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INTERNATIONAL JOURNAL OF ENGINEERING SCIENCES & RESEARCH TECHNOLOGY
TIME AND COST OPTIMIZATION BY MSP SOFTWARE

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ABSTRACT
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. Optimization is a systematic effort made to improve profit margins and obtain the best results under given circumstances. There is a Systematic planning and programming with effective management is necessary for timely completion of the project. There is availability of various tools and techniques for optimization. Optimizing performance of the different techniques adopted at one stage of the construction process may not be beneficial if the methods used are not to up the efficient level. In this approach we have studied various factors which affect the cost of projects. again in this approach we have studied various techniques and various materials used for cost optimization. Also the need of optimization is discussed.

KEYWORDS: Optimization, time and cost, construction, techniques, delay, activity.

INTRODUCTION
During the last several years, the construction industry has been on the rise all over the world. This increase in the demand for construction was the main motive to adopt construction management & rank it as crucial element in construction process that is needed to handle the challenges and the risks associated with projects. In the field of Construction the term project refer as a temporary end undertaken to create a new product or service to achieve specified objectives within the assigned resources. For all construction projects, the main objectives are to handover the project within the required time and cost. Each project has its planned budget and schedule. The budget is a measure of the cost that the project will consume in order for the final deliverable to be finished. Generally, the cost is subdivided into direct cost and indirect cost. The direct cost is basically the cost of the resources such as labour material and equipment and is calculated by adding up the resources cost of all the activities. The indirect cost is the addition of general overhead and job overhead, or in other words, it is a cost other than the direct cost that can be assigned to a specific activity. Project objectives cannot be attained unless proper management of the construction is implemented. Employing effective planning in terms of scheduling, budgeting, safety and quality at the early stages of the project is very important since it allows control over the process from its initiation phase to its close out phase, minimizes delays and cost over-runs &assists in achieving the project objectives efficiently. Nowadays, construction project participants are becoming more aware of the high impact associated with the delays in terms of cost and litigations. In fact, meeting compulsory deadlines of projects are necessary due to the following important reasons.
1.   Launching Time of Project.
2.   Incentives or bonuses rewarding the early completion of a project.
3.   The desire to avoid unexpected unforeseen conditions or risks.

Project Planning Steps
The following steps may be used as a guideline, or checklist to develop a project plan:
1. Define the scope of work, method statement, and sequence of work.
2. Generate the work breakdown structure (WBS) to produce a complete list of Activities.

3. Develop the organization breakdown structure (OBS) and link it with work Breakdown structure o identify responsibilities.
4. Determine the relationship between activities.
5. Estimate activities time duration, cost expenditure, and resource requirement.
6. Develop the project network.

Time Cost Trade off techniques is 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. In reality due to different uncertainties, the actual cost and time of each option is not certainly known for the manager in advance. Therefore, total time and cost of project may differ significantly because of these uncertainties. Analyzing the time and the cost is essential in order to obtain an optimum schedule that maintains the project deadline while having the lowest cost. Optimization as a word refers to the determination of a highest or lowest value over some range, either to maximize the profit or minimize the loss. Time-cost optimization is defined as scheduling technique using the critical path method by which the project duration is shortened with a minimum of added cost". In general, project time and cost are linked via a relationship. As the project schedule or the project time is shortened, the direct cost (material, labour) of critical activities increase, while the indirect cost (overheads) of the project decreases. The study in this paper is aimed at developing a new model to solve the time-cost trade off problem taking into account the total float loss impact. Construction Projects are more risky. Quantification and minimization is one of the primary goals of construction research. When a project is scheduled, the normal schedule will have certain risks that are measured by the probability of completing the project on time. As the project duration is shortened to reduce the total cost the total float is lost resulting in more critical activities. This in turn results in reducing the probability of completing the project on time & increases the risk of schedule delays. There is need to incorporate that extra risk into the time-cost trade-off problem. This will be helpful in getting a more reliable project schedule.

OBJECTIVES OF PROJECT
➢ The main objective of project to reduce cost of project by using msp software and other techniques
➢ As well as to optimise the construction duration of the overall project
➢ During the construction various risk factor created on a site and the project objective to minimise risk factor at construction site.
➢ All available equipment on a site which are effectively used.also Effective use of available resources.
➢ Identify tools for tracking and controlling a project.

NEED OF OPTIMIZATION
In project it is necessary to decide which optimization is required and amount of detail that will be in used into the construction stage. The optimization of time and cost is necessary as it could minimize both the time and total cost of project. This optimization in time and cost helps to achieve the greatest benefit. All of the construction company have planning and scheduling the time first before starting the project and some of the company did not follow well. The time constraint of the project and this situation will lead the delayed of the project.

LITERATURE REVIEW
Shanmugapriya S., Dr. Subramanian K. (October 2013) [1] Time overruns and Cost overruns has been a major issue in many Indian construction projects. The objective of this paper to study significant factors causing Time overruns and Cost overruns in Indian construction projects. The result accomplished from the survey revealed that the major cause for time overruns are contract modification, material market rate, and high level of quality requirement and the major cause for cost overruns are, change in material specification, high transportation cost, and escalation of materials price.

Salunkhe. A, Patil R (Janeuary2014) [2] Construction delay is considered to be one of the recurring problems in the construction industry and it has an adverse effect on project success in terms of time, cost and quality. The time and cost for performance of a project are usually important to the employer and contractor. The authors highlight the types of construction delays due to which project suffer time and cost overrun. Also give external and internal factors that influence the construction process and outline the effect of delay in large construction projects.

T.Subramani, P S South, M.Kavitha (June. 2014) [3] The main objectives of this paper are to identify and analyze the causes of cost overrun in construction. The results carried out from survey showed that, poor contract

management, slow decision making, poor schedule management, increase in material/machine prices poor design/ delay in providing design, rework due to wrong work, long period between design and time of bidding/tendering and wrong estimation/ estimation method are the major causes of cost overrun.

METHODOLOGY
TIME-COST OPTIMIZATION WITH NETWORK ANALYSIS
There is availability of various techniques for optimization and project control software, still many construction projects do not achieve their cost and time objectives. The basic scheduling techniques commonly used in practice include the Critical Path Method (CPM) and Program Evaluation Review Technique (PERT)

Work Breakdown Structure (WBS)
The WBS is described as a hierarchical structure which is designed to logically subdivide all the work-elements of the project into a graphical presentation. The full scope of work for the project is placed at the top of the diagram, and then sub-divided smaller elements of work at each lower level of the breakdown. At the lowest level of the WBS the elements of work is called a work package. A list of project's activities is developed from the work packages. Effective use of the WBS will outline the scope of the project and the responsibility for each work package. There is not necessarily a right or wrong structure because what maybe an excellent fit for one discipline may be an awkward burden for another.

The WBS elements at various levels can be related to the contractor's organizational breakdown structure (OBS), which defines the different responsibility levels and their appropriate reporting needs as shown in The figure, also, shows that work packages are tied to the company unified code of accounts. The unified code of accounts allows cataloging, sorting, and summarizing of all information.

CRITICAL PATH METHOD
Critical Path Method (CPM) was developed to optimize the organization of complex procedures of an activity network and also to identify critical activities in a network critical path. Because activities in the network can be carried out in parallel, the critical path is the length of the longest path from the start of project to its finish. An activity is said to be critical if there is no delay in determining its start and finish times .Once the duration of all the activities is estimated, the project duration can be calculated with CPM, the project duration is the sum of the durations of all activities on the critical path.

PROGRAM EVALUATION AND REVIEW TECHNIQUE
Since uncertainties such as inclement weather, unforeseen site conditions, poor labor performance, inadequate recourse allocation, low equipment performance and in for management style incurred during a construction process, it could be difficult to estimate activity durations correctly. Program evaluation and review technique (PERT) was originally designed to orient time elements of a project and adopted probabilistic time estimate to determine the probability that a project could be completed by a given date. This method uses weighted values of three time estimates: i.e. pessimistic, most likely and optimistic duration to estimate the mean and variance. The expected mean values then are used to determine the mean critical path.
1. Optimistic time (O): the minimum possible time required to complete a task,
Assuming condition that everything proceeds better than is normally expected
2. Pessimistic time (P): the maximum possible time required to complete a task,
Assuming condition that everything goes wrong (but excluding major Catastrophes).
3. Most likely time (M): the best estimate of the time required to complete a task,
Assuming condition that everything precedes as normal.
4. Expected time (TE): the best estimate of the time required to complete a task,
Accounting for the fact that things don't always proceed as normal
$$TE = (O + 4M + P) \div 6$$

Time-cost optimization is based on the idea of shortening the critical activities with the minimal increase in cost per unit of time. It is usually performed through the following steps:
1. Developing the schedule based on the normal duration and normal cost of projects activities.
2. Estimating the crash cost and duration for each activity and finding the crashing slope. The crashing slope, which is a constant cost per unit of time, can be found through the following formula: Crash cost per time (Slope) = (Crash cost – Normal cost) / (Normal time – Crash time)

3. Identifying the critical activities on the critical path, then identifying the critical activity that can be crashed with the least cost; that is, the activity with the least crashing slope. If there is more than one critical path, a critical activity from each path should be selected and crashed as long as the two selected activities can still be crashed and the total crash cost of the selected activities is the smallest.

4. Shortening the activity by the units required (maximum crashing units = normal time – crashing time).

5. The new cost and duration of the project should be calculated at this stage, and then steps through 3 to 5should be repeated until the optimum point, where the overhead cost savings are greater than the increased direct cost, is achieved This technique is based on the use of "Link lag values" that helps in determining the possible number of times the activity can be crashed. Chance-constrained programming model to incorporate the variability of funding then translate it into a corresponding deterministic at pre-defined confidence level.

"The cost optimization is a process that should be carried out throughout the construction period to ensure that the cost of the building is kept within the estimated cost limits". In the construction field, time saving can also be transformed into some kind of opportunity such as bonus of early completion or saving in overhead. Therefore, the lowest tender price may not be the only criterion for project success and thus concurrent optimization in both time and cost is highly encouraged and desirable.

Men will result from them .In integration with other functions method, the cost optimization system will combine with some other necessary operation in the administration of a contract and not as a separate entity. For example, it may be combined with a labor utilization scheme, in which the optimization is kept on the optimal utilization of the labor employed.
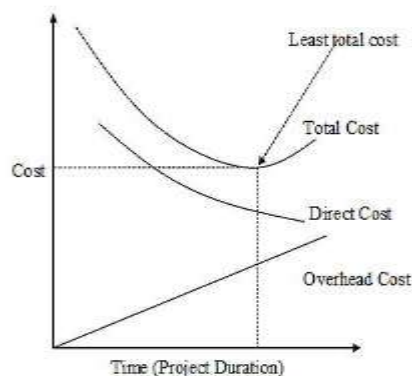
FREQUENTLY USED METHODS
1) Work Programmes: Contractors prepare and use schedules to monitor progress and financial performance of project.

2) Inspection of Works: Inspection of works is carried out and comparison is made with the budget of project.

3) The project Budgets: Cost and expenditure attached with responsibility centers along with work targets to be accomplished.

4) Site Meetings: Meetings held to check and review the progress of work and compare it with the monetary allocations.

5) Record Keeping: Documentation work of activities carried out to enable early
Detection of variation from the set standards.

6) Monitoring Work and Cost Performance: Clients, consultants and the contractors Used monitoring tools of schedules, budgets, inspection and feedbacks to keep a watch on the cost performance of project.

7) Evaluation of Works Carried Out: Quantification of works and comparing with the costs in the bill of quantities. Inspection was also reportedly used to evaluate works.

DATA COLLECTION

Project Name	Shriram park
Address	Karad -tasgaon road near thorat hospital karad
Building Type	Residential
Name of Contractor	Pradip J. Jadhav (D.ARCH)

Construction Started	16 jan 2016
Expected Date of Completion	1 june 2017
Total cost of Project in Rs.	4 crore.
No of Floors	5
Area of Project	1025 sqm.
Name of Project Incharge	Mr. Dushyant Jadhav

CASE STUDY
Jadhav and Associate well known for their superior quality and the service bring Shriram park a scheme of luxurious 1 and 2bhk apartment at karad – tasgaon road, near thorat hospital, opposite Hirai park goleshwar karad. Which is no doubt one of the most prized possessions of the city with clam and quite surrounding away from pollution and traffic noise and jam road.

SITE DATA:-
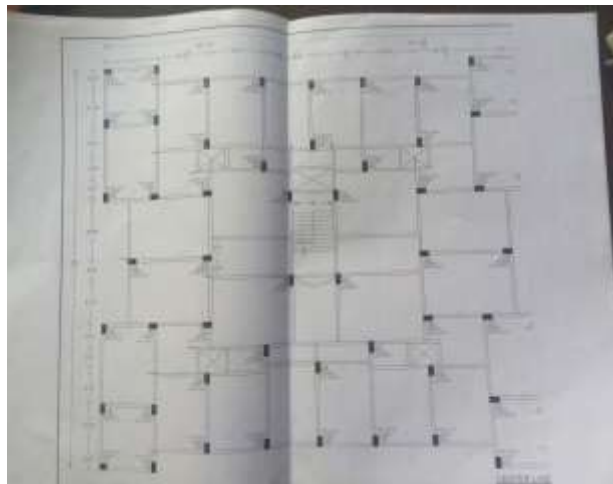
Photo no.- 1 center line plan

## DATA ANALYSIS
MS PROJECT FOR CONSTRUCTION
MSP is very user friendly and inexpensive and provides decent default reports and graphs. A casual user of MS Office with no scheduling experience can quickly create schedules' and pick MSP up. However a seasoned scheduler working on a construction contract is likely to struggle with maintaining the schedule.
The main areas are:
1) MSP Baseline management is confusing for the average scheduler.
2) MSP updating method of using % Complete is not suitable for construction schedules.
3) MSP Data Date issues which in effect complicate the schedule update process are confusing for construction schedulers
4) Due to the difficulty of using MSP to note uncompleted work before the Data Date, the difficulties in removing status for what-ifs, and identifying the difficulty

On this site MSP software is being used for the planning and scheduling the activities of the project. On this site the inputs given to the MSP are the activities to be performed, their duration, start and finish dates and the activities are being linked which gives idea of performing the activities at the certain time and in certain duration.
Below shown is a typical format prepared on the site of their master schedule.
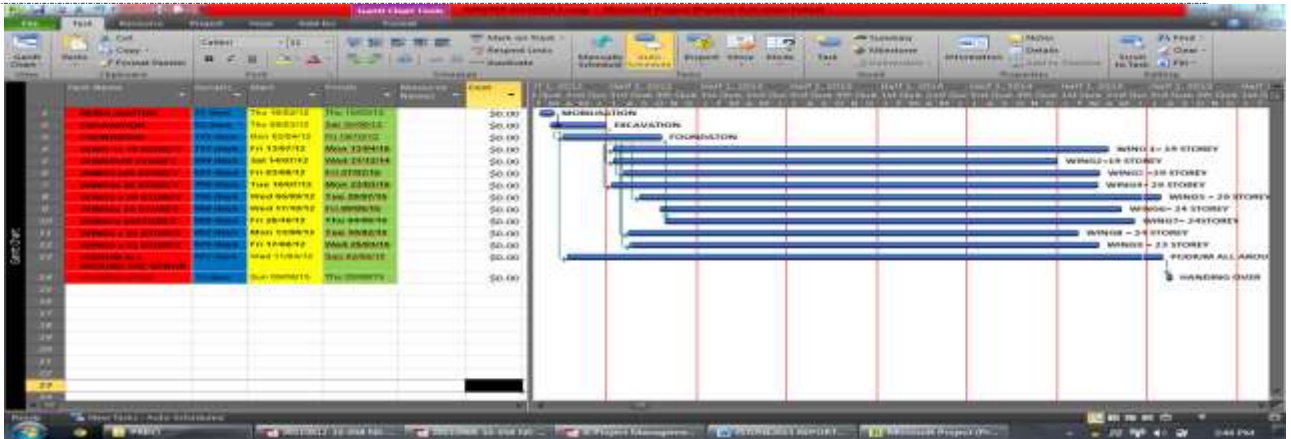
PHOTO NO.5- MSP SCREEN SHOWING MASTER SCHEDULE OF FUTURE TOWERS.

Now you can see in the above image that the software does not show any resources assigned to the activities in the resource name column and the cost of the activities in the cost column. This is because the resources were not assigned in the resource sheet of the MSP software. Hence resources required for the activities and respective costs are not displayed.

The MSP schedule should be given the details of activities and also the resources as input data so that the software gives a beneficial output which can be used for proper planning and scheduling which can be illustrated from the example given below which is a MSP Master schedule of the Rivera residential project at karad by jadhav developers.
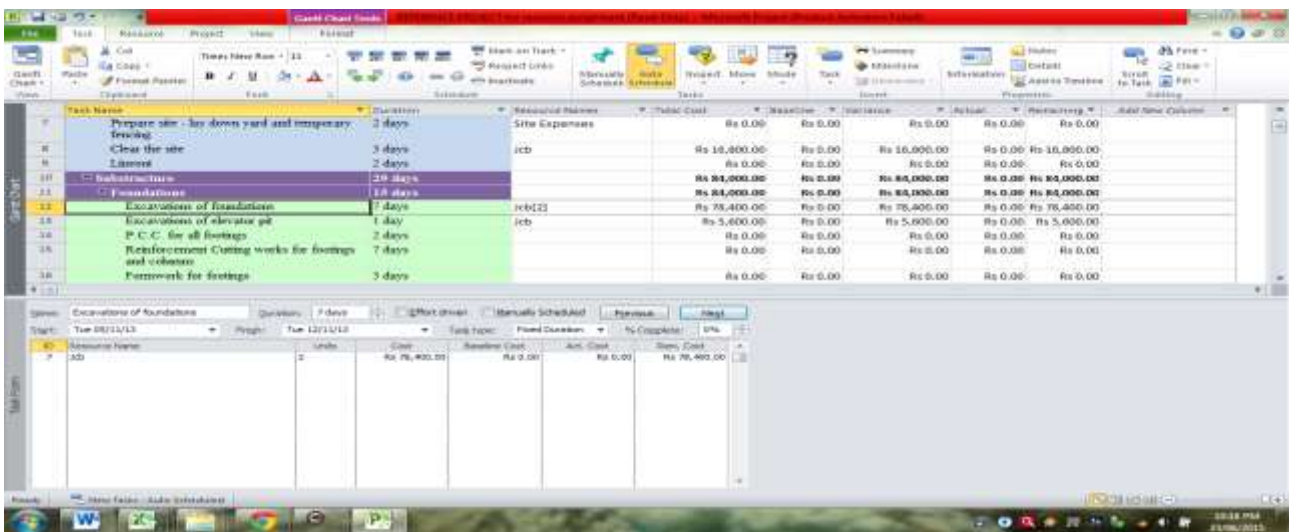
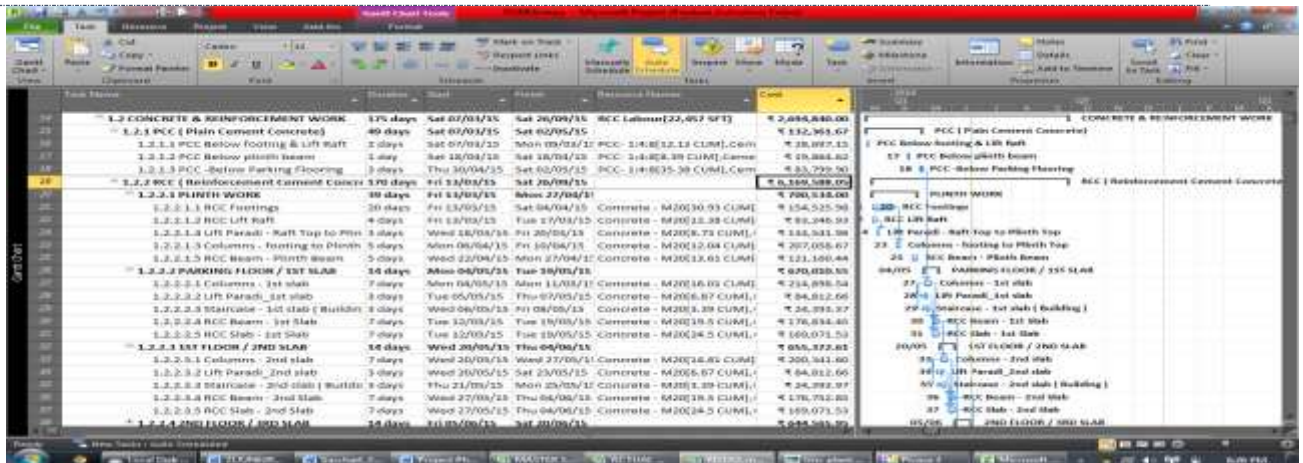*PHOTO NO7 –MSP SCREEN SHOWING RESOURCE USED FOR PARTICULAR ACTIVITY*

PHOTO NO 8 - MSP SCREEN SHOWING TOTAL PROJECT WORK WITH ACTIVITIES & THEIR RESOURCES & COST

Double clicking on the activity gives details of all the resources assigned to the activities which help to get information of the resources (equipment) needed for the activities for further planning and scheduling. After giving the details to the software about the resources, they are assigned to the activities in result of which software gives the proper information about which resources are needed for the particular activity and hence the cost of each activity is being estimated separately.

Therefore MSP gives a clear picture about the activities to be executed and the resources needed for the execution of the activity .Proper management can be done during project to avoid failure in achieving objective in given specified time. MSP can handle large and complex project and meet the demand of today's project. On future towers MSP was being used but not to its full capacity. MSP was used to plan and schedule the activities and organize accordingly but information about resources was not given to the software. Hence there was no information obtained about resources and cost needed for the execution of the activity.

So not getting the idea about the resources on the site resulted in

1) Improper planning, scheduling and organizing of Equipment resource for various activities.
2) Improper management of various capacity equipment at right work.
3) Improper management of funds.

CONCLUSION

In this paper we have reviewed different techniques for optimization. To minimize the construction cost and duration at each phase is important. It is a need to meet the present day requirements and to complete the project within the estimated time, cost, and available resources. Mainly affecting the factor on cost of project is delay in project and material. Several methods have been developed and applied to analyze the time-cost problems, but they can optimize only one parameter. Various low cost materials also suggested for optimizing the cost of project along with maintaining the quality and strength of the project. Also various mathematical method and software based models studied for optimization. It is essential for a construction industry to improve the production rate of equipment. In order to achieve this, the overall Equipment Effectiveness was improved with low machine breakdown, less idling and minor stops time, reduced accident in plants, increased the productivity rate, optimized process parameter, improved profits though cost saving method. Proper planning, selection, procurement, installation, operation, maintenance and equipment replacement policy plays important role in equipment management for successful completion of project.

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