



# RESOURCE SCHEDULING IN RESIDENTIAL BUILDING CONSTRUCTION BY CONSIDERING COST AND TIME

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**ABSTRACT:** Construction management is an important branch civil engineering, which deals with effective and efficient management of any construction work. In the construction project, time and cost are the most important factors to be considered in the planning of every project. The aim of project is to finish the projects on time, within budget and to achieve other project objectives. It is a difficult task undertaken by project managers in practice, which include constantly measuring progress, evaluation of plans, and corrective actions should be taken whenever required. The essentials of construction management are functional utility, structural stability, economy, speed and quality of construction. In this thesis work, estimation and costing of the residential building in terms of optimization time and cost. For this particular building, analysis is going to be performed in terms of optimizing time and cost. In analysis part, for this building scheduling will be performed by using **MS PROJECT**. The engineering economy study involves computing a specific economic measure of worth for estimated cash flows over a specific period of time. Then factors are introduced to increase the duration of the project, then by schedule crunching and project crashing technique optimization of time and cost will be found ensured early completion of the project. This paper analyzes resource constrained project using Microsoft Project by resource leveling and compares the time cost implications with scheduled time and estimated cost.

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## I. INTRODUCTION

### 1.1 BACKGROUND

A project is an organization of cost, time and risk and the maximal quality simultaneously. People dedicated to the deployment of a set of resources for a specific purpose or objective.

Total project costs include both direct costs and indirect costs of performing the activities of the project. Direct costs for the project include the costs of materials, labor, equipment, and subcontractors. Indirect costs, on the other hand, are the necessary costs of doing work which cannot be related to a particular activity, and in some cases cannot be related to a specific project. Thus, planners perform what is called time-cost trade-off analysis to shorten the project duration. This can be done by selecting some activities on the critical path to shorten their duration.

Construction managers need to develop a schedule for directing and controlling resources of workers, machines, and materials in a coordinated and timely fashion in order to deliver a project within the limited funding and time available Trade-off between these conflicting aspects of project is a challenging job and as such planners are faced with numerous possible combinations for project delivery.



In large scale project preparing accurate and workable schedules with consideration of resources is very difficult task, for this use of project management software's like MSP, Primavera can be advantageous. Resource conflict or over allocation can be resolved in Microsoft Project 2013 by delaying activities, splitting certain task or updating task automatically. When project levels resources, assignments are distributed and rescheduled.

## 1.2 SCOPE OF WORK

The main goal of the project is to finish the project with minimum cost and within the time. This model will better handle in areas such as resource constraints, time and cost overrun during the construction. It gives clear idea how to finish the project within the predefined deadline.

## II RESULTS AND DISCUSSION

Sites are visited to perform questionnaire survey. Usually, a questionnaire consists of a number of questions that the respondent has to answer in a set format. While questionnaires are inexpensive, quick, and easy to analyze. The main aim of this survey is to find out factors affecting the project in terms of time and cost. Survey was actually conducted in newly constructed buildings. Survey was conducted to engineers and owners.

### 2.1 RESIDENTIAL BUILDING IN CUMBUM (G+2 FLOOR)

- DATE OF START : 11-03-2014
- TO BE COMPLETED : 21-12-2015.
- COMPLETED ON : 25-01-2016

Nearly 25 factors were collected from literature survey and listed, and survey conducted for this factors.

### 2.2 ANALYSIS OF BUILDING

#### 2.2.1 Details of building

Top 12 factors affecting time and cost from above projects are taken into an account for residential building in terms of optimizing time and cost.

From particular building, analyzes is going to be performed in terms of optimizing time and cost. In analysis part, for this building scheduling will be performed using Microsoft project. Then factors are introduced to increase the duration of the project, then by schedule crunching and project crashing technique optimization of time and cost will be found

#### 2.2.2 PREPARATION OF DETAILED ESTIMATE

Estimation means calculating the materials, labor, and equipment needed to complete a construction project. The resources required for this project is obtained from detailed estimate. By estimation, resources are fed into the Microsoft project and scheduled. Total cost and duration required for the project is estimated.

#### 2.2.3 COST ESTIMATE

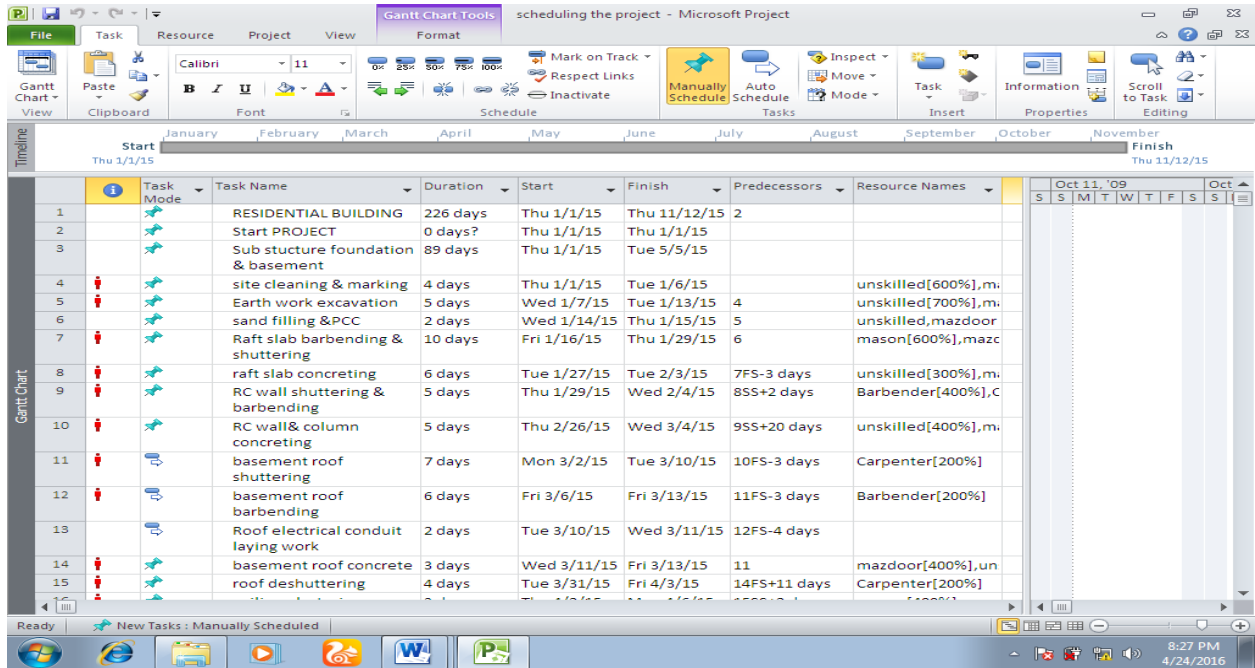
Before undertaking the construction of a project it is necessary to know it probable cost. The main objective of this estimate is to enable one to know beforehand, the cost of work. So while preparing the estimate very carefully the calculations should be carried out. The actual cost of a work is known at the completion of the work. Account of all expenditure is maintained day to day during the execution of work. At the end of

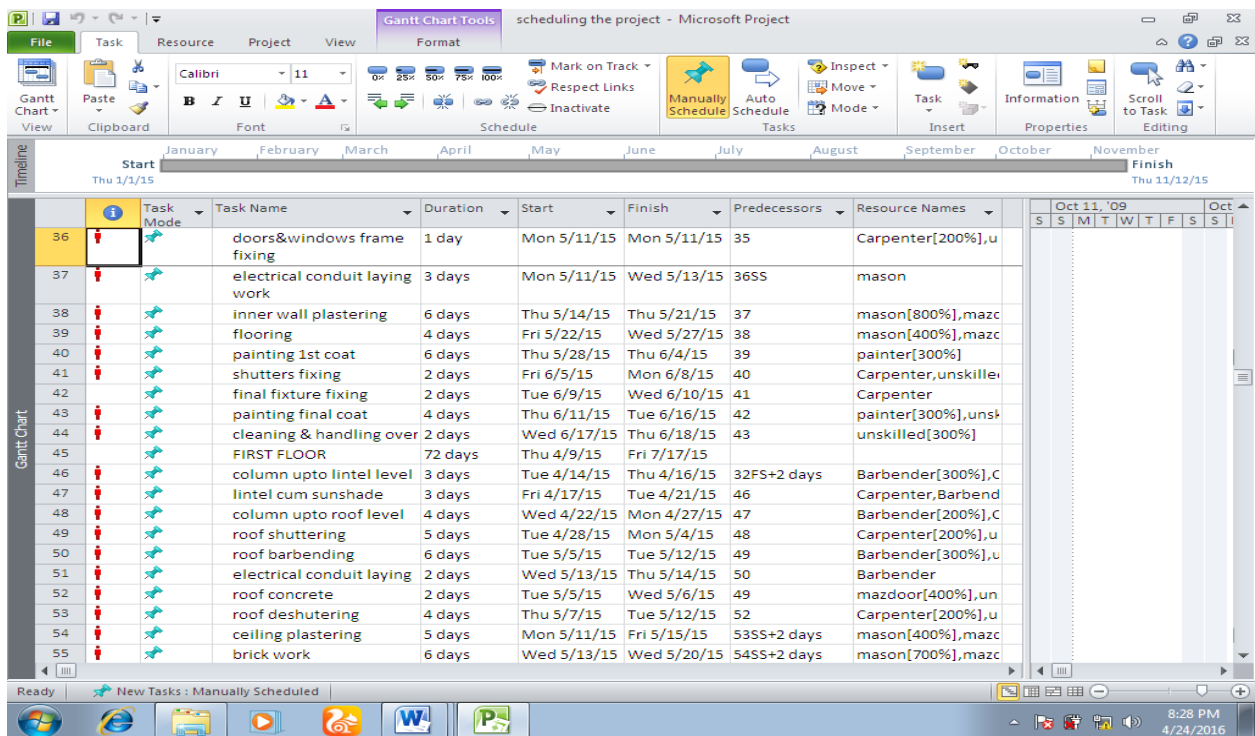
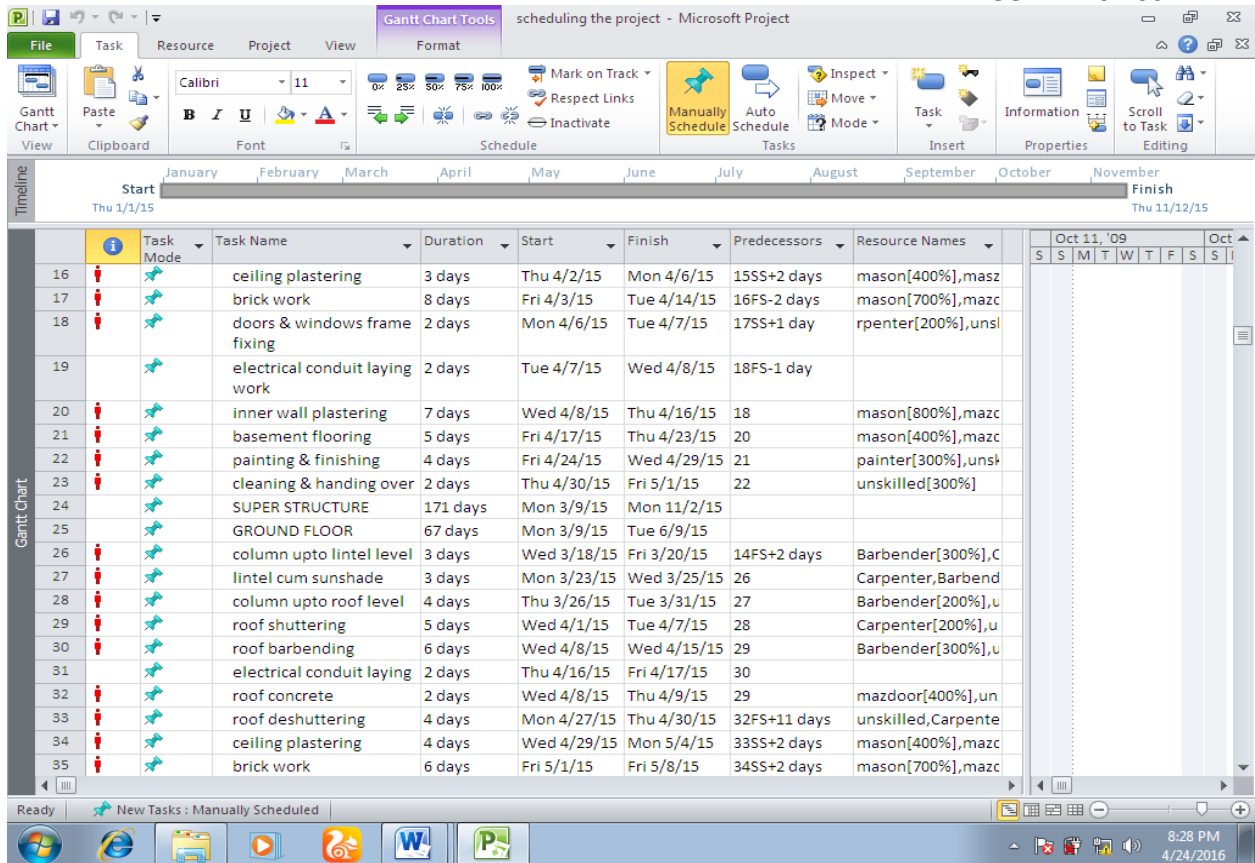


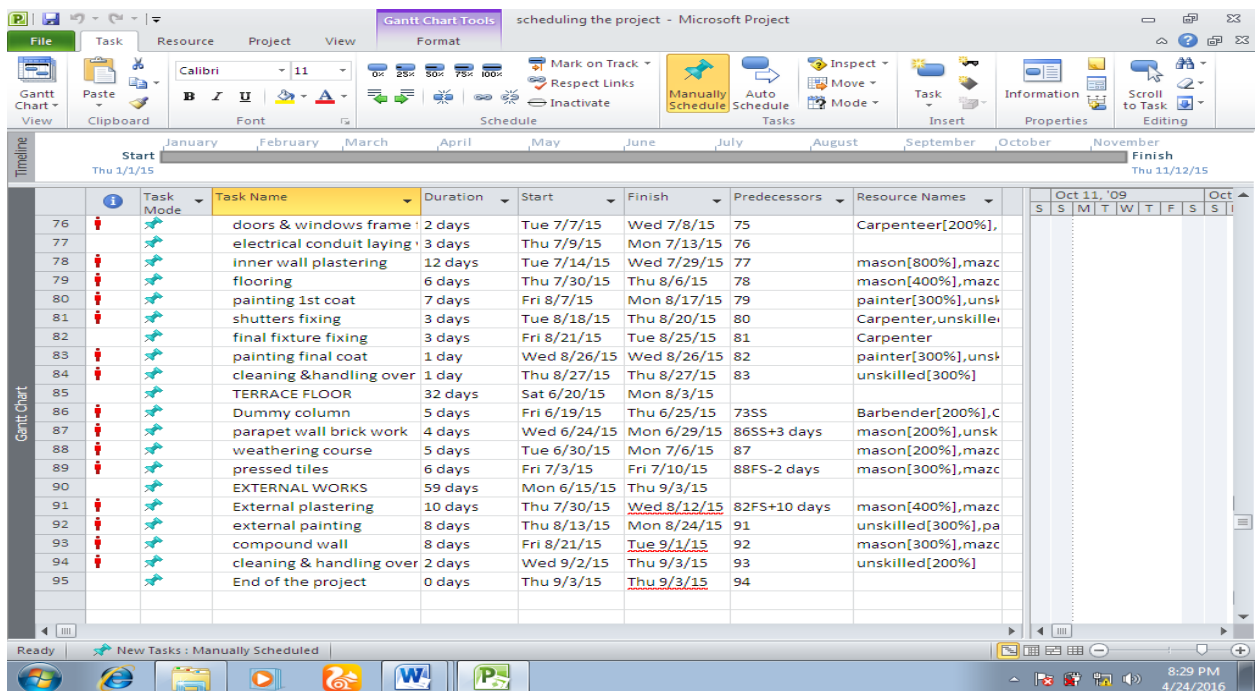
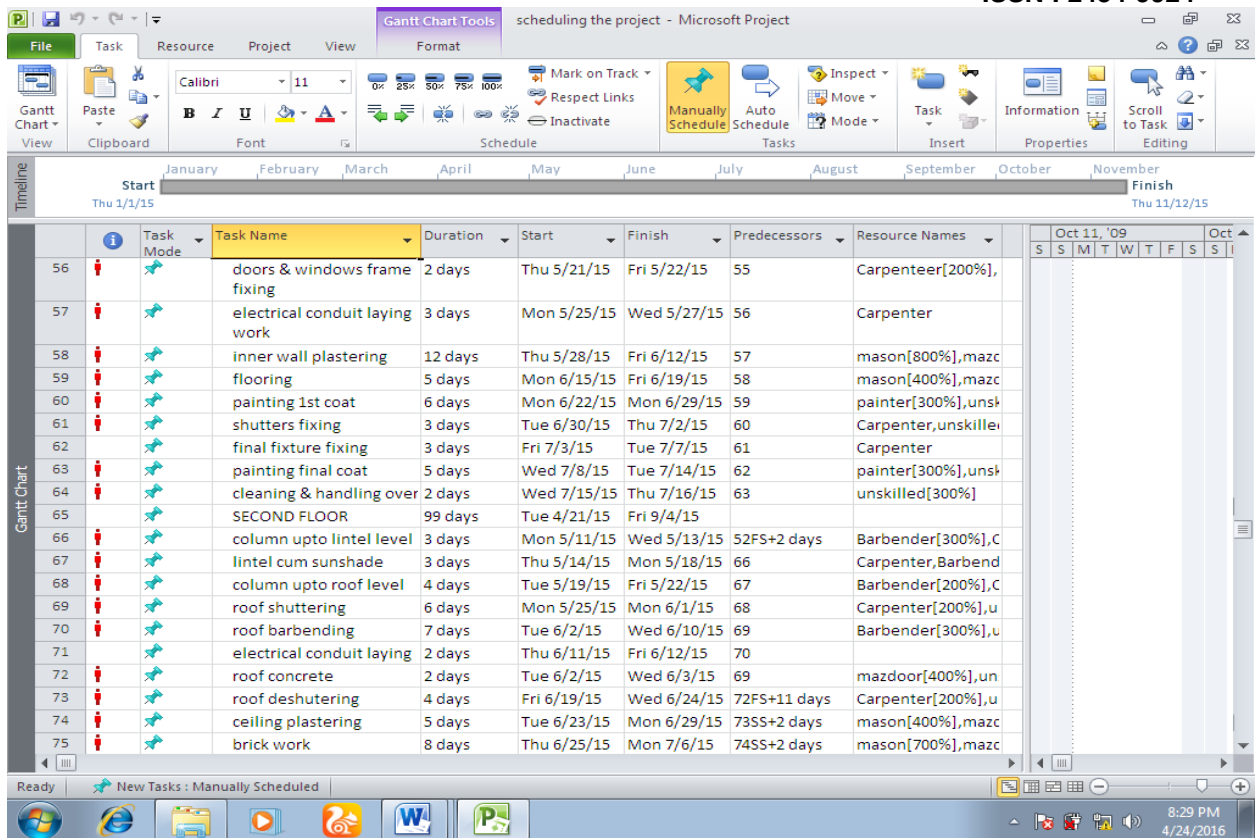
completion of work the actual cost is known. The actual cost should not differ much from estimated cost. The cost of each item of work is estimated from quantities already computed.

### 2.2.4 SCHEDULING THE PROJECT

Project is scheduled according to the resources derived from the detailed estimate. Using the Microsoft project scheduling is done. Project is scheduled to start on 01/01/15 and to end on 10/08/15.







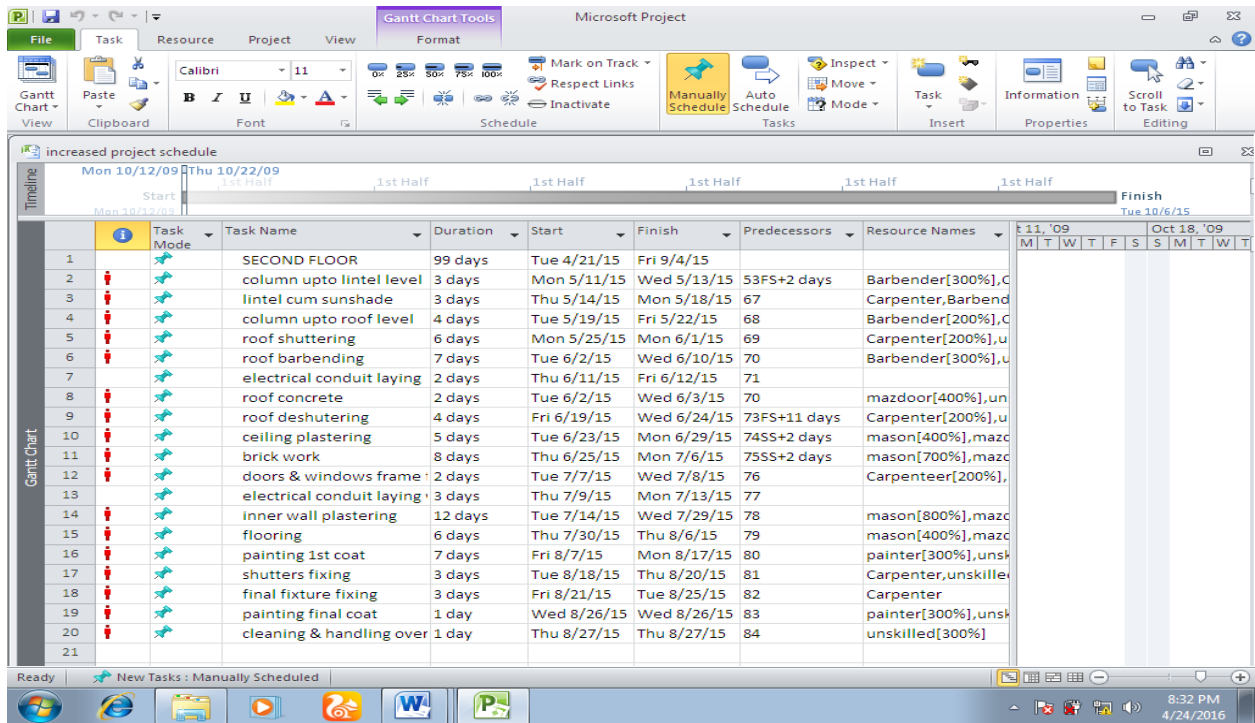
### Project Schedule

#### 2.2.5 INCREASED PROJECT SCHEDULE

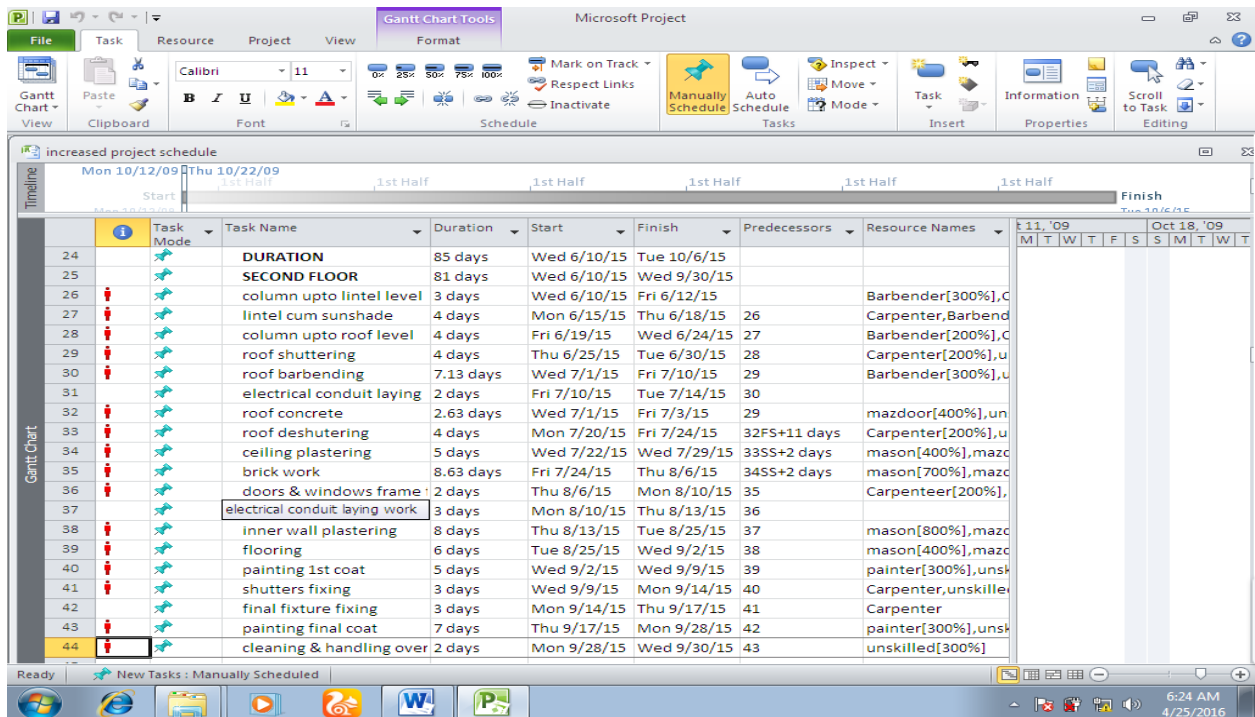
Now the factors affecting the project is introduced. Due to some factors like shortage of materials, cash flow project duration is increased and new schedule is formed. Second floor should start on 04/21/15 but



started on 06/10/15. Later crunching and crashing technique will be used for optimizing the construction time and cost.



Schedule duration



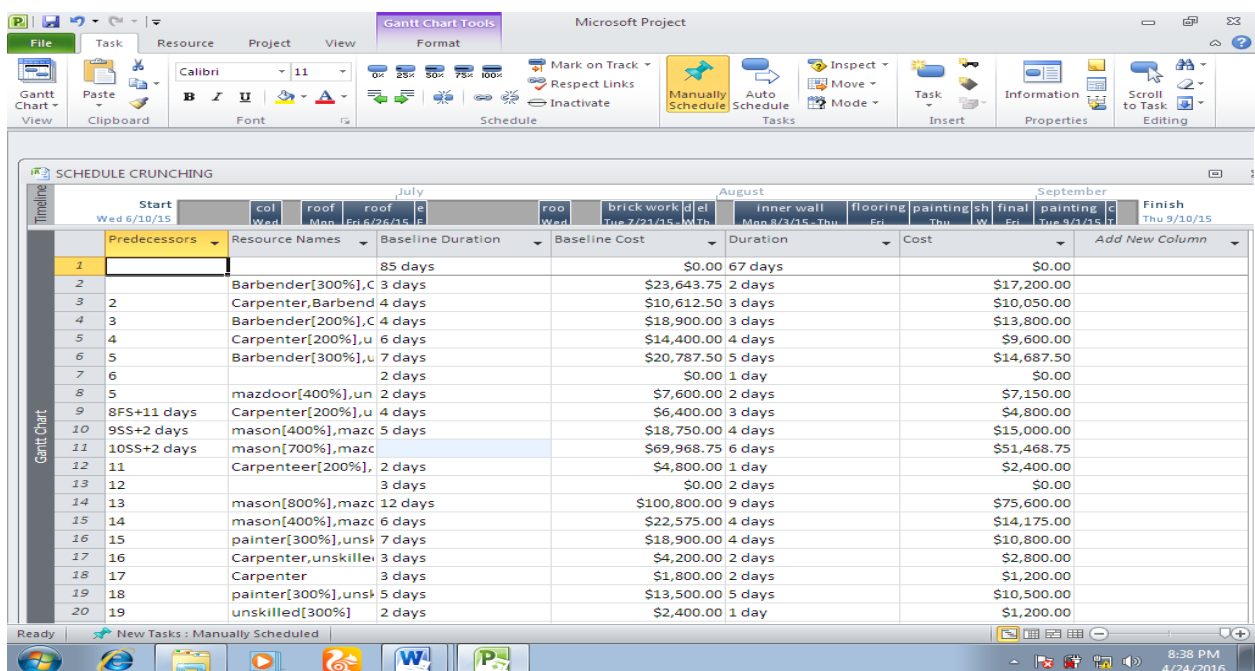
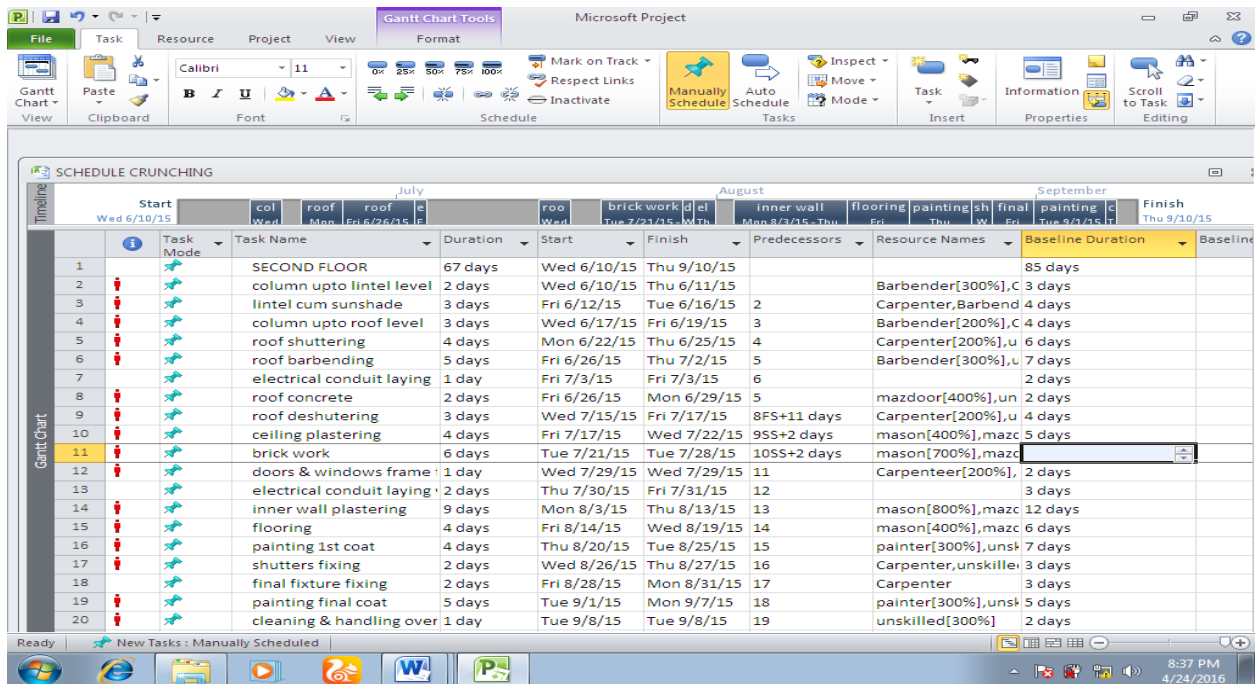
Increased duration



## 2.3 TECHNIQUES TO OVERCOME FACTORS

### 2.3.1 Schedule Crunching

Crunching is a period of time in which one must make an effort quickly in order to finish the project. In this technique, increased duration and cost of a project can be reduced. But crunching should be optimum, otherwise it leads to poor quality. By using this crunching technique, the duration of the project was reduced from 85 days to 67 days.



Duration Reduced by Schedule Crunching



| genre     | Second Floor | Head Room | Terrace Floor | External Works | TOTAL COST | SAVINGS |
|-----------|--------------|-----------|---------------|----------------|------------|---------|
| original  | 3,00,035     | 44,087    | 60,112        | 92,600         | 4,96,834   | 97,974  |
| crunching | 2,62,430     | 32,955    | 39,525        | 63,950         | 3,98,860   |         |

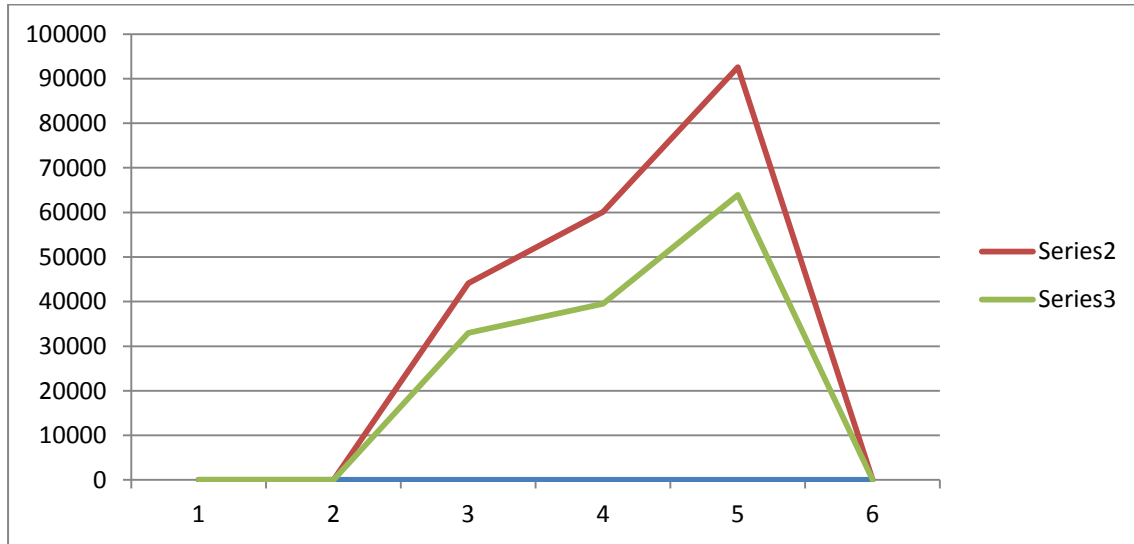


FIG 4.3.1.1 GRAPH OF SCHEDULED AND CRUNCHED

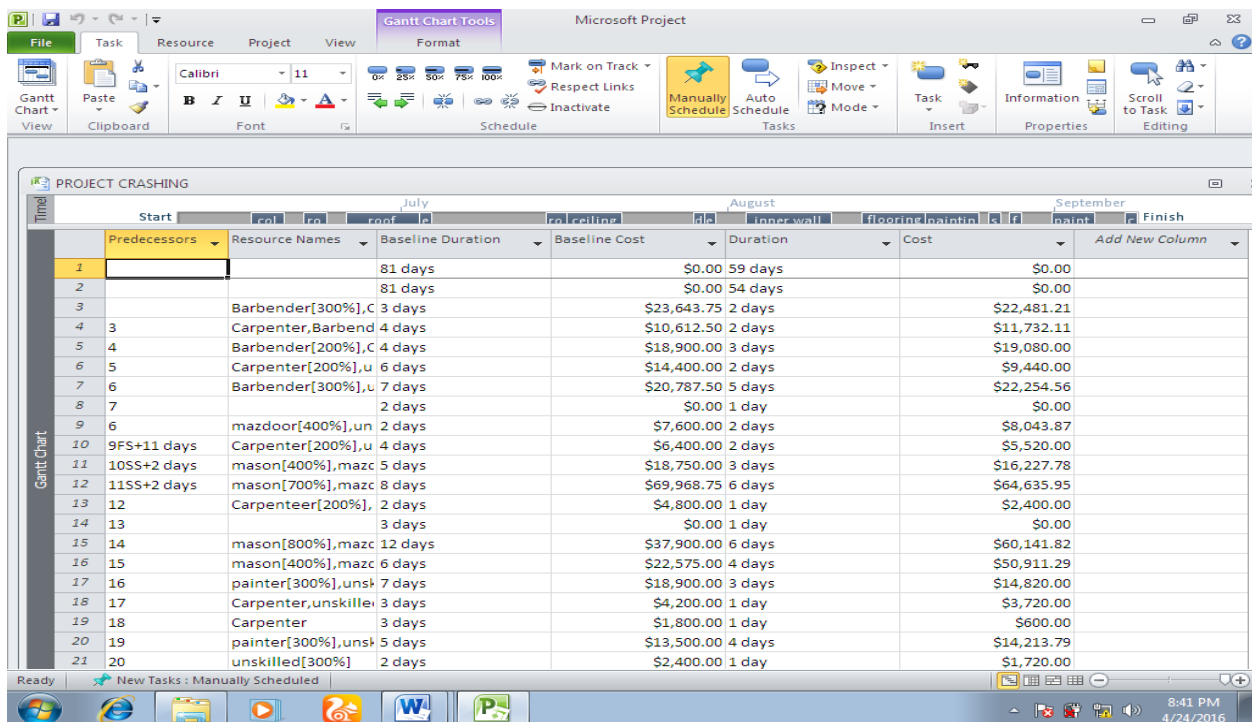
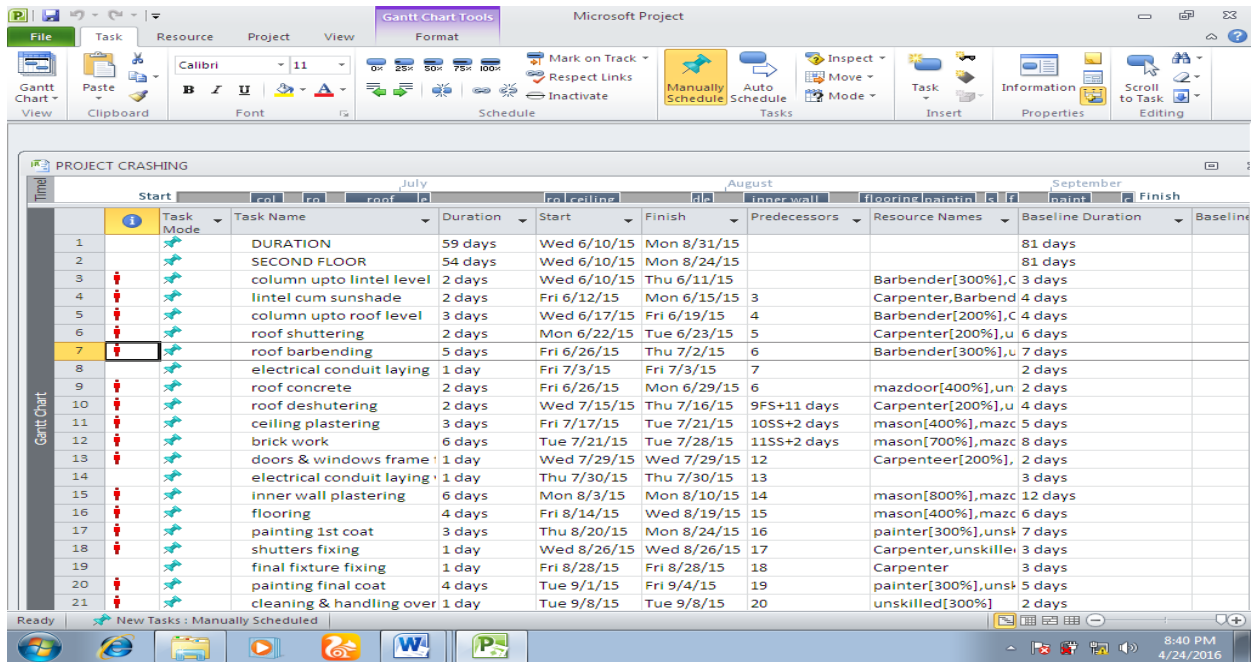
|               |                                      |
|---------------|--------------------------------------|
| ORIGINAL COST | <span style="color: red;">—</span>   |
| CRUNCHED COST | <span style="color: green;">—</span> |

|                              |  |
|------------------------------|--|
| Increased duration = 60 days |  |
| Duration reduced = 17 days   |  |

### 2.3.2 Project Crashing

Crashing means adding of additional resources to a project in order to finish the project in a specific deadline. But adding of resources should be optimum it should not affect the cost of the project. By using this crunching technique the duration of project reduced from 85 days to 59 days. There are a number of standard and typical approaches to attempting to crash a project schedule. One of the most commonly utilized methods involves increasing the assignment of resources on schedule activities. This essentially means decreasing the time it takes to perform individual activities by increasing the number of people working on those activities.



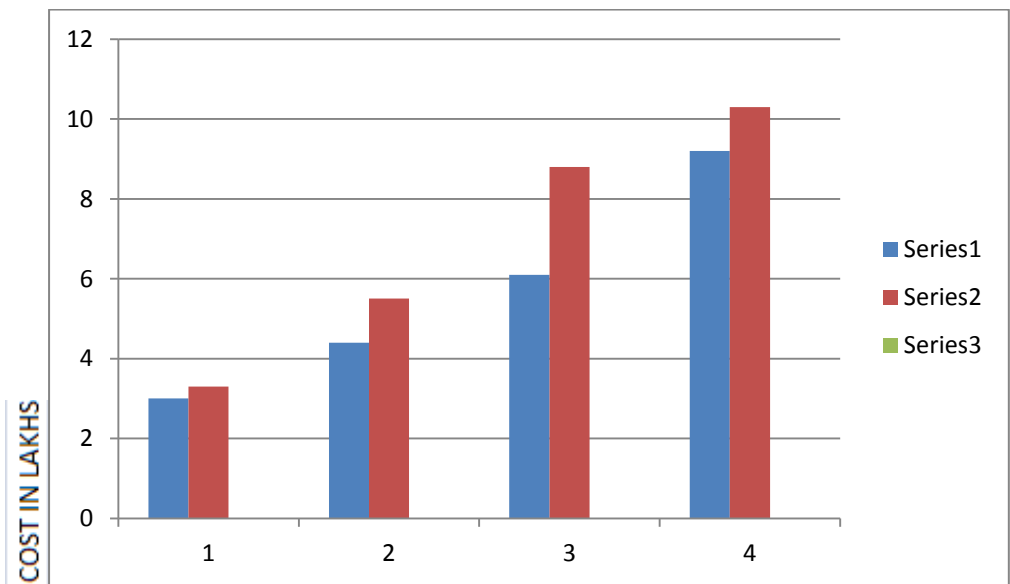


Duration Reduced By Crashing



| Resource Name    | Type     | Material | Initials | Group | Max.   | Std. Rate   | Ovt. Rate | Cost/Use | Accrue At | Base Calendar |
|------------------|----------|----------|----------|-------|--------|-------------|-----------|----------|-----------|---------------|
| 1 mason          | Work     |          | m        |       | 2,000% | \$75.00/hr  | \$0.00/hr | \$0.00   | Prorated  | Standard      |
| 2 mazdoor        | Work     |          | m        |       | 1,900% | \$56.25/hr  | \$0.00/hr | \$0.00   | Prorated  | Standard      |
| 3 cement         | Material | 1bag     | c        |       |        | \$300.00    |           | \$0.00   | Prorated  |               |
| 4 sand           | Material | 100cu.ft | s        |       |        | \$5,000.00  |           | \$0.00   | Prorated  |               |
| 5 brick          | Material | 1 load   | b        |       |        | \$19,000.00 |           | \$0.00   | Prorated  |               |
| 6 aggregate      | Material | 100cu.ft | a        |       |        | \$2,800.00  |           | \$0.00   | Prorated  |               |
| 7 steel          | Material |          | s        |       |        | \$0.00      |           | \$0.00   | Prorated  |               |
| 8 lime           | Material |          | l        |       |        | \$0.00      |           | \$0.00   | Prorated  |               |
| 9 paint          | Material | 1 litre  | p        |       |        | \$200.00    |           | \$0.00   | Prorated  |               |
| 10 tiles         | Material |          | t        |       |        | \$0.00      |           | \$0.00   | Prorated  |               |
| 11 teak work     | Material |          | t        |       |        | \$0.00      |           | \$0.00   | Prorated  |               |
| 12 stone masonry | Material | sq.ft    | s        |       |        | \$40.00     |           | \$0.00   | Prorated  |               |
| 13 painter       | Work     |          | p        |       | 800%   | \$62.00/hr  | \$0.00/hr | \$0.00   | Prorated  | Standard      |
| 14 operator      | Work     |          | o        |       | 100%   | \$75.00/hr  | \$0.00/hr | \$0.00   | Prorated  | Standard      |
| 15 unskilled     | Work     |          | u        |       | 1,800% | \$50.00/hr  | \$0.00/hr | \$0.00   | Prorated  | Standard      |
| 16 barbender     | Work     |          | b        |       | 800%   | \$56.25/hr  | \$0.00/hr | \$0.00   | Prorated  | Standard      |
| 17 carpenter     | Work     |          | c        |       | 800%   | \$75.00/hr  | \$0.00/hr | \$0.00   | Prorated  | Standard      |
| 18 polisher      | Work     |          | p        |       | 900%   | \$0.00/hr   | \$0.00/hr | \$0.00   | Prorated  | Standard      |

| Genre    | Second Floor | Head Room | Terrace Floor | External Works | Total Cost | Savings |
|----------|--------------|-----------|---------------|----------------|------------|---------|
| orginal  | 3,00,035     | 44,087    | 60,112        | 92,600         | 4,96,834   | 88,532  |
| crashing | 3,37,937     | 55,343    | 88,821        | 103,265        | 5,85,366   |         |



GRAPH OF SCHEDULED AND CRASHED

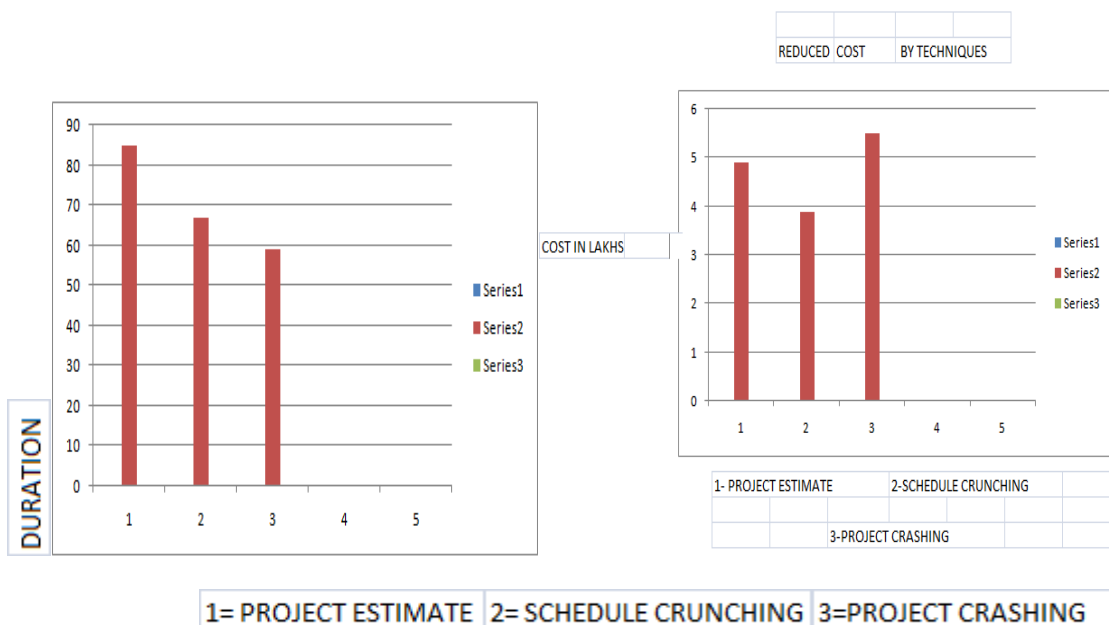
ORIGINAL COST ——— (Blue line)  
 CRASHED COST ——— (Red line)  
 Increased duration=60 days  
 Duration reduced=26 days

### 2.3.3 Comparison of Technique

| GENRE             | COST SAVED & INCREASED |
|-------------------|------------------------|
| PROJECT ESTIMATE  | 4.9 LAKHS              |
| SCHEDULE CRASHING | 3.9 LAKHS              |
| PROJECT CRASHING  | 5.8 LAKHS              |

| GENRE             | DURATION REDUCED |
|-------------------|------------------|
| PROJECT ESTIMATE  | 85 DAYS          |
| SCHEDULE CRASHING | 67 DAYS          |
| PROJECT CRASHING  | 59 DAYS          |

#### REDUCED DURATION BY TECHNIQUES



1= PROJECT ESTIMATE    2= SCHEDULE CRUNCHING    3=PROJECT CRASHING

FIG : 4.3.3 Comparison of Technique

### III CONCLUSION AND FUTURE STUDY

Many project managers suffer to finish the project within the duration and estimated cost. They may add more resources to finish the project within the duration or they finish the project by delay. From the result, It is found schedule crunching is most effective technique in optimization of time and cost. But quality is not guaranteed in this technique. If project duration is decreased of optimum ,then we can achieve quality by this technique. In order to achieve more profit we should not reduce than optimum it may lead to collapse and to do rework. In order to achieve quality project crashing is a good technique. Thus optimization of time and cost is achieved.

#### SCOPE FOR FURTHER STUDY

- In schedule crunching technique how far the duration can be reduced in terms of not reducing the quality of the project can be studied.



#### IV REFERENCES

- [1] Anuja Rajguru, Parag Mahatme Effective techniques in cost optimization of construction project: *IJRET: International Journal of Research in Engineering and Technology eISSN: 2319-1163 | pISSN: 2321-7308*
- [2] Chung-Wei Feng & Liang Liu, Associate Member, ASCE, and Scott A. Burns, Member, ASCE stochastic construction time-cost trade-off analysis *Journal of Computing in Civil Engineering, Vol. 14, No. 2, April, 2000. qASCE, ISSN 0887-3801/00/0002-0117-0126*
- [3] Ehsan Eshtehardian & Reza Abbasnia, Abbas Afshar (2008) Optimization of uncertain construction time-cost trade-off problem First International Conference on Construction In Developing Countries (ICCIDC-I) "Advancing and Integrating Construction Education, Research & Practice" August 4-5, 2008, Karachi,, Pakistan
- [4] Elhag T.M.S. and A.H. Boussabaine (1999) Evaluation of construction cost and time attributes Hughes, W (Ed.), 15th Annual ARCOM Conference, 15-17 September 1999, Liverpool John Moores University. *Association of Researchers in Construction Management, Vol. 2, 473-80.*
- [5] Mario Vanhoucke & Work continuity constraints in project scheduling Operations and Technology Management Center, *Vlerick Leuven Gent Management School, Reep 1, B-9000 Gent (Belgium)*
- [6] Mohammed Nooruldeen Azeez & Angham Alsaffar Construction Time-Cost Optimization Modeling Using Ant Colony Optimization *Number 1 Volume 20 January 2014 Journal of Engineering*
- [7] Olawale, Y.A. and Ming, S. (2009) A survey of construction project cost and time control practices in the UK. In: Dainty, A. (Ed) *Procs 25th Annual ARCOM Conference, 7-9 September 2009, Nottingham, UK, Association of Researchers in Construction Management, 877-86.*
- [8] Olawale, Y., and Sun M. (2010). "Cost and time control of construction projects: Inhibiting factors and mitigating measures in practice." *Construction Management and Economics, 28 (5), 509 – 526.*
- [9] Rhuta Joshi & Prof. V. Z. Patil Resource Scheduling of Construction Project: Case Study *International Journal of Science and Research (IJSR) ISSN (Online): 2319-7064 Index Copernicus Value (2013): 6.14 | Impact Factor (2013): 4.438 Volume*
- [10] Salim S. Mulla & Prof. Ashish P. Waghmare A Study of Factors Caused for Time & Cost Overruns in Construction Project & their Remedial Measures *ISSN : 2248-9622, Vol. 5, Issue 1, ( Part -6) January 2015, pp.48-53*
- [11] Salim S. Mulla & Ashish P. Waghmare Causes of Time & Cost Overruns in Construction Projects in Pune-India & their Recommendations *IJSART - Volume 1 Issue 7 –JULY 2015 ISSN [ONLINE]: 2395-1052*
- [12] Sarath Gunathilaka & Martin Morgan Tuuli and Andrew R J Dainty Critical analysis of research on project success in construction management *journals Department of Civil & Building Engineering, Loughborough University, Loughborough, Leicestershire, LE11 3TU, UK*



[13] Sanjay bhoyar & dhananjay k. parbat Multi-objective  
Model for time-cost trade-off in repetitive construction projects *International Journal of Civil, Structural, Environmental &  
Infrastructure (IJCSEIERD)* ISSN (P): 2249-6866; ISSN (E): 2249-7978 Vol. 4, Issue 4, Aug 2014, 13-24 © TJPRC Pvt. Ltd