that there is unbalance bidding while undertaking for activities.

Table 2 Final Cost Of Bid Submitted By Contractors after execution of the project

Sr No	C1	C2	C3	C4	C5
A	15097681	16547011	15668514	14465310	14831970
	7526.25	11812	11812	10125	11643
	4667157	5255975	4262306	4682286	4172433
	1990793	2675909	2113808	2192800	2352580
	2998034	14285049	2498651	2937121	3773744
B	85,064,524	97737844	85247117	93182727	97421197
C	2,101,764	2076719.755	1854232.6	195347.475	2674240
D	868,257	1052885	1033444	1085058	1070175
Total	112795736.6	139643204.8	112689884.6	118750774.5	126307982
Rankings	L2	L4	L1	L3	L5

Table 3 Ranking of Contractor at Bidding Stage and Completion Stage

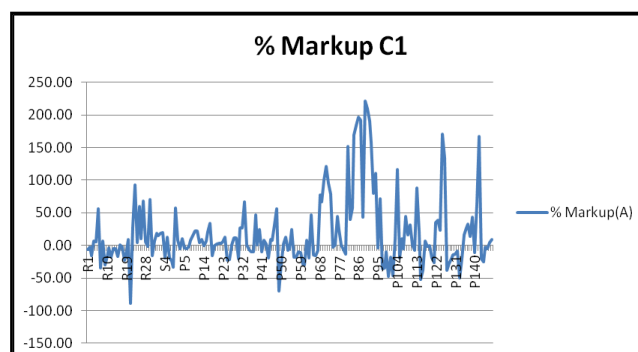
Name of Contractor	Ranking as per Est. Cost	Ranking as per Act. Cost	Est. Cost	Act. Cost
C1	E1	A2	124211698	112795736
C2	E5	A5	157183869	139643205
C3	E3	A1	136425537	112689885
C4	E2	A3	133891561	118750774
C5	E4	A4	145460842	1263077982

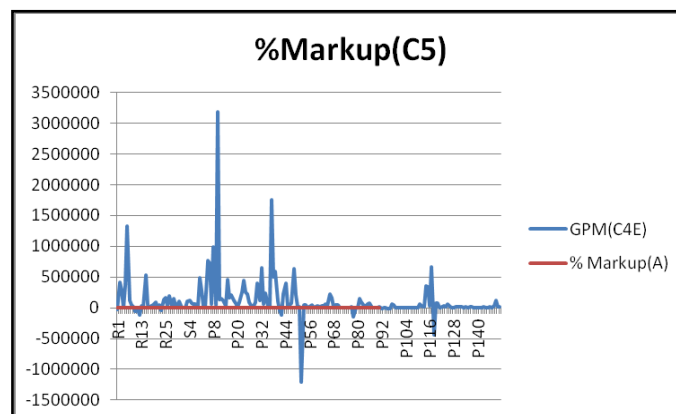
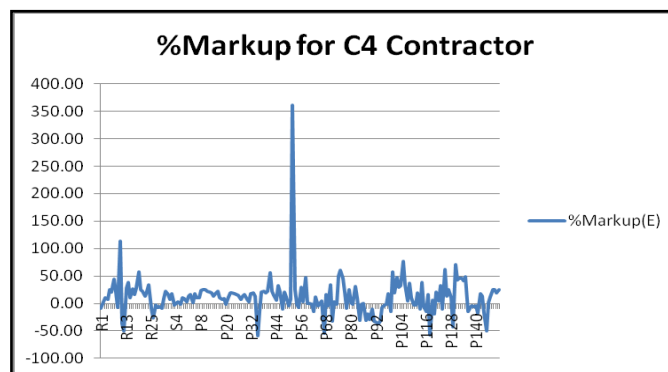
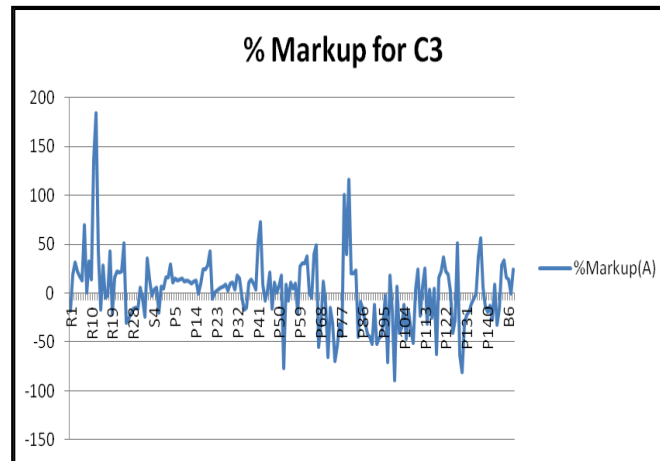
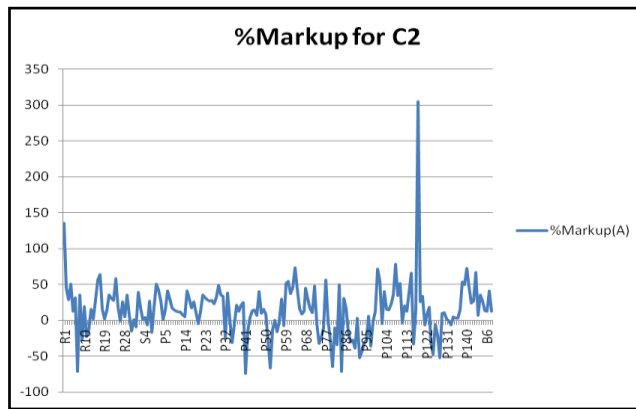
VI. DATA ANALYSIS

In-order to understand the pattern of unbalanced tendering in the project by contractor, % Mark-up gained by each activities has been calculated by using the following formula.

1. $U.C. = (BIUC - EQ)$
2. $GPM = (SP - UC)$
3. $\% \text{ Markup} = \left(\frac{GPM}{UC} \right) * 100$

Using these formulas %markup for each activity has been graphically represented as follows.





Depending upon the strategies that each contractor has adopted, it is observed that contractor has exploited the estimated quantities & specification of the activities in order to gain the maximum profit and compensating for the unforeseen uncertainties. This kind bidding is known unbalance bidding. In order to realize which activities are the target activities for the process of unbalance bidding, these can be known by using the statistical tool for P-Value by testing Anderson-

Darling Normality Test (P-Value) in Minitab software. All activities having P-Value less than 0.05 (i.e. 95% confidence level) are identified to understand the trend of unbalancing. Since the no of observation are small for study, the P-value up to 0.08 has been considered as floating activities in the study.

In order to realize the actual impact total value has because of the independent linear variable, using linear regression equation are generated which are as follows. Due to limitation of no of response variable (dependent variable), the data of the activities have been clustered into equal size depending on total no of variable each activity has. For this, Minitab software has been used to find the generating equation of dependent and independent variable. Following are the equation for the entities to be constructed in the project.

Regression Equation for Road Work

$$Y-RW = -194453886 + 16972 \text{ Load-1} + 34522 \text{ Load-2} - 26423 \text{ Load-3} + 272.9 \text{ Load-4}$$

Regression Equation for Sewage Disposal Network

$$Y-SD = 167210 + 55.7 \text{ Load 1}$$

Regression Equation for Box Culvert

$$Y-BC = 349115 + 49.0 \text{ Load 1}_1$$

Regression Equation

$$Y-FB = 37650658 + 246 \text{ Load F} + 10.33 \text{ Load B}$$

VII Development of FAR Model

Based on the data analysed using the reference of the literature review following are the steps for calculating the Lowest Bid (L1).

- Step 1) Rationalize all the data submitted by Bidder of the Project is sequential activities.
- Step 2) Calculate the unit price for all the bid items
- Step 3) Calculate the bid price for the project.
- Step 4) Using the P-Value Test determine normality of the data and identify the items having $P < 0.05$ (95% confidence interval).
- Step 5) Calculate the Bid Item Unit Cost (BIEUC) of all such activities having $P < 0.05$.
- Step 6) Calculate the Bid adjustment coefficient for all bidders.
- Step 7) Calculated the adjusted item price for all bid item having $P < 0.05$.
- Step 8) Compare Original Bid price against the Modified Bid Price
- Step 9) Calculate whether the Lowest Bidder Still remain the lowest or not?

For Calculating Bid Item Unit Cost:

$$\text{BIEUC} = \frac{\text{Average of unit price of Bid Item submitted by all Bidders}}{1 + (\% \text{ mark up})}$$

$$\text{BAC} = \frac{\text{BID Price of an item}}{\text{BIEUC of an Item}}$$

$$\text{ABIP} = \text{BAC} * \text{OIP}$$

VIII Conclusion

1. Majority of the projects executed by the Govt Dept. Face the problem of Unbalance Tendering.
2. Unbalance Tendering is generally adopted by the contractors in order to avoid uncertainties in the project.
3. Estimated Quantities are not precise. There is major deviation in the quantities from the estimate to the Final Bill.
4. Due to lack of availability of the detail drawings at the early stages of project precise judgment of Final Cost are not.
5. Unbalance Tendering is an acute problem which keeps the genuine bidder away.
6. Provision of I/D clause in large scale infrastructure projects can be beneficial thus by giving contractors an confidence of assured RRR.
7. Owner should make suitable provision for giving timely amount of RA Bill to contractors thus allowing them to maintain cash flow.
8. An awareness of the issue and the detail classification will improve the uncertainty detection within quantity capability during bid preparation.
9. Identifying and evaluating uncertainties will increase the accuracy of quantity take off and reliability of bid price.
10. Bid Documents are a fundamental medium of communication; hence detail description helps to improve interpretability between the project participants

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