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Time , Cost , Quality Trade Off Analysis in Construction Projects Based on Reesource Allocation using Microsoft Project

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Abstract **- The time, quality, and cost are three important but contradictive objectives in a building construction project. It is a tough challenge for project managers to optimize them since they are different parameters. Tradeoffs between project duration, total cost, quality and risk are extensively discussed in the project scheduling. This paper tries to develop a Time, Cost and Quality optimization model that enables managers to optimize multi objectives. The model is from the project break down structure method where task resources in a construction project are divided in to series of activities and further in to construction labors, materials, equipment and administration. Quality is an important parameter correlating highly with time and cost parameters .But it is not a quantitative in nature , practical time cost , quality tradeoff models are seldom developed from previous research works of the literature. Although the objectives of cost and time must be mentioned frequently by natural numbers. This paper will present a new solution for solving time, cost, and quality tradeoff problem based on project break down structure method and task resource allocation. The resource utilized in a construction activity would eventually determine its construction time, cost, quality tradeoff model is finally generated based on correlations between construction activities. .**

INTRODUCTION

The time, quality and cost are usually three contradictive objectives which are often trade off in project practices by managers randomly if they lack efficient tools. The time,
Quality and cost are interdependent parameters in a building project. When the construction time is shortened, the project
Cost should be added. It is a tough challenge to balance those objectives in a practice. The cost is usually the most important determinant of selecting a contractor in current construction industry. A contractor is undergoing fewer profit margins now than ever when current construction industry is more competitive. He might lose all profit or even if he fails to implement one or two more projects properly in right quality, time and cost. In order to reduce cost, some contractors risk using inferior construction materials and incapable labor which frequently results in poor quality and safety standards. A construction project contains many un certainties. It requires a number of resources and a large amount of investment. Time and cost are main management goals. Contractors want to get the highest profit so they must plan to complete the job in early time with a minimum cost. Much previous formulate to solve the time cost trade off scheduling problem for construction projects.

OBJECTIVE

Time Cost Trade off techniques are developed to achieve the delivery of the project at the required completion date & the least cost associated with the project. In general Time-cost optimization may be defined as a process to identify suitable construction activities for speeding up and for deciding by how much so as to attain the best possible savings in both time and cost. Resource leveling is a technique in project management that overlooks resource allocation and resolves possible conflict arising from over-allocation. When project managers undertake a project, they need to plan their resources accordingly. This will benefit the organization without having to face conflicts and not being able to deliver on time. Resource leveling is considered one of the key elements to resource management in the organization. An organization starts to face problems if resources are not allocated properly i.e., some resource may be over-allocated whilst others will be under-allocated. Both will bring about a financial risk to the organization.

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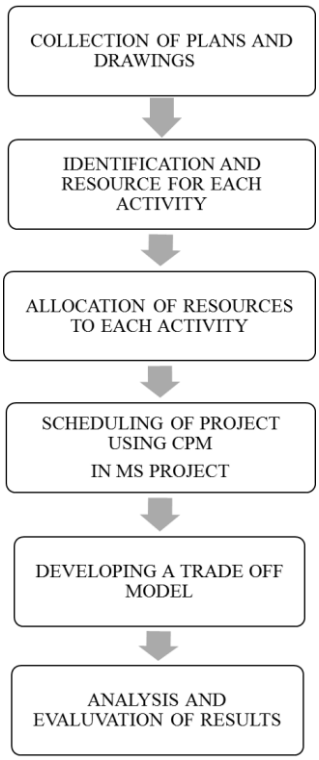
METHODOLOGY

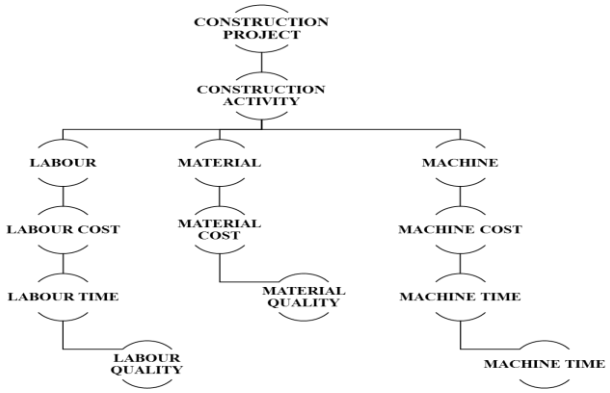


IDENTIFICATION AND ESTIMATION OF RESOURCES FOR EACH ACTIVITY

Each task involves different types of materials for construction. The type of materials required for each and every activity has to be determined. Quantity of materials required can be estimated from quantity of each work necessary for completion. Cement , sand ,coarse aggregate and fine aggregate should be identified in appropriate units Duration of each activity for completion should be estimated based on availability of materials and labors in site .Number of labors required will estimated on the basis of work quantity involved in construction process and productivity of each worker and nature of work include local preferences and culture, population density, distribution of trips, climate, geography, topography, available financial resources, local technical capacity**.**

WORK BREAK DOWN STRUCTURE

A work breakdown structure (WBS), in project management and systems engineering, is a deliverable-oriented breakdown of a project into smaller components. A work breakdown structure is a key project deliverable that organizes the team's work into manageable sections. When an activity is too large or complex for a reliable duration estimate project guide lines state than an individual activity that takes up more than 10 percent of the project schedule has to be broken down. A project manager uses a break down technique to reduce the activity to smaller tasks. Ideally the project manager can estimate the duration of tasks that individual workers perform more accurately than the whole activity.

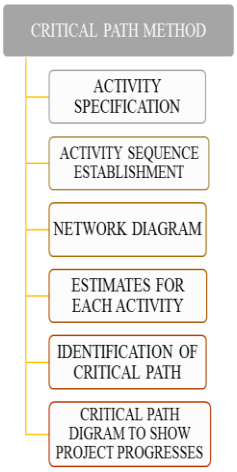


ALLOCATION OF RESOURCES TO EACH ACTIVITY

Various resources (Material, Labor, Machine) have to be allocated based on availability of nature of work involve and duration of project**.**

KEY STEPS IN CRITICAL PATH METHOD:

Let's have a look at how critical path method is used in practice. The process of using critical path method in project planning phase has six steps.



QUANTITY SURVEYING

Estimation is the one which helps in determining the quantity of each and every resource required for construction. Estimation helps in identifying the total budget of the project which includes civil work, electrical work, furniture work, plumbing and sanitary work, engineer's profit and consistency cost. Before estimating the quantity of materials it is more important and specific to study the plans and all other drawings of the construction building. So that the dimensions of each footing, column, beam, slab, length, height and thickness of brick wall can be calculated

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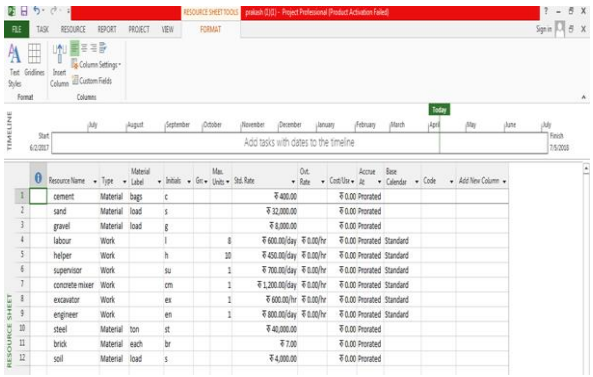


SCHEDULING USING MICROSOFT PROJECT SOFTWARE

Microsoft project is project management software used in construction for the preparation of construction schedule. In this project management software we can assign and duration resources to each activity in construction so that the final output will be total duration required to complete the project and total budget of the project. To be more specific we can identify the critical activities which may be affect the entire the project .For simpler approach, entire construction has been divided into various levels such as foundation level, plinth level, ground floor & first floor – sill level, lintel level, roof level and various structural elements under each levels are identified. Various activities necessary for the construction in each levels are identified. Activities necessary for the construction includes the site clearance, site marking, excavation, back filling, sand filling, bar bending, bar reinforcing, shattering, concreting, curing, brick work, plastering and flooring etc.

CALCULATION OF QUALITY

Project quality is made of two main parts, product quality and process quality it is important that both are taken in to account for the project quality assessment. Only in this way construction quality assessment will be related to total quality assessment will be related to total quality assessment. This quality assessment methodology could be a good estimate of the overall project quality but it is not really building and construction process quality .It is only one of the various project performance indicators to measure project performance indicators basis. A weighted approach is used to aggregate the aggregate the estimated quality for all the considered activities to provide an overall quality of the project level. For each activity of the work break down structure (WBS) two types of weights are identified the weight (Bi) of each quality indicator of the activity to indicate the relative importance of each indicator to the others being used to measure the quality of the activity and weight (Ai) of the activity to represent the importance and contribution of the quality of the single activity to the overall quality

$$Q = \sum N\ Ai \sum B\ Q\ i$$

Where,

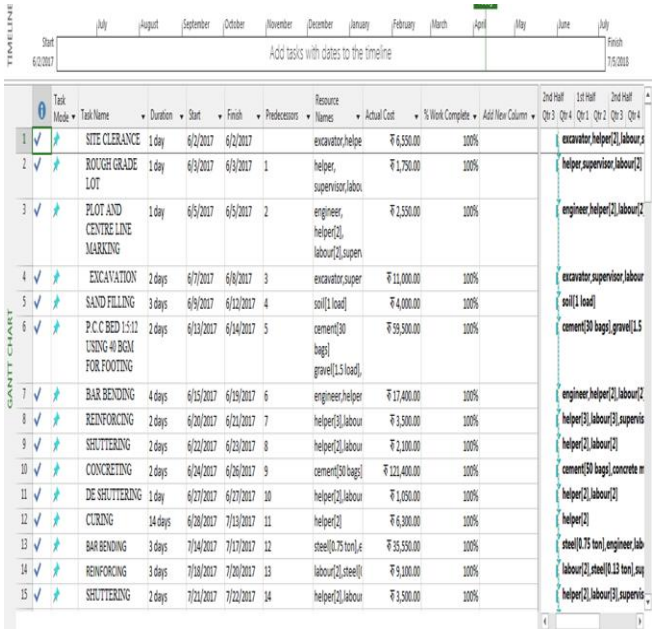
Q = overall quality of construction project;
Ai = Weight of quality of activity
Bi = weight of quality indicator of activity
Qi = performance of quality indicator in activity

RESULTS AND DISCUSSONS

After scheduling the activities using Microsoft office project, we can identify the critical Activities, budget of the project and the project duration in resource levelling techniques over allocated resource will be levelled. The data collected were used for estimation from schedules and different kinds of results were obtained.

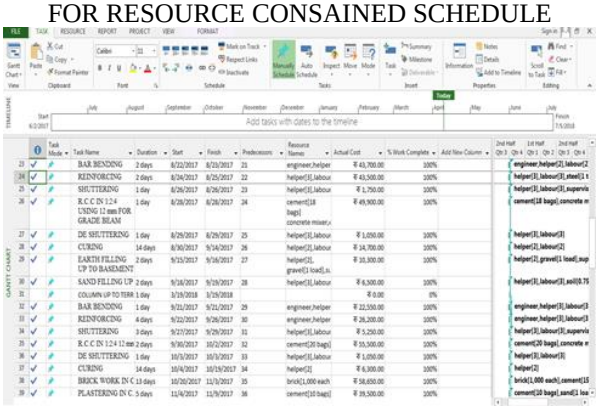
RESULTS FROM MICROSOFT OFFICE PROJECT SCHEDULING

After entry of data, resulting scheduled can be viewed in Gantt chart view in which the output is displayed as bars .Each bar represents each activity and length of the bar defines the duration with required resource data on sides. The results schedule



DATA SHEET WITH COST OF EACH ACTIVITY FOR TIME CONSTRAINED SCHEDULE

DATA SHEET WITH COST OF EACH ACTIVITY FOR RESOURCE CONSAINED SCHEDULE



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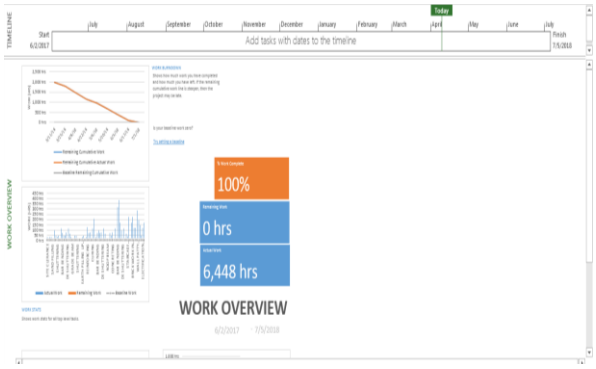
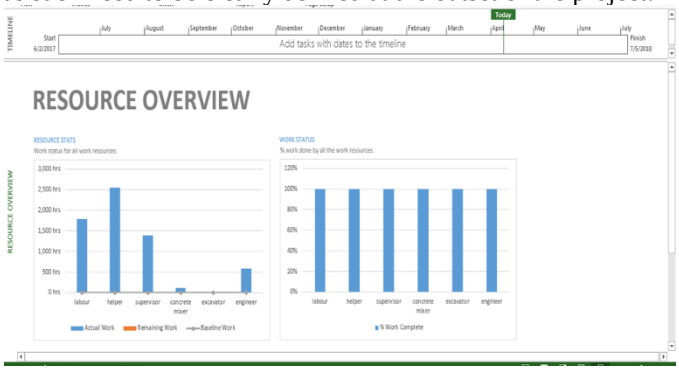


WORK OVER VIEW OF THE PROJECT

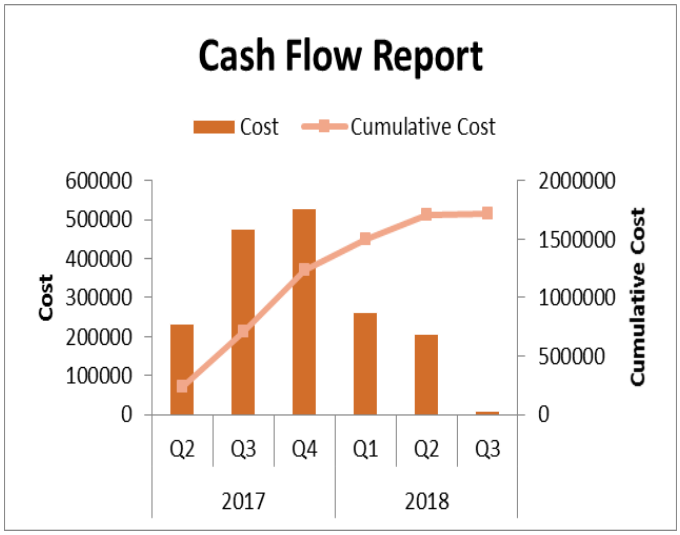
RESOURCE OVER VIEW

The overall project organization framework used for directing and controlling the project is established. Ownership, management and project team member roles vary by project and as such need to be clearly defined at the outset of the project.



CASH FLOW

The cash flow sets out when costs will be incurred and how much they will amount to during the life of the project. Predicting cash flow is important in order to ensure that an appropriate level of funding is in place and that suitable draw-down facilities are available. Until the main contractor has been appointed, cash flow projections are likely to be based only on agreed fee payment schedules for consultants and a simple division of the construction cost over the likely construction period (or perhaps an allocation of construction cost over an s-curve distribution). It is only when the main contractor is appointed, a master programed prepared and some form of payment schedule agreed that cash flow projections become reliable.

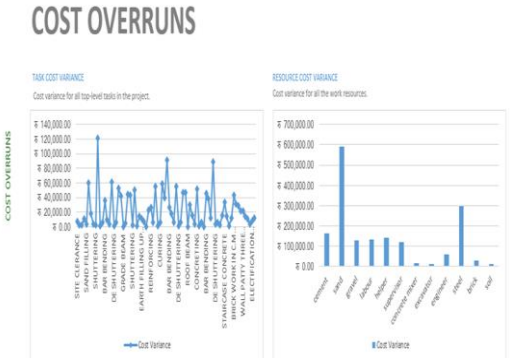


COST OVER RUN

A cost overrun, also known as a cost increase, underrated or budget overrun, involves unexpected costs incurred in excess of budgeted amounts due to an underestimation of the actual cost during budgeting. The aim of the research is to assess the causes leading to cost overruns on construction projects.

- To identify the causes that lead to cost overrun and to evaluate their relative importance.
- To get opinion on these causes from major players in the construction industry namely contractors, clients and consultants.
- To test the strength of association between the rankings of the respondent groups.
- To rank the causes of cost overrun on the basis of importance.
- To assess how frequent each of these causes occur.

To assess how severe the impact of these causes will be on the total cost of the project.



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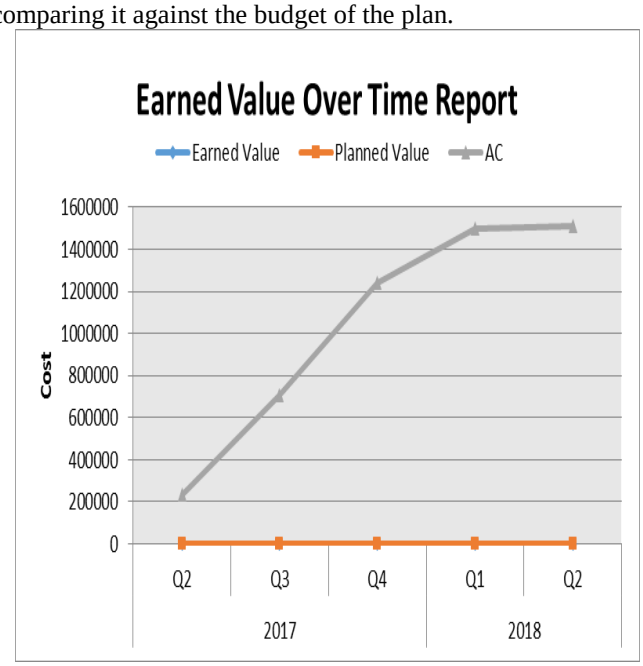
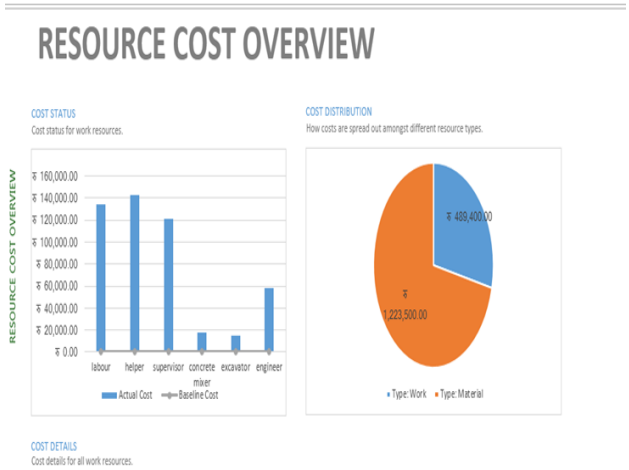
EARNED VALUE REPORT

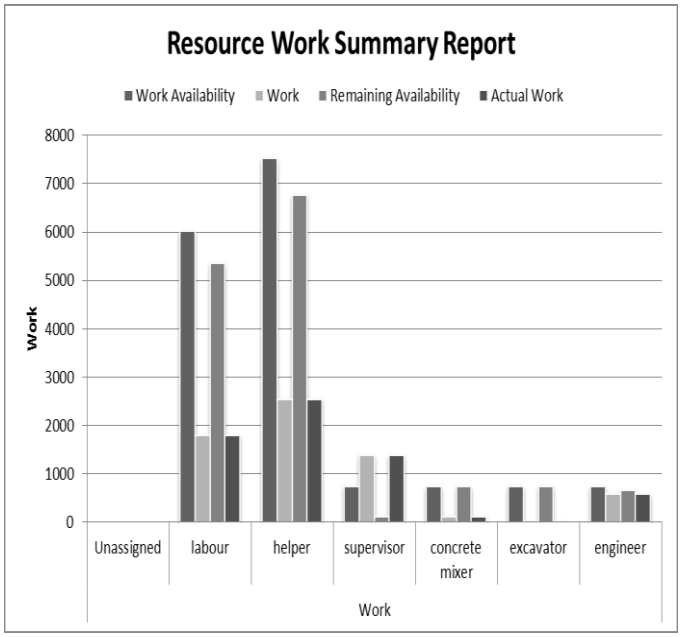
Earned Value Analysis (EVA) is a method that allows the project manager to measure the amount of work actually performed on a project beyond the basic review of cost and schedule reports. Work has been accomplished in a plan and comparing it against the budget of the plan.



COST OVER VIEW OF RESOURCES

It can create cost resources in Project. Cost resources are different from work and material resources. Cost resources represent costs commonly incurred to complete various tasks within a project that are not directly tied to the amount of work performed or materials used.





CONCLUSION

Completing a project on time and within budget is not an easy task. The project scheduling phase plays a central role in predicting both the time and cost aspects of a project. More precisely, it determines a time table in order to be able to predict the expected time and cost of each individual activity. At the same time quality should not compromised in case of limited budget and time. It is the duty of the project manager to bring in the quality integrated model in to a construction project. Therefore the time, cost, quality trade off model will serve the point of helping the project managers to follow the quality codes without considerable increase in cost and time

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