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Scheduling and Financial Analysis of a High Rise Building

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***Abstract**: Scheduling using MSP Software is a process which involves estimation, sequencing the activities, resources allocation and timing. The construction scheduling is to complete the project in time and match the resources with the allocated time. Scheduling using MSP Software gives good controlling and clear schedule to a project. EV Analysis is a standard method of measuring a project's progress at any given point of time, forecasting its completion date, final cost and analysis variance in the schedule and budget of the project. This project deals with scheduling using MSP and EV Analysis for a apartment building. Thereby process time and cost overrun are avoided.*

I. Introduction

Multi-storey buildings aim to increase the area of the building without increasing the area of the land the building is built on, hence saving land and, in most cases, money(depending on material used and land prices in the area, of course). Large scale industrialization and prohibitive land cost in India have resulted in a vast expansion in the building programme stages has reached when multi-storey construction is becoming essential and inevitable. Land use economy is achieved by construction of multi-storey buildings which results in large building more concentrated on relatively small built up area. This makes available a large proportion of open space for creating natural environments. This also ensures better day-lighting and greater airflow as well as well as freedom from street noise. Living and working in such buildings provide panoramic view of the city. One production scheduling and control technique which tries to surpass. The CPM difficulties for multi-storey building scheduling are the Line of Balance (LOB) technique. The LOB technique was developed in the early 40's into the manufacturing environment and adapted by researchers for using on construction industry in the close as possible to the original scheduled by reviewing and reprogramming under changed condition in order to adhere to the target time of completion

II. Scheduling & Financial Analysis

The project schedule is a calendar that links the tasks to be done with the resources that will do them. Before a project schedule can be created, the project manager must have a Work Breakdown Structure (WBS), an effort estimate for each task, and a resources list with availability for each resource.

A. Scope

A project manager's time is better spent on working with the team to create a WBS and estimates than on trying to build a project schedule without them. The project schedule is the core of the project plan. It is used by the project manager to commit people to the project and show the organization how the work will be performed.

Schedules are used to communicate final deadlines and, in some cases, to determine resource needs. They are also used as a kind of checklist to make sure that every task necessary is performed. If a task is on the schedule, the team is committed in doing it. In other words, the project schedule is the means by which the project manager brings the team and the project under control.

B. **Purpose of Scheduling**

- Schedule is a reflection of the plan, but the plan must come first.
- It is the determination of the timing and sequence of operation in the project and their assembly to given the overall completion time.
- The process of scheduling may uncover flaws in the plan, leading to revisions of the plan.

c. MS Project

Microsoft Project MSP is a project management software programme developed and sold by Microsoft which is designed to assist project managers in developing plans, assigning resources to tasks, tracking progress, managing budgets and analyzing workloads..

A planning engineer develops the most appropriate method and sequence of construction operations for a particular project, in conjunction with the site manager. They plan and oversee the entire programme of work and must anticipate a contract's demands in terms of labour, materials, equipment and technical challenges. As well as ensuring that construction is completed safety to high technical standard, the planning engineer is also responsible for specifying the timing of the contract. This can be major responsibility when penalty clauses for late completion are written into project contracts.

Typical work activities include:

- Selecting the appropriate techniques and sequence of events for a particular project.
- Presenting schedules of work, often with visual aids as bar charts and procedures diagrams.
- Monitoring progress throughout the construction process and comparing this with the projected schedule of work.

D .Financial Analysis

EVA Analysis

Earned Value Analysis (EVA) is an industry standard method of measuring a project's progress at any given point of time, forecasting its completion date and final cost, and analyzing variances in the schedule and budget as the project proceeds. It compares the planned amount of work with what has actually been completed, to determine if the cost, schedule, and work accomplished are progressing in accordance with the plan. As work is completed, it is considered "earned".

1) Calculating Earning Value

Earned Value Management measures progress against a baseline. It involves calculating three key values for each activity in the WBS:

a) The Planned Value (PV), (formerly known as the budgeted cost of work scheduled or BCWS)
b) The Actual Cost (AC), (formerly known as the actual cost of work performed or ACWP)
c) The Earned Value (EV), (formerly known as the budget cost of work performed or BCWP)

These three values are combined to determine at that point in time whether or not work is being accomplished as planned. The most commonly used measures are the cost variance:

Cost Variance (CV) = EV - AC

Schedule Variance (SV) = EV - PV

These two values can be converted to efficiency indicators to reflect the cost and schedule performance of the project. The most commonly used cost-efficiency indicator is the cost performance index (CPI). It is calculated thus:

CPI = EV / AC

The sum of all individual EV budgets divided by the sum of all individual AC's is known as the cumulative CPI, and is generally used to forecast the cost to complete a project.

The schedule performance index (SPI), calculated thus:

SPI = EV / PV

is often used with the CPI to forecast overall project completion estimates.

A negative schedule variance (SV) calculated at a given point in time means the project is behind schedule, while a negative cost variance (CV) means the project is over budget.

III. Result and Discussion

A. **Project Details**

1) Name of the project : RESIDENTIAL BUILDING
2) Total area of Construction : 15050sq.ft
3) Total saleable area : 21,500sq.ft
4) Grand total cost Construction : Rs 10, 00, 00,000 /
5) No of floors : 6
6) Rate/sft : Rs 5000/

B. **Budget of the Project**
The cost incurred to complete the project is estimated as follows.

1) Grand Total:

Table I Cost Budget Of The Project

Sl.NO	**Description**	**Total cost**	
1)	Building works	Rs	9,36,16,772
2)	External development works	Rs	25,58,846
3)	Architectural Features	RS	38,24,382
	Grand Total	Rs	10,00,00,000
	Total building area		15,050sq,ft
	Rate/sft	Rs	1993.35

C. **Quantity of the Activity**

1) **Quantity of the foundation activity**

- Total Site Area = 2000m^2
- Total Building Area = 1400m^2
- Total Footing Excavation = 438m^3
- Total P.C.C Quantity = 64m^3
- Total Footing Concrete = 2454m^3
- Total Footing Reinforcement = 23163kg
- Total Pedestal Reinforcement = 2699kg
- Total Pedestal Concrete = 91m^3
- Total ground slab =140m^3

3) **First floor to fifth floor**

- Total column concrete =50m^3.
- Total column reinforcement =4002kg.
- Total slab concreting =1356m^3.
- Total slab Reinforcement =14576kg.
- Total shuttering .=20487m^2

4) Sixth floor

- Total column concrete =35m^3.
- Total column reinforcement =2654kg.
- Total slab concreting =1267m^3.
- Total slab reinforcement =10356kg.
- Total shuttering =13243m^2.

D. Economy in Construction Cost

The construction should be done as economically as possible by organizing labour, materials, transport, supervision, etc., a well organized work cost less. All design and working drawings should be prepared in advance, requirement of materials should be worked out and materials should be organized, collected and stocked close to the site of work well in advance so that work is not held up for want of materials. The whole construction shall be completed as quickly as possible so that the supervision cost may be minimum possible Over-head costs should be kept as low as possible

1) Concrete:

Concrete is a homogeneous mix of cement, coarse aggregate, fine aggregate and water. The concrete members will transfer the load from the building to the soil. Concrete can be prepared by two means Ready mix concrete (RMS) and Standard mixing concrete (SMC). The SMC is cheaper when compared with RMC. But the RMC will reduce the time and it will provide a uniform homogenous mix

2) **Ground floor**

- Total column concrete =53m^3.
- Total column Reinforcement =4553kg.
- Total slab Concreting =1540m^3.
- Total slab Reinforcement =15750kg.
- Total shuttering =22487m^2

Table Ii Cost For Concrete

Type of material		Amount in Rs
concrete	RMC	1,65,82,160/
	SMC	88,93,980/

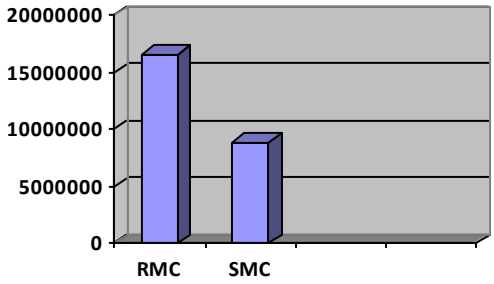

Fig 1 Cost Comparison for Concrete

E. Scheduling Of the Structural Activities

Table Iii Schedule Of The Structural Activity

si.no	Tasks	Duration	Predecessors
1	Mass Excavation	8 days	-
2	Footing Excavation	8 days	2SS+11 days
3	P.C.C	11 days	3SS+11 days
4	Foundation - RCC	30 days	4SS+8 days
5	Column/Lift Wall Upto G.F LVL	30 days	5SS+6 days
6	Ground Floor - Beam/ Slab	37 days	6SS+5 days
7	Ground Floor Column/Lift Wal	23 days	7SS+14 days
8	1st Floor - Beam/Slab	30 days	8SS+21 days
9	1st Floor - Column/Lift Wall	23 days	9SS+6 days
10	2nd Floor - Beam/Slab	30 days	10SS+14 days
11	2nd Floor - Column/Lift Wall	23 days	11SS+7 days
12	3rd Floor - Beam/Slab	30 days	12SS+14 days
13	3rd Floor - Column/Lift Wall	23 days	13SS+7 days
14	4th Floor - Beam/Slab	30 days	14SS+14 days
15	4th Floor - Column/Lift Wall	23 days	15SS+7 days
16	5th Floor - Beam/Slab	30 days	16SS+14 days
17	5th Floor - Column/Lift Wall	23 days	17SS+7 days
18	6th Floor - Beam/Slab	30 days	18SS+14 days

19	6th Floor - Column/Lift Wall	23 days	19SS+7 days
20	Terrace Floor	40 days	20SS+14 days
21	Above terrace Column/Lift Wall	30 days	20 days
22	Slope slab/OHT/M.R Room	20 days	21 ays

F. Base Line Cost Report

This report shows the budget,baseline and actual cost of the structural activities, in this chart two bar present in the cost. The bar represent the budget cost upto the baseline .The second bar shows remaining period of the budget cost.

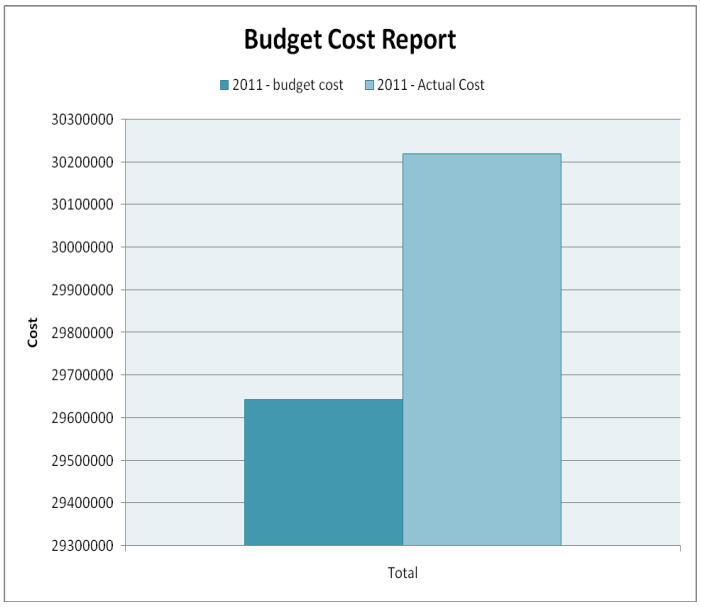

Fig 2:Base Line Cost Report

G. Cash Flow Report

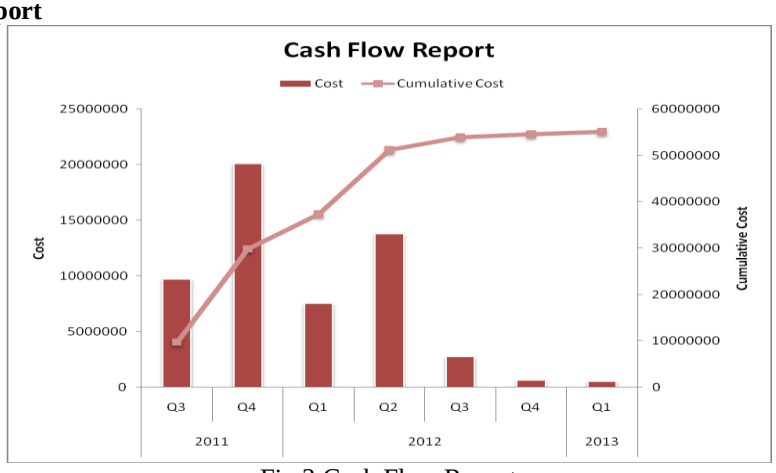

Fig 3:Cash Flow Report

The above report shows how much amount spent in quarterly period of year in the project. Two type of cost represent in the chart.

1. Budget cost
2. Cumulative cost

The sum of the budget cost is known as cumulative cost.

H. Earned Value Analysis Of The Structural Activity

Table 4-EV Analysis of activity.

Tasks no	**Actual cost AC** in Rs/-	**Earned value EV** in Rs/-	**Cost variance (AC-EV)** in Rs/-
1	33,000.00	30,600.00	2,400.00
2	42,000.00	32,000.00	10,000.00
3	2,20,000.00	2,01,000.00	19,000.00
4	89,31,576.00	88,31,576.00	100000.00
5	5,80,900.00	5,60,900.00	20,000.00
6	57,65,678.00	59,90,750.00	2,25,072.00
7	24,30,524.00	24,20,216.00	10,308.00
8	59,11,850.00	59,09,936.00	1,914.00
9	9,21,436.00	9,20,416.00	1,020.00

IV. Conclusion

After complete the schedule and financial analysis of the building it has been observed that

1. there is more difference between budget cost and actual cost
2. the cost difference is due to the huge increase in the material's price and the labour's wages.
3. The time lag in construction activity due to the natural disturbances.

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