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COMPARATIVE STUDY OF FAST TRACK CONSTRUCTION FOR KUMBHMELA-2015 PROJECTS AT NASHIK

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Abstract— An effective and well known technique for earlier completion of construction projects is to overlap the project activities or phases that normally would be performed in sequence. Fast track projects are those in which construction begins before all of the architect's drawings and specifications are complete. Also known as a Duration compression technique to shorten the project schedule usually to meet the target dates, phased construction, and the method is intended to save time by passing the traditional sequence of documentation, tendering and construction. Overlapping, also called fast-tracking technique of construction.

The paper explains the overlapping mechanism in detail, and same is applied plot hardening subproject of Kumbhmela-2015 Nashik. Amongst the various methods used for Fast tracking or Overlapping Microsoft project gives optimum duration.

Keywords — Construction planning, Fast Track construction, Construction management, Overlapping strategy, scheduling.

I. INTRODUCTION

Fast tracking is a duration compression technique to shorten the project schedule usually to meet the target dates. The idea of fast track construction was developed in 1960s. The concept of fast track construction can best be visualized in the comparisons of steel structure versus concrete structure for a multi storey building. Fast track construction is a scheduling technique in construction project management that may be associated with design build, construction manager adviser, and construction manager constructor. Fast track construction reduces the project time by overlapping the project design and construction phases. Fast track construction project may be successful if a building is completed on time, within budget, without accident and specified quality standards and owners satisfaction. Various time-cost tradeoffs have been extensively studied in the project management and construction management literature; however, limited research exists to address the activity overlapping time-cost tradeoff. The demand for these projects completion in a shorter duration has laid to various scheduling compression methods i.e. Line of Balance and in the software is MSP for the construction duration . In fast tracking activities normally done in sequence and perform in parallel it results is increase in and cost of project should be increased. A key requirement for the success of the fast-track method is the timely release of information to the construction group by the project designers. Studies in various Government construction sites the lack of knowledge of construction management and also not aware about the fast tracking methods, it causes the delay the projects, considering the five major factors and other sub factors for fast tracking the projects. A two part methodology can be used to gather information for the research methodology.

II. OVERLAPPING PRINCIPLES IN CRITICAL PATH METHOD

The concept of fast track construction can best be visualized in the comparisons of steel structure versus concrete structure for a multi storey building. Fast track construction is a scheduling technique in construction project management that may be associated with design build, construction manager adviser, and construction manager constructor.

The fig. 1 shows the strategy of overlapping done for the fast track construction projects and also shows the relationship shown between the two activities like start to start activities and start to finish activities. These relationships are very important to overlapping the construction projects.
The path has the longest duration is called the critical path and the activities that lie on the critical path are called critical activities.
To better understand the overlapping principle, the type of relationships between activities should be identified. Four types of relationships between design activities are possible (Fig2):
1. Dependent activities: in order to start, on e activity requires the final information from another activity.
2. Semi-independent activities: to start, one activity requires only portion information from other activities.
3. Independent activities: no information dependency exists between two activities.
4. Interdependent activities: a two way information exchange between the activities occurs until they are complete.

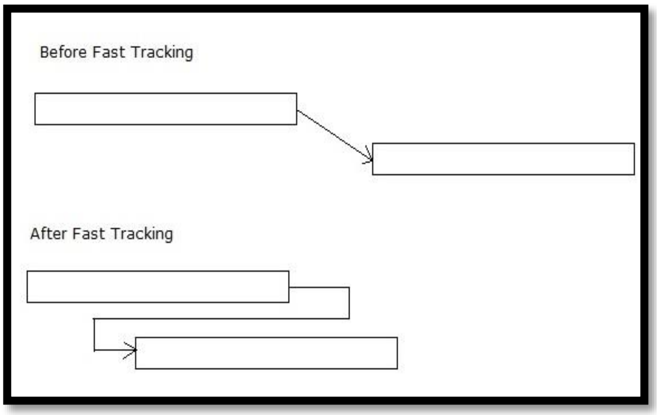

Fig-1: Strategy of overlapping

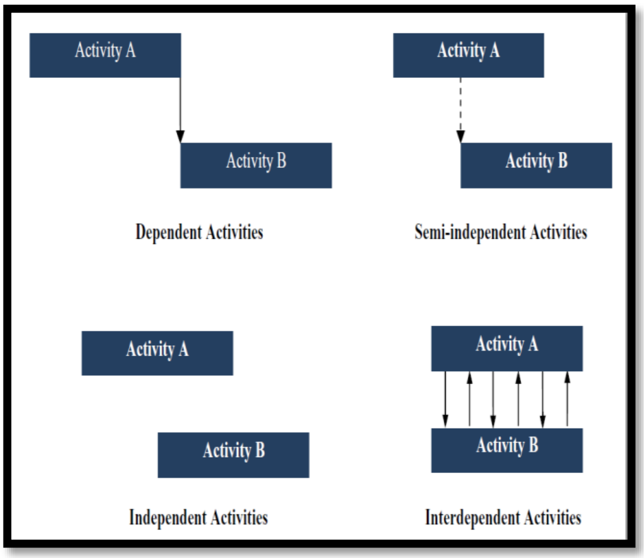

Fig-2: Four types of activity relationships

Fig 2 shows the mechanism of overlapping two dependent activities, in which the start of an activity depends on the finish of another activity and the second activity can only be started if the first activity is finished completely.

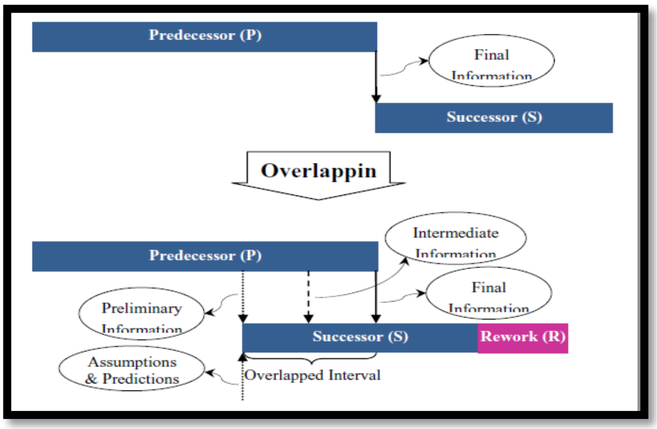

Fig-3: The mechanism of activity overlapping

The above fig. 3 shows the mechanism of overlapping for design and engineering activities in construction projects is different from that for other types of activities, such as procurement, construction, and commissioning. The main objective of this paper was to generate insights to better understand the mechanism of design activity overlapping. [4]
As mentioned earlier, this paper proposes a overlapping principle strategy based on Critical path method framework to quantify the dependencies among design activities. Figure 4 and figure 5 shows comparison between start to finish activities and overlapping activities.

III. LINE OF BALANCE SCHEDULING

The object of scheduling a repetitive process may be summarized as being to ensure that:
1. A programmed rate of completed units is met.
2. A constant rate of repetitive work is maintained.
3. Labor and plant move through the project in a continuous manner such that a balanced labor force is maintained and kept fully employed.
4. The cost benefits of repetitive working are achieved.
In order to meet these objectives, a network diagram for one of the many units to be produced is prepared as a first step. Then, the man hours necessary, as well as the optimum crew sizes are estimated for each activity. This information yields a natural rhythm for each activity (e.g., number of units/day) defined as the optimum rate of output that a crew of optimum size will be able to produce. Any rate of output that differs from a multiple of the natural rhythm is bound to yield some idle time for labor and equipment. That is why the number of crews necessary for the entire project is so arranged that the rate of output, a multiple of the natural rhythm, is as close to the target rate as possible. Once the number of crews, and the actual rate of output have been computed for each activity, the LOB diagram can be drawn. The number of units to be produced is plotted against time. Two oblique and parallel lines, whose slope is equal to the actual rate of output, will denote the start and finish times respectively of each activity in all the units, from the first to the last. An example of an activity that has duration of 0.5 days and a natural rhythm of 2 units of production per day is given in Fig. 1. In the first case only one crew of optimum size is used and an actual rate of production of 2 units per day is achieved. In the second case, two crews of optimum size are employed and an actual rate of production of 4 units per day is achieved. The vertical arrows show the movement of the crews from one unit to the next. There is no idle time for any of the crews in either of the cases. The actual rate of production is the slope of the line of balance joining the start times of the repetitive activity in each unit, and is calculated as

$$m = \frac{Qj - Qi}{tj - ti}$$

where m = rate of production (units of production per units of time);
Qi, Qj = number of units started (i and j) and
ti, tj = time elapsed between the start of the project and the start of the ith and jth units, respectively. The slope of the line of balance joining the finish times of the repetitive activity in each unit is also equal torn. If the duration of the activity is known and if the actual rate of output is limited to a multiple of the natural rhythm, then the foregoing equation is effectively reduced to

$$m = \frac{P}{d}$$

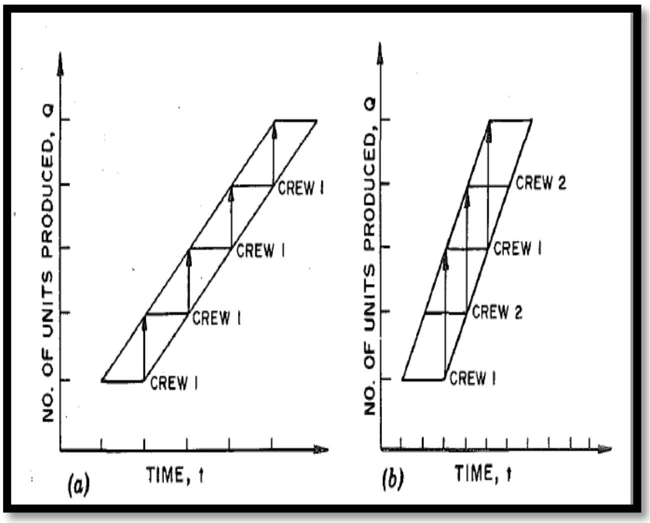

Fig 4. Line-Of-Balance Diagram for Activity (Activity Duration = 0.5 Days; Natural Rhythm = 2 Units/Day): (a) Number of Crews Used = 1; Actual Rate of Production = 2 Units/Day; (b) Number of Crews Used = 2; Actual Rate of Production= 4 Units/Day

where p = number of crews used in the activity; and
d = duration of the activity in one unit. The time ordinate t of the start of an activity is calculated by the following relationship:

$$ti = t1 + \frac{1}{m}(Qi - 1)$$

where ti = time ordinate of start of activity in ith unit
t1 - time ordinate of start of activity in first unit
m = rate of production
Qi = number of units produced, i. The value of tx, the start time of the activity in the first unit can be obtained from the time calculation performed for the unit network. The finish time of the activity in the ith unit can be calculated by adding the duration of the activity (d) to its start time on unit i (ti).

IV. DATA ANALYSIS

In Kumbhmela projects so many repetitive works occurring in these projects. For example analysis of projects with the help of one ongoing project from the Kumbhmela project i.e. Plot hardening is

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the work form Kumbhmela works. In the Plot hardening seven times repetitive works, these works are analyzed by CPM, LOB and MSP for duration of plot hardening activities.
Table no 1 indicates Duration and number of Gangs of which duration is estimated empirically by standard formulae from IS 7272 part II. The number of gangs as per the general requirement based on skill. Overall table shows the co-relation of duration and number of gang with respect to particular activity.

Table 1. Activity name, duration, No of gangs used in the plot hardening

Sr. No.	Activity Name	160 Acers	
		Duration	No of Gangs
1	Dressing & cleaning	9	2
2	Cutting down trees	3	2
3	Excavation for road way	6	2
4	Conveying material	11	4
5	Compaction	14	3
6	Shifting unwanted excess	11	3
7	Supply & spreading hard murum	44	10
8	Compacting sub base	35	10
9	Supply & spreading 12/10 mm	31	10
10	Providing 7 fixing indicator stone	7	4
11	Replantation	5	3

V. RESULTS AND DISCUSSIONS

1. Line of balance method based on the no of gangs and duration, the manual analysis shows duration is 288 Days for completing the whole project which duration is more than the CPM as well as MSP.
2. The Critical path method is based on the activity oriented and manual analysis shows the duration is 268 Days for completion the whole project which is more than the MSP and less than LOB. CPM gives results better than LOB.
3. MSP is based on the computer based programming network which at the end gives the most efficient results as compared to other methods the duration is 176 Days

Table 2. Total Duration of Plot hardening

Name of Project	Line of Balance	Critical Path Method	Microsoft Project
	160 Acre	160 Acre	160 Acre
Plot hardening	288 Day	268 Day	176 Day

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VI. CONCLUSION

Analysis of Kumbhmela projects-2015 at Nashik specifically selected of 'Plot hardening' are summarized based on the study.

1. Fast tracking is a duration compression technique to shorten the project schedule usually to meet the target dates. It generally takes place more quickly than normal.
2. Above results conclude MSP gives the most effective and better results for same project. Also as it is software based making less tedious as calculations are avoided. Spot or actual changes which cannot be predicted earlier and could affect the duration adversely as MSP being the software based making it easy convenient to redefine the duration as per changes.
3. CPM and LOB are the traditional methods based on manual analysis; hence comparatively time consuming as compare to MSP. Also duration by CPM and LOB is found to be more than MSP.

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