

Estimation of Cash Flow from Value of Work Done for Construction Projects in India

G Dhamodaran, K.R.Divakar Roy

ABSTRACT--- *Background/Objectives: To estimate the Cash Flow from Value of Work Done (VoWD) for a Construction project in Indian environment*

Methods: Deducting mobilisation advance and retention amounts from total Value of Work done completion.

Results/Findings: Can be implemented at construction industries especially for the process plant construction projects.

Conclusion/Application: 'Cash flow estimation every month in part of construction progress calculation' can be implemented in construction industries which helps Client organization to arrange required fund in advance

Keywords: Value of Work Done (VoWD) - a quantitative project performance value which is calculated based on the Earned Value Method (EVM)

I. INTRODUCTION

Cost management is one of the important aspects of Effective project management like Scope management, Time management, Change management, Risk management and Communication management. Budgeting and monitoring the budget and ensuring effective cost control system implementation are keeping a control on the project with which cost overrun of the project can be controlled.¹ At the same time, monitoring cash flow is critical to ensure the seamless execution of the project throughout the entire construction period. The budgeted cost will be spent in distributed manner and will not be of linear. Some system should be in place to ensure allocation of the required cost on time. Any delay in arrangement of fund will interrupt the construction work hence required amount should be estimated and provided to management in advance to allow time for sourcing².

Construction product transportation is a physical activity involved in the flow of things between the point of origin and the point of consumption in order to meet requirements of customers or corporations⁷. Money is important resource like man, machine and material for any of the project which supports day to day operation of construction execution. Because of inadequate cash flow to support construction many of the projects failed or delayed. Delayed fund arrangement delays the project and on other hand early arrangement of fund Costs Company to pay huge financing charges³. As cash is the resource arranged by management, it is regarded as management resource. Cash flow management is based on controlling, updating, monitoring and forecasting the cash flow. During the project progress, many financial related decisions would be taken to ensure

the project completion on time. These decisions are being taken based on the cash flow forecasts. Hence accurate cash flow projection is important.

II. PRESENT METHOD BEING FOLLOWED IN THE INDUSTRY

Currently the traditional method getting some gestimate figures from the contractors and conveying the same with some safety margin to Project Manager for funding arrangement. Project Managers request the same with Management and Management is arranging the same with some financing agencies or from banks in the form for loans. While approaching the financing institutes, the projection given by the Project Manager is considered as the basis and accordingly fund is released. Due to inaccurate forecasting, either facing shortage of cash or left with unused money⁴.

It flows from the client to the contractor and on to the subcontractors and suppliers. It is beneficial for clients to know the cash flow plan in advance, to arrange funding sources accordingly, and ensure smooth functioning of the project (Kenley, 2003). Similarly, accurate cash flow forecasting is essential for the survival of any contractor at all stages of the work.

A. Classical methods

The procedure of the classical method can be seen in any text book of Project management. This is prepared by tabulating periodic payments and receipts using the project Gantt chart as basis⁵.

B. Mathematical methods

Many researches developed mathematical models based on various assumptions. Khosrowshahi has proposed a mathematical model for forecasting of project expenditure by identifying variables associated with the physical shapes of expenditure profiles for different types of projects. This is suitable only for contractual negotiations.

Park, Han & Russell have attempted to estimate cash flows by categorization of different project activities on the basis of time lags involved between their physical occurrences of different stages⁶.

Jarrah, Kulkarni & O'Connor collected actual cash flow data in form of monthly account summary reports for various projects under Texas Department of Transportation. The sample consisted of different category of projects such as construction and replacement of bridges, new non-freeways, road overlay and rehabilitation of existing roads,

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G Dhamodaran, School of Mechanical Engineering, Department of Mechanical Engineering, Academy of Maritime Education and Training (Deemed to be University), Chennai.

Dr.K.R.Divakar Roy, Department of Mechanical Engineering, Andhra University.

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landscape scenic enhancements, widening of freeways etc.

Projects were further classified in different cost ranges. Based on the scatter chart of payments against time for different projects in a given category, a fourth degree polynomial regression analysis was used to obtain the cash flow curves that turned out to be characteristic 'S' shaped for most of the projects.

Although statistical significance could not be proved due to limited availability of data, a feasible approach for cash flow prediction was established⁷.

He has suggested a set of new measurements and indicators based on contract prices and financial accounts for the proposed 'contractor cash flow' model in line with the 'earned value' measurements and indicators in view of possible integration of both systems. Wages and benefits is an important motivators of the employees working in civil construction companies⁸

There are many more research papers by various researchers trying to get the accurate model and are either too ideal conditional projects or involve more calculations which generally not being followed in many projects. Currently there is no any standard model to estimate the cash flow.

If the employers fails to fulfil the salary structure company the performance level will not improve as expected by the higher authorities.⁹ Functioning of a well-established organization need the hard work of employees. Recruitment and selection is a long-lasting one and a central aspect of HR Management. There was lot of problems needs to be handled by the HR department¹⁰ Labor welfare facilities are an important tool to increase the productivity of the employees in any organization.

Salary along will not motivate the employees, so in addition to the company must provide some welfare benefits to their employees¹¹. This paper investigates the impact of Internal Locus of Control on personal variables and job related factors. The primary research strategy employed was the survey strategy¹². Researcher is very much interested on emission rates to know which mode of transport if more eco-friendly and remove logistical problems. SICAL Logistics has recently started a new project named Coastal RORO service as a part of their green logistics¹³.

III. PROPOSED METHOD TO CALCULATE CASH FLOW FORECAST FROM VALUE OF WORK

To predict the cash flow requirements, the terminologies and types of cash flows are to be understood to accurately estimate the cash flow.

A. Definitions

Advanced payment

This is amount of money paid to the contractor for mobilization purposes. Then, it is deducted from running bill of contract progress payment. Facilitating this mobilization advance improves the contractor cash flow during his initial period of contract and ensures them to mobilize completely. However this strategy to be used only for projects which require expensive site preparatory requirements like contractor office, contractor labor camp,

warehouse, batching plant, fabrication shops, material storage yard, etc.

Retention

Retention is the percent of money retained by the owner from every invoice by deducting before making the payment to contractor against certified invoice. This is to ensure the performance of the work performed by the contractor to minimum period after completion of the work. The accumulated retention amount will be paid to the contractor after completing the guarantee period varies from 12 months to 24 months in Indian conditions.

Running account bills

This is amount of money equivalent to the work performed by the contractor which will be as per the contractual provisions of the contract. Rate for the every activity will be defined in the contract along with the quantity to be executed. Upon completion of certain quantity from the Bill of Quantities, for every month contractor will raise the invoice against the certification. After receipt of the invoice this will be certified and will be paid in next month.

B. Major Terminologies

Contract

Contract shall mean the agreement between Company and Contractor as set out in Scope of Works document, Completion Schedule, Contract Price or Contract Value, General and Special conditions all as may, from time to time, be supplemented or otherwise modified in accordance with applicable provisions

Contract Value

Contract Value shall mean total Contract Price payable by Company to the Contractor for rendering the service in accordance with the agreed price schedule.

Contract Schedule or Schedule

Schedule shall mean the time schedule for performing Contract services and will be changed from time to time if required.

C. Estimating the Cash Flow from VOWD

Mobilization advance

This is the amount to be given to the Contractor for his mobilization expenses. Contractor is required to establish his office, warehouse, labor camp, fabrication shop, storage yards, testing laboratories etc. To set up these infrastructure facilities, Contractor requires certain amount which is generally in India it varies from 10 to 15 % and mostly it is of 10% of the contract value.

This will be paid generally in the 1st month. Accordingly Cash Out can be expressed as a step function as below.

$$\begin{aligned} \text{CO} &= 10\% \text{ of Contract Value for the first month} \\ \text{CO}_i &= \text{MA} \times \text{CV} \text{ if } i=1 \end{aligned} \quad (1)$$

Where,

CO_i = Cash Out for i th month



CV=Contract Value
MA=Mobilization Advance in %
i=Month

Progressive payments

Total Contract Value will be paid to the contractor with respect their progress. After completing the work in every month, Contractor periodically every month he raises invoice based on the joint measurement sheet with field engineers. This invoice will be settled within some stipulated time which will be generally 30 days in Indian conditions. From this certified amount, the percent of mobilization advance paid on 1st month will be deducted proportionate to be percent of Mobilization advance paid.

$$CO_i = MA \times CV \text{ if } M=1$$

$$= [\sum (P_{ij} \times CR_j)] \times (1-MA) \text{ if } 1 < M < n \quad (2)$$

Where,

CO_i=Cash Out for ith month

P_{ij}=Activity wise Physical progress certification for ith month

CR_j=Contract Rate for respective activity

MA=Mobilization Advance in percentage of Contract Value

i=Month

n=Project Duration excluding Performance guarantee period

Further, this Cash Out to be adjusted with retention amount.

Retention Amount

The portion of amount which is retained by client to ensure the performance of the facility which was built by the contractor. Upon end of performance period, this entire amount will be released to the Contractor.

Accordingly the Cash Out can be estimated as below

$$CO_i = MA \times CV \text{ if } M=1$$

$$= [\sum (P_{ij} \times CR_j)] \times (1-MA) \times [1 / (1-R)] \text{ if } 1 < M < n$$

$$= R \times CV \text{ if } M=m \quad (3)$$

Where,

CO_i=Cash Out for ith month

P_{ij}=Activity wise Physical progress certification for ith month

CR_j=Contract Rate for respective activity

MA=Mobilization Advance

i=Month

n=Project Duration excluding Performance guarantee period

R=Retention Amount in % of Contract Value

m= 1st month after completion of performance guarantee period

IV. ESTIMATING CASH FLOW FOR A SAMPLE PROJECT & RESULTS

A. Cash Out estimation based on the progress with effort earned weightage

This can be seen from a small example and we can forecast the Cash Out. The efforts required for each of the activity are tabulated and the contribution to overall project

man-hours are individual weightage for each of the activity. These productivity norms are majorly depends on technologies involved, machineries employed etc. The tabulated productivity norms are generally being followed in India.

Table-1: Total Bill of Quantities and their weightages

S No	Activity	Scope	UoM	Unit Man-hour	Total Man-hour	Effort Weightage
1	Concreting	12000	CUM	75	900000	40%
2	Structural Steel Fabrication	4000	MT	120	480000	22%
3	Structural Steel Erection	4000	MT	95	380000	17%
4	Piping Fabrication	12000	ID	3.5	42000	2%
5	Piping Erection	35000	IM	4.5	157500	7%
6	Equipment Erection	4500	Mt	50	225000	10%
8	Electrical Cable Laying	1500	MTR	1	1500	0%
9	Instrumentation Cable Laying	3000	MTR	1	3000	0%
10	Painting	14000	SQ.MTR	3	42000	2%
					2231000	100.0%

The weightages above are calculated based on the effort required to complete each of the activity. Each activity in the Bill of Quantities are measured in different unit of measurement (UOM) and it is necessary to convert them into one measurement entity. Only man-hour effort or the money to be spent can substitute this requirement.

These above calculated weightages are useful for progress calculation and for the each of the activity there will be defined rates in Contract. These rates can be used to arrive the cost weightage for the each activity to be carried out for the project which will be used for estimating the cash flow and other financial decisions.

B. Cash Out estimation based on the progress with cost weightage

The cost weightage is depends on the quantum of each activity and its respective contractual rate as effort based weightage depending on quantum of the work and its respective productivity norms. Accordingly, we can tabulate the above table to arrive to the cost weightage.

Table-2: Total Bill of Quantities and their weightages

S No	Activity	Scope	UoM	Unit Rate	Contract Value	Cost Weightage
1	Concreting	12000	CUM	12000	144000000	38.92%
2	Structural Steel Fabrication	4000	MT	20000	80000000	21.62%
3	Structural Steel Erection	4000	MT	15000	60000000	16.22%
4	Piping Fabrication	12000	ID	1000	12000000	3.24%
5	Piping Erection	35000	IM	500	17500000	4.73%
6	Equipment Erection	4500	Mt	12000	54000000	14.60%
8	Electrical Cable Laying	1500	MTR	200	300000	0.08%
9	Instrumentation Cable Laying	3000	MTR	250	750000	0.20%
10	Painting	14000	SQ.MTR	100	1400000	0.38%
					369950000	100%



V. CONCLUSION

As this reduces lot of man-hour efforts and time this method can be encouraged for many of the construction projects. Also this helps in forecasting accurate cash flow and supports management in arranging the cash required in advance. Change Orders arises out of change in scope are to be added to the Contract Value after approval and the same procedure will be followed while dealing with these approved Change Orders.

Further the method explained above can be extended to other pre-construction activities like, engineering, ordering, manufacturing, delivery etc. The entire estimation is not taking care of the taxation part and is to be added before projecting to the management.

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AUTHORS PROFILE



G Dhamodaran received his Bachelor Engineering in Mechanical Engineering from Bharathiar University Coimbatore and Master Engineering in Manufacturing Technology from PRIST University, Tanjavur since 1997 and 2011 respectively. He is currently a PhD Student in AMET University, Chennai. His research interest is in Construction Project Progress Monitoring and Measurement.



Dr KR Divakar Roy received his Bachelor Engineering in Mechanical Engineering from Andhra University, Visakapatnam and Master Engineering in Industrial Engineering from Andhra University, Visakapatnam since 1974 and 1985 respectively. He received his PhD in 2009 from Andhra University for his research topic "Growth Strategies for an integrated steel- A System Dynamics Approach. Published many number of papers and attended various national and international conferences. Fellowship in Institute of Engineers (India).