Measures for Cost Escalation in Bridge

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Abstract- The study throws light on various existing and traditional methods that are being used in computation of Cost Escalation in the construction sector. The thesis reviews the existing methods for calculation of escalation in India and premeditates the techniques adopted by the other nations across the globe. The existing method in India uses Wholesale Price Index (WPI) for materials and Consumer Price Index (CPI) for labour to calculate the escalation. Similar approach is being followed by many other countries too, but now-a-days some of the organisations have realized the shortfalls and hitches in this traditional method. Few organisations have taken initiative to develop construction specific cost indices such as Construction cost index (CCI), Producer Price Index (PPI), etc.

The cost of escalation obtained from the present method is too low than the actual escalation amount incurred in the projects. The three main reasons for such a difference are: the use of WPI which is a general price index, the non availability of indices for majority of construction materials and the absence of construction specific regional wise cost indexes. Hence an urgent need has been felt to review the present approach.

The use of actual prices (purchase rates) of the materials in the escalation formulae and secondly, the adoption of CCI to calculate escalation. In this study both the methods suggested have been proved with valid practical data and evidences and have been found to be significantly better than the existing approach.

Keywords - *cost, construction, escalation, estimation, material*

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I. INTRODUCTION

The construction industry has a major role in the development of the Indian economy. The construction industry is the second largest industry in India after agriculture. This industry consumes 40 to 50% of the national five year plan outlay and contributes 20% of gross domestic product. Medium to large construction projects take over a year for completion and the cost of materials and labour often increase, which leads to major problems in administration of the contract.

Increase in cost is determined by dynamic relationships between many factors, including acts of nature, interest rates, oil prices, global commodity markets, wars, wage rates, and the overall health of the economy, as well as supply and demand for the required goods or services. Increase in prices of construction material as well as the cost of labour has become extremely unpredictable hence estimation of the escalation cost with reasonable accuracy is very important. 'Escalation' is a term used in most countries, to indicate the extent of these changes from the commencement of a project through any point during its life. As equivalent terms, fluctuations', 'rise and fall' and 'contract price adjustment' are used interchangeably.

Cost escalation is defined as changes in the cost or price of specific goods or services in a given economy over a period of time. It refers to the increase in the amount of money required to construct a project over and above the original budgeted amount. Cost escalation occurs when actual costs exceed previously estimated values.Escalation is the provision in the cost estimate for increases in the cost of equipment, material, labour, etc., due to continuing price changes over the time. Escalation is used to estimate the future cost of a project or to bring historical costs to the present. Escalation is a risk that can account for a substantial part of construction cost, especially in long term projects where the variability and uncertainty is greater. Therefore there is a need to assess the risk of cost escalation in construction programs. The importance of studying and understanding the various aspects and concepts related to "Cost Escalation" and to propose new and modified theories so that this subject area inclines towards accuracy and perfection.

This study evaluates the various procedures and techniques used for forecasting the escalation in prices in the construction industry. The study reflects methods by which participants in construction projects can both track the extent of escalation and work together to minimize the impact of cost escalation on the success of a project.

This study evaluates the various fundamentals related to the subject of "Cost Escalation" in Construction projects. It first reviews the literature work associated with this study which has been carried out in the past by various researchers

across the globe. The aspects connected to the escalation have been discussed in detail, such as, causes of escalation, escalation clause in contract documents, different approaches and techniques used for calculating escalation.

Image 1.Actual Flyover Construction

The study reveals the important parameters used in the calculation of escalation, like Wholesale Price Index (WPI) and Consumer Price Index (CPI) along with their advantages and limitations for their use in the escalation calculations. The study also evaluates the limitations and problems associated with the existing formulae application for forecasting the cost escalation. This thesis proposes some new approaches towards cost escalation workings and explains them in detail with the help of illustrative examples. The practicability and application of these new approaches has been tested and justified by applying them to an actual case study of a flyover construction project, "Construction of flyover Pune."

II. METHODOLOGY

The intention of the client while floating a tender is to obtain a minimum bid price from various contractors applying for tender, with optimal quality as per specification, for a client to expect a minimum bid from the contractor client should either share the risk involved in the contract or reduce the risk factor from the contract so that the contractor will not consider the risk factor while bidding for the tender. Due to economic un-stability we can see a large fluctuation in the prices of the construction material and hence the need for the effective method for the calculation of cost escalation in construction contracts accurately is strongly felt.

The various escalation formula and provisions which have already been discussed lack in either of the things listed below due to which we are unable to attain the accurate escalation cost of materials.

1. The rate of escalation is calculated by linking it with the Wholesale Price Index (WPI), the Consumer Price Index (CPI) and the price of the diesel only for POL but the WPI and CPI do not truly reflect the price variation in any specific industry including construction, its material and wages of construction labour.

2. The price index calculated is based upon Laspeyres, Paasche and Fisher Ideal Index. It has not been clearly established which of the three methods used to calculate price index is accurate under various circumstances.

3. In the calculation of WPI about 676 distinct items are considered and out of the total weight age of 1000 only 26% of the total are relevant to the construction industry.

4. Escalation formula have been separately established only for materials such as Cement, Steel and POL which is about 45% of the total material cost and the remaining 55% of the material is covered under a general formula.

5. Every construction project is unique and it is inappropriate to apply the General indices such as WPI or CPI rather specific indices developed sector wise and regional wise will be more accurate.

6. The formula used for the calculation of the escalation cost needs further improvisation to attain accurate results.

There are many parameters involved in the calculation of any price index and due to so many drawbacks in calculation of indices; it is very difficult to develop indices which reflect the true picture of the variation in prices of different material. Due to various complications, it is not possible to obtain completely flawless values of the cost indices.Hence, it is proposed to use a practical approach for calculation of cost escalation which eliminates the use of cost indices and still gives realistic results.

Values to be considered:

1. Use the actual market rates of the material to calculate the difference in the cost, instead of various cost indices which are complicated and not very accurate.

2. The base price of the material used during construction can be fixed on the basis of the date of release of the tender document.

3. The base price can be fixed with the help of the approved vendors who have been agreed by both the parties of the contract.

4. The current price should be taken as the price of the material in the month under consideration.

Steps explained through an illustrative example:

Consider a tender released on 1st April 2012. Suppose we have to calculate the price escalation for cement (43 grade) for the month of December 2012.

Quantity of 43 grade cement consumed in the month of December = Q = 5000 bags.

Base price of cement (i.e. Market rate of cement 28 days prior to date of release of tender-

2nd March 2012 = P0 = Rs.290 per bag

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Current price of cement (i.e. Market rate of cement on the

15th December 2012 = P1 = Rs.310 per bag

Using equation,

Escalation amount for 43 grade cement for month of Dec. 2012
= 0.85 x Q x (P1 – P0) = 0.85 x 5000 x (310 - 290)=Rs.85000

(Note: The contractor's profit has been assumed as 15% which is not payable under escalation. Hence, a factor of 0.85 has been considered in the above formula)

The above simple illustrative example shows that how the cost escalation of various materials can be computed without using the messy cost indices.

It is high time that instead of using the general cost indices such as WPI and CPI whose main function is to calculate Inflation and not escalation, construction industry specific cost indexes based on construction sector and region should be developed to accurately calculate the changes in the escalation cost. Such indices are already been released by CIDC-Construction Industry Development Council in India. It has been publishing the Construction Cost Indices since 1998. Construction Cost Indices monitor variations in overall cost of construction for various types of projects such as buildings, roads, bridges, railway construction, dams, power plants, industrial structures including factories etc. The work should be further carried out to calculate the CCI values for all the sectors of the construction industry and covering all the regions of India. Such an indices should be used in Indian form of contracts, such as CPWD- Central Public Work Department, MRSDC-Maharashtra State Road Development Corporation, MRTP- Metropolitan Transport Project, MES- Military Engineering Service, etc., since the CCI index is weighted considering the construction related items only.

Image 2.Flyover Construction at site

The Construction Cost Indices are computed by considering only the materials that actually pertain to construction, unlike WPI, which considers 676 items of all general sectors and categories. Thus, CCI is construction specific and hence precise. It eradicates the involvement of

unnecessary items which have no relation with construction. The CCI is computed more precisely as compared to the WPI.

Instead of multiple indices, CIDC releases single CCI monthly for each construction sector (discussed earlier). Hence, complications and complexities are reduced to a great extent. Unlike WPI, the CCI is calculated on grounds of Base Year which is revised more frequently as compared to that of WPI.

III. RESULTS& ANAYSIS

The two new and innovative approaches of the cost escalation workings have already been explained in this study. The existing traditional methods of cost escalation have also been seen in detail. The cost escalation on materials and labour is obtained by using the cost escalation formulae and applying onto them, the generalized wholesale price and consumer price indexes, respectively.

In this approach, the escalation of the construction material has been obtained by applying the actual market rates (i.e. market prices) of purchase instead of the WPI and generalized indexes. In thecase study, this new concept has been applied on the two major construction materials: cement and steel.

In this approach, the total cost escalation of the project has been obtained by applying the CIDC's Construction Cost Indexes (CCI) instead of WPI and CPI. The CIDC releases CCI for 11 construction sectors. The CCI for the Bridge Sector for Mumbai region have been considered.

We calculated the escalation on the following elements:

- Labour
- POL
- Plant & Machinery
- Bitumen
- Cement
- Steel
- Other Materials

The existing formulae for each of the above elements along with the WPI and CPI are applied to them and the following results are obtained:

Approach I) Simple but detailed method

Component	Escalation Amt. in Rs.
Labour	21550999
POL	7287459
Bitumen	1407576
Cement	1939698
Steel	8069948
Other Materials	9754331
Total Escalation	**50010011**

Thus, the total escalation actually claimed by the project

= Rs.5.00 Cr

= (5.00/47.13) x 100 = 10.60 % of Contract Value

Approach II) Simple but compact method

Component	Escalation Amt. in Rs.
Labour	27346977
POL	6191509
Bitumen	3376746
Cement	1012240
Steel	2048624
Other Materials	10991970
Total Escalation	**50968066**

Thus, the total escalation actually claimed by the project

= Rs.5.09 Crores

= (5.09/47.13) x 100

= 10.80% of Contract Value

Approach III) Market Rate Method

Component	Escalation Amt. in Rs.
Labour	27346977
POL	6191509
Bitumen	4189642
Cement	5471119
Steel	11707475
Other Materials	10991970
Total	**65898693**

Thus, the total escalation actually claimed by the project

= Rs.6.58Cr

= (6.58/47.13) x 100 = 13.96 % of Contract Value

Approach IV) CCI Method

Project Tender Release Date :December 3, 2011

Therefore, CCI - 28 days before tender release date = $CCI0$ = 121.22
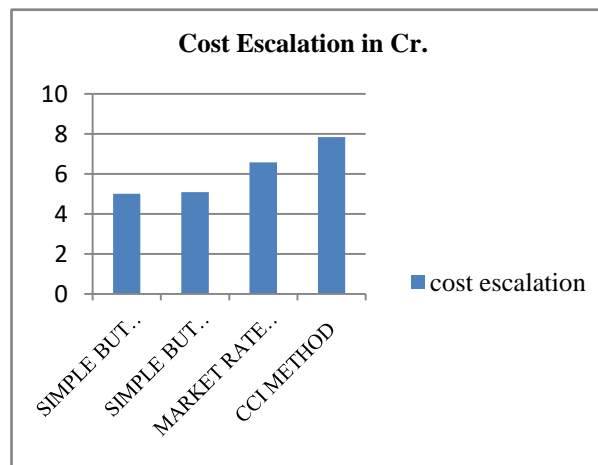
Project Completion Date :Nov 2015

Therefore, CCI – at completion date = $CCI1$ = 144.96

Total Escalation Amount obtained by CCI method

= 0.85 x Value Certified x (($CCI1$ - $CCI0$) / $CCI0$)

= Rs.78460522

= Rs.7.84 Cr = (7.84/47.13) x 100 = 16.63 % of Contract Value.

Graph.1 Comparison of calculation of cost escalation

Comparison 1
- Total escalation by market rate method
  =Rs.6,58,98,693
- Total escalation by simple but detailed method
  =Rs.5,00,10,011
- Difference =Rs.6,58,98,693 – Rs.5,00,10,011
  =Rs.1.58 Cr.
- Percentage difference in total escalation amount
  =31.77%

Comparison 2
- Total escalation by market rate method
  =Rs.6,58,98,693
- Total escalation by simple but compact method
  =Rs.5,09,68,066
- Difference =Rs.6,58,98,693 – Rs.5,09,68,066
  =Rs.1.49 Cr.
- Percentage difference in total escalation amount
  = 29.29%

Comparison 3
- Total escalation by Simple but detailed method
  =Rs.5,00,10,011
- Total escalation by Simple but compact method
  =.Rs.5,09,68,066
- Difference =Rs.5,09,68,066 – Rs.5,00,10,011
  =Rs.0.09 Cr.
- Percentage difference in total escalation amount
  =1.91%

Comparison 4

• Total escalation by market rate method
  =Rs.6,58,98,693

• Total escalation by CCI method
  =Rs.7,84,60,522

• Difference =Rs.7,84,60,522 – Rs.6,58,98,693
          =Rs.1.25 Cr.

• Percentage difference in total escalation amount
  =19.06%

IV. CONCLUSION

As the case study proves both the new approaches have yielded better results than the results obtained from the traditional methods. If the escalation workings would have been done through Market Rate Method, the project would have probably saved Rs.1.95 Crores, from the contractor's point of view. If the workings would have been done through the CCI method, then it would have fetched a gain of Rs. 2.60 Crores. This is an enormous amount, which is entirely lost in the game of construction contractor ship, just due to the existing impractical and vague techniques and traditional procedures.There are many other drawbacks that the construction projects suffer due to the pitfall of the existing system.

It has been observed continuously over the years, that the existing methods do not yield a realistic value of the escalation amount.The value obtained from the traditional methods is found to be much lower than the value of escalation actually incurred during the project.

This paper propagates such new approaches that try to minimize these pitfalls in the existing system. The study presents the new concepts which have been duly justified and proved with the help of illustrative examples, actual case studies and worldwide evidences that support these new approaches in every way they can.

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