The main goal of this study is to find out the optimum duration for the completion of project. In this project the data is duration and cost. Generally critical path method is used for repetitive type of construction but in this project we use activity based costing. The collected data is analyzed and find out the optimum duration and cost. The outcomes of the project will be shown that there still have rooms for construction process improvements with the application of Activity Based Costing.

ABSTRACT
There are so many approaches have been used for repetitive construction projects towards optimizing time and cost. In this project we have implemented a proposed theoretical model for effective utilization of Activity Based Costing to get optimum duration and cost. Generally critical path method is used for repetitive type of construction but in this project we use activity based costing grant chart to find the duration of project. The goal of any construction project is to complete the project within the estimated time and with minimum cost. The delay in a construction projects affects both owner and contractor. There are so many approaches have been used for repetitive construction projects towards optimizing time and cost. In this project we have implemented a proposed theoretical model for effective utilization of Activity Based Costing to get optimum duration and cost.

KEYWORDS Activity based costing, Grant chart, cost, duration.

1.1 INTRODUCTION
Activity Based Costing is a costing approach that assigns resource costs to cost objects such as products, services, or customers based on activities performed for the cost objects. The premise of this costing approach is that a firm’s products or services are the results of activities and activities use resources which incur costs. Costs of resources are assigned to activities based on the activities that use or consume resources (resource consumption drivers), and costs of activities are assigned to cost objects based on activities performed for the cost objects (activity consumption drivers). ABC recognizes the causal or direct relationships between resource costs, cost drivers, activities, and cost objects in assigning costs to activities and then to cost objects. ABC assigns factory overhead costs to cost objects such as products or services by identifying the resources and activities as well as their costs and amounts needed to produce output. Using resource consumption cost drivers, a firm determines the resource costs consumed by activities or activity centres (activity cost pools) and calculates the cost of a unit of activity. The firm then assigns the cost of an activity to products or services by multiplying the cost of each activity by the amount of the activity consumed by each of the cost objects.

1.2 Objective of Study
The goal of any construction industry is to achieve higher productivity with optimum duration and optimum cost. The present study aims to evaluate the effective management of activities to achieve the optimum duration for project.
The objectives of the project are

- To study the concept of activity based costing in construction projects.
- To involve the study regarding unnecessary activity & losses occurring during the project.
- Identifying the sources of activities using software base & compare with actual project on site.
- Analysis the above collected data.
- To give the discussion and suggestion for effective activity based costing management for construction project.

1.3 Methodology
At initial stage the project will be studied from Details drawings obtained from construction site. Planning of all the activities will be done and scheduling will be done depending upon the number of activities in Software. The data is collected from the housing construction project. The data is based on the residential buildings consisting of various types of blocks. The following data is collected from the construction site for various types of blocks i.e. expected completion time of project, Quantity of work for each activity, optimistic, pessimistic and most likely time for each activity, expected skilled and unskilled labor required for completion project etc.

Analyze the above collected information and prepare a result. In the analysis to minimize the overall project duration in the construction projects by activity based and spread sheet are used to prepare optimum scheduling for the effective utilization of the project on the basis of data collected from housing project.

To outcome of this will be feasibility of the project before execution, during execution and after execution can be analyzed.

2 PREVIOUS RESEARCHES
2.1 Cost object
Traditional costing methods normally utilize a single cost object a product or service. However, an effective and accurate costing system has to incorporate multiple cost objects. The activities are classified as

1. Unit level activities, which are performed each time a unit of a product or service is produced.
2. Batch level activities, which are performed each time a batch of goods is produced (1)

Reciprocal allocation method allocates costs by recognizing that the support departments provide services to each other as well as to the production department’s jobs, or project. (2) The stage of the ABC system attributes activity costs to the cost objects, through cost drivers which correlate the activities with those products and services. Cost drivers are used to identify the way activities are consumed by products/services.

3. Seven behavioral and organizational variables are important to cost
management practices identified they are: Top management support; linkage to competitive strategies, performance evaluation and compensation, non-accounting ownership, sufficient resources, training in designing, implementing and using cost management system and consensus about the clarity of the objectives of the cost management system, indicators as behavioral and organizational variables reviewed. Despite the many advantages to be derive from the adoption of ABC and activity-based management (ABM), the adoption of these techniques has been low in practice. Although there has been a growing awareness of ABC and ABM over the past decade, the overall rate of implementation has been low. Continuous improvement of ABC can give a better solution of the problem. The implementation of ABC can make the employees various cost involved. This will then enable them to analyze the cost, and to identify the activities that add value and those that do not add value. Finally, based on this, improvements can be implemented and the benefits can be realized. This is a continuous improvement process in terms of analyzing the costs, to reduce or eliminate the non-value added activities and to achieve an overall activity. (6)

The allocation of cost to each activity center depends on activities that are performed. Any activities that are not related to the specific cost elements are eliminated, as those activities do not add values to the ultimate goal of the division. Critics of ABC generally fell into two camps. Some argued that ABC was inconsistent with the principles of continuous improvement and total quality management. They wrote that ABC lacked customer focus, was not process-oriented, did not enhance organizational learning, and was top down in approach (i.e., did not involve employees). Other argued that ABC was inconsistent with the theory of constraints. A common argument was that ABC could not reliably measure the short-term impact of decisions on operating costs, inventory and throughput. These criticisms reflected a misunderstanding of the purpose and nature of ABC. Early versions of ABC were designed to reveal strategic insight into sources of profitability. The intention of ABC was neither to provide day-to-day guidance on process quality nor to measure short-term variable costs.

Table 2.1 shows the basis of Activity Based Costing is the assumption that cost objects (products, projects, customers, divisions etc.) consume activities and activities consume resources. First resources are allocated to the activities (through so called resource cost drivers) and then to the cost objects, through so called activity cost drivers. (9)

Activity-based costing (ABC) is defined as a methodology that measures the cost and performance of activities, resources, and cost objects. Specifically, resources are assigned to activities, then activities are assigned to cost objects based on their use. ABC recognizes the causal relationships of cost drivers to activities. ABC begins with the companies’ products, determines the activities used in the production and delivery of those products, and computes the costs of various activities. The costs of the activities used in the production of a product are then assigned to that product in a manner that approximates a causal relationship. (10)

Table 2.1 give any idea of how Operational ABM works to enhance efficiency, lower costs and asset utilization. It can increase the capacity of resources by reducing machine downtime, improving or eliminating entirely faulty activities and processes and increasing the efficiency of the organization’s resources. The benefits from operational ABM can be measured by reduced costs, higher revenues through better resource utilization and cost avoidance.
product using the cost structure base illustrated above, direct labour, direct materials and manufacturing overheads are attributed or allocated to the single unit of product.

Traditional methods trace the direct labour and direct material into the certain single product unit by the product volume. That is:

\[
\text{Total unit direct cost} = \frac{\text{Direct labour cost} + \text{Direct material cost}}{\text{Product volume}}
\]

Fig 3.1 shows traditional cost systems that misallocate the overhead costs, ABC traces costs by using resource and activity drivers that reveal activities’ and objects’ consumption patterns on the basis of the cause and effect relationship. In activity costing systems, there are three building blocks: the resources, the activities and the cost objects.

![Building blocks in activity based costing](image)

**Table 3.1 Allocation bases for traditional method and ABC**

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Indirect Cost</th>
<th>Activity-based costing</th>
<th>Traditional</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Production control</td>
<td>No. of process operations</td>
<td>Direct labour hours</td>
</tr>
<tr>
<td>2</td>
<td>Inspection</td>
<td>No. of inspections</td>
<td>Direct labour hours</td>
</tr>
<tr>
<td>3</td>
<td>Warehousing stores</td>
<td>Receipts and issues</td>
<td>Direct labour hours</td>
</tr>
<tr>
<td>4</td>
<td>Purchasing</td>
<td>Purchase orders</td>
<td>Direct labour hours</td>
</tr>
</tbody>
</table>

The change is calculated by using the following formula:

\[
\text{ABC cost change} = \frac{\text{ABC cost} - \text{traditional cost}}{\text{Traditional cost}} \times 100
\]

Table 3.1 shows the allocation of traditional method and ABC. The distortion by traditional cost is very dangerous as compared to ABC and also the direct labor hour by traditional method is much more as compared to ABC analysis.

The activity in the construction project should be properly organized for smooth performance of work. As depicted in Figure 3.2, direct labour, materials, machine costs and energy are classified as unit-level costs, whereas the setups and purchase orders activities belong to the batch-level class. Maintaining engineering change notices or process engineering are product-sustaining activities. Plant management, buildings and grounds maintenance, heating and lighting are activities that sustain the factory.

![The Construction operating expenses](image)

**4. Activity Based Costing By Software**

1. From the data collected from Purna Construction site, the activities are allocated and as per the activity the planning will be done and executed on site.
2. The site contains Six Shops and Twelve Flats the total area of project is 15,091sqft and total cost of project is 1,89,96,293.24 by traditional method.
3. The data is taken from site and planning is done in software and Grant Chart is prepared showing activities and their resources.
4. Initially the data collected from site the activities are allocated and cost of each activity allocated as per data given by site engineer shown in Table 4.1
5. The activities are placed in software (Microsoft Project Planning) and accordingly the duration is allotted along with the resources shown in Table 4.2.
6. From the activities placed in software the entire cost of project is calculated as per planning.
7. The duration difference by actual planning & by traditional method is calculated and with that difference the cost is also worked out.
8. From Microsoft Project Planning initially WBS (Work Break Down) structure is made and for each activity tentative days are allocated by knowing experience of the contractor shown in Table 4.2
9. The estimate is prepared for each items that is included in construction work.
10. The cost is allotted for each activity depending upon the quantity of work.
11. The total quantity of work is calculated and then planning and scheduling is done for entire project.

The allocation of materials is done on site for each activity and accordingly planning is done.

**Table 4.1 Activity Distribution by Planning Method**

<table>
<thead>
<tr>
<th>WBS</th>
<th>Task Name</th>
<th>Summarized Cost</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Resi. Appartment</td>
<td>17,680,368.11</td>
<td>366 days</td>
</tr>
<tr>
<td>1</td>
<td>Part &quot;A&quot;: CIVIL WORK</td>
<td>17,120,368.11</td>
<td>327 days</td>
</tr>
<tr>
<td>1.1</td>
<td>PLINTH LEVEL STRUCTURE</td>
<td>1,583,597.40</td>
<td>40 days</td>
</tr>
<tr>
<td>1.2</td>
<td>RCC WORK</td>
<td>6,051,327.97</td>
<td>161 days</td>
</tr>
<tr>
<td>1.3</td>
<td>MASONARY WORKS</td>
<td>750,903.19</td>
<td>128 days</td>
</tr>
<tr>
<td>1.4</td>
<td>WATERPROOFING WORKS</td>
<td>1,144,323.13</td>
<td>24 days</td>
</tr>
<tr>
<td>1.5</td>
<td>PLASTER WORKS</td>
<td>1,625,100.47</td>
<td>79 days</td>
</tr>
<tr>
<td>1.6</td>
<td>COLOURING WORKS</td>
<td>743,787.98</td>
<td>55 days</td>
</tr>
<tr>
<td>1.7</td>
<td>FLOORING &amp; DADO WORKS</td>
<td>2,135,670.19</td>
<td>82 days</td>
</tr>
<tr>
<td>1.7.1</td>
<td>Vitrified tiles flooring</td>
<td>1,270,480.64</td>
<td>50 days</td>
</tr>
<tr>
<td>1.8</td>
<td>DOORS &amp; WINDOW WORKS</td>
<td>1,717,958.00</td>
<td>90 days</td>
</tr>
<tr>
<td>1.8.1</td>
<td>single leaf flush door</td>
<td>497,600.00</td>
<td>30 days</td>
</tr>
<tr>
<td>1.8.2</td>
<td>S.S. Railing</td>
<td>202,219.68</td>
<td>20 days</td>
</tr>
<tr>
<td>1.10</td>
<td>MS Grill work @ 25 kg/kg</td>
<td>368,138.76</td>
<td>25 days</td>
</tr>
<tr>
<td>1.11</td>
<td>M.S. PERGOLA</td>
<td>57,683.34</td>
<td>10 days</td>
</tr>
<tr>
<td>1.12</td>
<td>Kitchen / Pantry Platform</td>
<td>378,840.00</td>
<td>30 days</td>
</tr>
<tr>
<td>1.13</td>
<td>TRIMIX AT STILT</td>
<td>360,818.00</td>
<td>10 days</td>
</tr>
<tr>
<td>1.14</td>
<td>1.14Electrification</td>
<td>300,000.00</td>
<td>176 days</td>
</tr>
<tr>
<td>1.15</td>
<td>Plumbing</td>
<td>260,000.00</td>
<td>160 days</td>
</tr>
</tbody>
</table>

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The Cash flow report gives an idea about the funds allocated for every quarter. From the graph it is seen that when the work is at completion stage the fund required are more as compared to initial stage of work. The Fig 4.2 shows allocation of work and baseline work. It indicates that actual work was less but due to delay the total work hours increased.

Fig 4.1 Cash Flow Report

Fig 4.2 BaseLine Cost Report

Base line work gives an idea about the project status and it work to be completed. Initially the baseline work will be very low as the progress of work is steady. As the project progresses the actual work and baseline work should be same. The Fig 4.3 shows the base line work done Quarterly for entire project the project work is maximum during last quarter in 2013.
5. RESULT FROM DATA ANALYZED

1. From the Table 4.1 & Table 4.2 it can be seen that the duration of the project can be curtailed through activity based costing and by proper planning.

2. On the basis of Traditional Data and software date the various parameters such as cost, duration is been compared and accordingly remedial measures can be taken.

3. From table it is been also observed that for some activities there cost difference is zero but still it took more days as compared to traditional method.

4. The actual project duration is 401 days and by effective utilization of activities we get the optimum duration of 366 days and table shows the corresponding cost. If the project duration get reduces both direct and indirect cost of project get reduces.

5. The Traditional Cost of Project is Rs.1,89,96,293.24/- and the planned cost of project is Rs. 1,76,80,368.11/- thus the difference in cost is Rs.13,15,925.13/-

6. This difference occurred due to lack of planning on construction site and poor workmanship for some activities incurred on site.

7. The cost of the project increased by 7.5% as compared to traditional method and this increased to cost and reduced the profitability of project.

8. Fig.4.1 shows the cost of project required during the construction work each and accordingly the cost allocation should be done in the project.

9. The baseline work and actual work is calculated and the difference between them is shown in Table 4.2 it indicated when the project should have been completed and actually when it is completed.

10. As seen earlier the maximum cost is required in fourth quarter of year 2013 similarly maximum labour and maximum work is also carried in fourth quarter of 2013 shown in Table 4.3.

11. For every project the activities will change and this change should be reflected on site as well as in software.

12. Any changes may on site should be mentioned in software so that if the project is extended the reason will be specified.

13. The software only gives an idea of tentative cost of project but a project progresses the cost may change, the change in cost and its details should be shown.

14. Actual planning and on site planning differs this should cannot be shown in software hence sometimes the actual duration is difficult to calculate.

15. For any activity of cost is changed it indirectly affects the total cost of project for minor activity the project cost will not get affected but for major activity if cost changes beyond limit then it may lead to disputes.

16. On every site though the comparison is done, still on every site activity’s planned and executed cannot be same, the difference in activities only can be minimised.

CONCLUSION

1. Now a day’s housing construction projects are continuously increases in our country. And it is observed that there is delay in project duration is cause due to improper planning on site. So to reduce this bar charts should be utilized effectively.

2. From the study of recent scenario it is observed that, now a day’s improper planning in major projects affects delay in the construction project scheduling. Delay in a construction scheduling affects the cost and time. If the schedule of project is delayed then automatically the project duration is increases and if project duration increases the total cost of the project increases and therefore the productivity of the project get reduced. And it seriously affects the owner and contractor in many ways.

3. The initial duration of Project was 401 Days and the planned duration was 366 days that is the difference in the duration is 35 days this increase in days also increased the cost of project by 7.5%

4. The initial cost of project was Rs.1,89,96,293.24/- and the planned cost of project was Rs. 1,76,80,368.11/- thus the difference is Rs.13,15,925.13/-

5. This difference leads to decrease in profitability of project and delay of project.

6. The project actually complete on 2th June 2014 and by planning it should be completed by 25 April 2014.

7. To improve the productivity of a construction industry the planning according to activity is necessary. There are so many factors that affect the planning on construction site. It is observed that in housing constructions projects the effect of poor planning results in losses in project.

8. The absenteeism of planning is seriously affects the construction industry. The effects of absenteeism in the workplace are directly proportionate to decreased productivity. With the help of proper planning work on site can be run smoothly and effectively.

9. There are five types of resources used in the construction industry like manpower, machineries, money, material and space. The management of resources in a proper way is the important thing. So we studied about various types of resource management like manpower management. Money management, equipment management,
material management and space management.

10. As we know that if the cost and time for the construction industry is reduce simultaneously the productivity of project is get increase. There are so many methods to find out the time duration to complete the project like Microsoft Project and CPM. But practically the project is not completed within the estimated time. There are so many factors which affect the time and cost of the project gets adversely affected.

11. From the study conducted on housing construction project for 2BHK flats and shops it is observed that we get the optimum duration for project with minimum cost the actual duration for project was maximum.

12. So by applying the grant chart analysis we get the optimum duration for both blocks. So we manage activities effectively by grant chart analysis we get the optimum solution.

13. The Table 4.2 shows the cost for various scenarios, and from that we observe that for the minimum duration, cost is also minimum as compare to original duration and cost. And important thing is that we get the optimum duration without crashing any activity.

REFERENCES