

Impact of Schedule Compression Techniques on Residential Building using MSP

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ABSTRACT

Schedule compression also familiar as project acceleration whenever need to complete the project in a stipulated time period on client or sponsor's request, or rushing to catch the deadline, the schedule compression techniques is there to help us. There are many ways to compress the schedule to expertise the work, out of which some common techniques are fast tracking and crashing. There are other such techniques which can be used to compress the schedule, such as cut the product quality or reduce the scope to save time. But that can increase the project risk as well as chances of high customer dissatisfaction. This current study deals with "The impact of schedule compression techniques on residential building using Microsoft Project software 2010". Network analysis is done by using critical path method and also it includes how to deal with client request for project acceleration using crashing and fast tracking techniques with the usage of residential building data using Microsoft Project 2010.

KEYWORDS: Time management, client demand, critical path method, schedule compression techniques, crashing and fast tracking, Microsoft Project 2010

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I. INTRODUCTION

A common nightmare for the project managers across the industries is to keep the schedule on track. But most often, for various reasons the schedule goes hay-way. It can be an unrealistic schedule planning which often happens in today's competitive market, or due to any unforeseen incidents or in-case of any force majeure. For instance, if project schedule gets out of hand, the managers for the respective projects will have to run the pillar to post to bring the project on track. But, that is not the same case always, it is also observed that the sometimes due to the client or sponsors request (pressure), the project managers have to complete the project before the planned scheduled date. Those are the testing times for the project managers when they have to complete the remaining work in a shorter time period. It is obvious that they have to work hard on multiple aspects of project management. They not only look for the ways to complete the project in a shorter duration but have to be vigilant enough to safeguard the project from any risk and quality issues. And it is also seen that the team morale often goes down in such situations. So

resource management including the people management is also an important facet which the managers have to care of. There are many ways to deal with those crucial situations, among them one of the proven technique which managers across the industries apply a technique to compress the project schedule which is called the schedule compression technique.

II. AIM

Detailed study is carried out how schedule compression techniques are beneficial to the construction industry. It also aims at how these schedule compression techniques can be used to compress the project schedule and their limitations of usage and how come these limitations can be overcome with usage of Microsoft Project software 2010.

III. OBJECTIVES

The primary objective of the study is to reduce the duration of construction project as per client request so this current study deals with following objectives by assuming manpower as extra resources,

1. To study the effect of fast-tracking and crashing technique on total duration of construction project.
2. To study the effect of fast-tracking and crashing technique on total cost of the construction project.
3. To suggest the beneficial schedule compression technique and recommendations as per client demand.

IV. MICROSOFT PROJECT

Still Microsoft project is one of the most commonly used project management software or project management tool. Generally, when we are working with these tools we must be aware of these advantages and disadvantages. The following are the advantages and disadvantages of Microsoft project 2010 they are,

Advantages:

1. ***This MS project has maturity:*** It is found that Microsoft Project 2010 as very mature project management tool which was first released in 1984 and from then till now nearly next 26 years there will drastic increase in number of project managers adopting this tool with added a lot of features that are found vital for managing projects
2. ***The support and reliability of MS Project:*** When compared to the other project management tools available in the market Microsoft project is developed by the most respected and reputable company in all over the world. Additionally, the third party support and training services for this project has spurred the growth.
3. ***Easy integration:*** This software offers integration with other Microsoft products that are heavily popular they are Microsoft word, Microsoft excel and Microsoft outlook.
4. ***MS Project is desktop application:*** In other words, this means it can be worked without any internet or internet is not required for project managers to work.

Disadvantages:

1. ***There is no option for collaboration:*** The one of the major drawback of Microsoft project is there is no communication between the project team but communication plays a major role in project management since it is a desktop application there will be complete absence of real collaboration which makes this as outdated for project managers since today's world is connected by social network.
2. ***Steep learning curve:*** To use this software effectively it requires training and experience about how tools will work. It will also add to the

disadvantage list because people who are lack in technical knowledge may face hard and long time to learn Microsoft project.

3. ***This software is generic focus:*** Which means the usage of this software is not focussed to particular industry.
4. ***Desktop application:*** This which was mentioned above that this software can be used without internet but this is an disadvantage because usually the project data file will be saved locally which may increase the project managers responsibility of keeping an eye on the file which forces him to backing up file.
5. ***Compatibility issues:*** These Microsoft project files does not run in other pc unless it is installed with MS Project software which means it is saved in proprietary format and there is an alternative for this that is to send in pdf or image file but it will be risky to send the real project plan details.

V. LITERATURE REVIEW

Chowdeswari, D. Satish Chandra, SS. Asadi [1]: made study on optimal planning and scheduling of high rise buildings. The main aim of this study was application of Microsoft project in very single aspect of a construction project from starting planning phase to the scheduling phase. This study provides how to do planning and scheduling for a G+8 multi storied building with Microsoft project software by observing the labour productivity, site conditions and available of resources with effective utilization of both time and resources

Kiruthiga Lakshmi Narayanaswamy [2] : made study on construction technologies for effective project schedule in high rise construction- a review. They stated that the methods and techniques using from few decades are not able to achieve the completion date of project on time and one of the major problems in high rise construction is project delay which means they are behind schedule which results in overrun of cost. They suggested various factors that contribute to the delay in construction projects like design finalization (approval of drawings), contract sign off, procurement, execution and also handing over. They concluded that today there are endless possibilities in any industry because of the advancements in technology and hence the advanced construction techniques in construction field which helps in effective completion of project schedule and completion of project without delay and also can reduce the construction time which is off top priority in high rise building constructions and also give quality, safety and which are economic (cost effective). They also concluded that Project delays

can be minimised by performing schedule compression through use of advanced technologies.

Mr. Harish Appasaheb Arekar, Prof. S.B. Patil [3]: made study on cost and time optimisation by using MSP & CPM for the economical use of manpower and equipment's in the construction of residential buildings. Normally cost optimization is done with the usage of different schedule compression methods. But in this growing construction industry the equipment use is limited for excavation, due to use of large manpower both the time and cost of the project gets increased. Since there is large scope to use of equipment's in construction area other than excavation. The outcome of this current study was to reduce the total schedule of the project as well as cost of the project. Hence, they suggested proper utilization and combination of equipment's and manpower can reduce both cost and time of the project. This study represents the sources of critical factors in construction project which affect the project success.

S. Ragavi, Dr. R.N. Uma [4]: made study on review of project management software's – MS Project and Primavera. Planning of high rise construction requires huge amount of paperwork, which can be reduced or minimised with the use of Primavera and MS project software's. these modern project management tool can beat or overcome the obstacles that are arising from conventional way of planning and organisation. In this current study, they made a comparative study between the Primavera and MSP software's to know the efficiency of each software. The entire study concludes us project scheduling done using Microsoft project software gives good controlling and clear schedule and Primavera software provides user friendly options while performing any task in multiple projects. Hence with the use of primavera software the cost of individual work break down can be known along with its duration. Primavera software gives better results for resource levelling in multiple projects.

P M Wale, N D. Jain, N R Godhani, S R Beniwal, A A Mir [5]: made study on planning and scheduling of project using Microsoft project (case study of a building in India). This study presents that by using Microsoft project management software it will easier to overcome the obstacles and which normally faced during traditional way of planning and it also helps for effective and optimum organisation of activities which gives complete vision to complete the project within the duration and economically. This study also gave information about the disadvantage and complexity of using traditional construction process for building construction and also stressed that the

traditional process of building construction creates lot of hurdles in various aspects such as improper judgement of resources for particular activity, allocation of resources etc

R. Vidhyasri, R. Sivagamasundari [6]: made study on factors influencing construction project scheduling. This study presents various attributes and factors by which construction project scheduling is influenced. According to this study weather climate, resources availability, clearance approval, government regulations, planning monitoring & control system seems to be top most factors and factors such as safety, price escalation and profitability time and cost overruns seem to be least factor. The researchers have made a remarkable contribution towards identification and assessment of critical scheduling factors. Unfortunately, in India still there is a gap between theory and practice observed by researchers. This study recommends, framework to be designed for quantifying the factors considering the uncertainties, the pivotal identification of the scheduling factors is needed. Simple statistical model for factors assessment in construction projects considering small and medium sized projects is necessary. Finally, suitable recommendations are to be suggested for risk mitigation during the life cycle of projects and make it successful.

Vishal Annappa Nimbale, Prof. Balasaheb Jamadar [7]: made study on Planning, scheduling and allocation of resources for multi-storied structure using Oracles Primavera P6 software. The main aim of this study was to know the role of project phases that is planning, scheduling, monitoring and controlling the progress of project by using primavera management software by carrying case study on Gulmohar residential apartment building. The end results of this case study is vitality of efficient planning, scheduling, monitoring and controlling and essential need and influence of the primavera p6 project management software.

VI. THE CRITICAL PATH

To identify the interrelationships between tasks that make up complex process network analysis can be helpful in following ways,

1. Which makes most appropriate moment for execution
2. Which helps in preparing project programming and programs which describe the sequence in which the various tasks must be carried out so which enables to complete the project on time.
3. Which helps to identify the critical path.

In a project a typical network which represents a set of different diagrams called as arrow diagrams which usually go from the origin node to the destination node. In the same way or in the same meaning or sense the path is known as sequence of connect events which usually flow from the start of a project to its end. The time which is necessary to cover any of these paths is the sum of the time of all activities involved in that path.

As we know in a project the route represents the project bottleneck is critical path and which requires longest period of progress time from start to the end of the project and also critical path indicates the minimum or short duration of timeframe which is necessary to complete the whole project and we can only reduce the project execution time by reducing the activity durations or paths involved in a project then only the project execution time can be shortened and it may be possible and we must note that the project duration cannot be reduced or remains unchanged even if we reduce the durations of non-critical activities and decreasing the critical activities may result in other critical path or may reduce the project time frame.

VII. EARNED VALUE

To access or to determine the progress of project it can be done by comparing the present amount of work and present cost of worked done to the actually planned before means what it has actually cost and earned value is the analysis which is used to determine this which gives a good indication that how the project is taking place when to the actually which was planned earlier and it helps to enable forecasts can be performed eventually to determine the time and cost that is required to complete the a project. This earned value analysis is carried out for each work packages that makes up the project. The present or actual outputs is measured against the planned output generally for every week or month or it may be often on a daily basis and work can be measured using the same units, price which individual company used which provides an opportunity to identify the mistakes risks and to take required remedial measures so that the construction project can be avoided by the impact of such risks in the earlier stages itself.

It also provides an insight accurately for the package contractors financial wellbeing. This also provides warning in the early stage itself for inefficient use of resources or of a shortage of resources or sometimes over locating of resources. There is also a key measure to calculate the actual resources quantity against the planned resource quantity using production units through which estimates have been produced in order to tender or price and it can be of

following below usually which is done per week but in critical situation per day is calculated.

1. The number of working hours or hours worked per week or day.
2. The number of employees or workers working in each day or per week.
3. The number of units fixed per week per person or per day per person.
4. Quantity of concrete or volume of concrete per week per person.

These above items or still there are more which can be updated or plotted weekly to alert the user to trends which allow them to investigate various causes. Further it provides a general picture of labour productivity for each operation monitored.

To carry out this type of analysis it requires packages or project planning can be broken down into packages, so that work will be simpler or easier.

VIII. METHODS

A. Fast track construction

One of the scheduling technique that can be used to reduce the overall duration or completion time of a project by conducting the tasks to occur simultaneously or parallelly but in the traditional contract this type of overlapping of tasks cannot be done and should be waited till the previous tasks completed. Generally, fast track construction is suited for,

1. Building types with repetitive elements
2. It is suited when straight forward construction processes involved.

Requirements

1. It requires coordination flexibility and cooperation in the project team.
2. The team which is responsible for project should be experienced in these fast track technique and which is helpful in determining and anticipating the risks that may arise from the project when it is developed.

Various risks that arise when fast-tracking is applied to construction project schedule

1. Since, in fast-tracking same number of team is going to perform when the schedule is condensed into a shorter period of time and therefore it likely requires more number of resources when compared to previously decided.
2. We know that in schedule compression usually tasks or activities occur earlier and hence costs of purchasing may be expensive or higher due to pressure of time or time pressure.

3. In addition to above the complexity of managing the interfaces between the elements and in complete information will be higher and there will be a greater number of variations when compared usual.
4. With the increase in extent of overlapping tasks and since the number of tasks or activities performed at the same time the risk also increases
5. When this type of decisions taken, the client will not be knowing exactly how much extra cost will be needed to proceed this action

B. Project crashing

The main aim of crashing is to reduce the duration of project to maximum extent with the minimum additional cost and the necessity for this crashing can be because of following reasons

1. Inaccurate programme planning.
2. Request from the client to complete a section of project or whole project than earlier planned.

The method of crashing can be achieved by various means such as increasing the working hours of employees, providing additional supervision, decreasing the scope of work, decreasing the quality of work, increasing resource quantity. The main risk associated with crashing is explained below

1. Before starting this type of technique one must be clear that the additional expenses caused from these techniques whether it is beared by client or contractor.
2. The other important risk when we are increasing the resource quantity may be additional resources may not be productive as we expected.
3. The project crashing is good or effective to certain extent but when the limits are crossed it must be restricted so what are such issues.
4. When additional crashing is longer effective to the project.
5. When it threatens integrity of the various works.
6. When the time reduction is no longer achievable or which is difficult to achieve.
7. When another path becomes critical.

IX. RESOURCE LEVELLING

As the speed of the construction activity increases it typically suggests that certain activities must be performed simultaneously that is during fast-tracking and crashing but generally in fast tracking when overlapping of tasks occur the same resources must perform in those tasks due to which an error in the

resource allocation is found. So, resource levelling can be used to analyze or determine the amount of large variations that occurring in the resource usage and in few situations, there will be necessity to use both resource levelling and resource smoothing.

Resource levelling can be used to find out when the project will complete with the present available resources and resource smoothing can be used to determine how best the works can be completed within the required deadline. commonly project managers use this type of resource levelling for critical path analysis, project crashing and fast-tracking.

X. RESULTS AND DISCUSSIONS

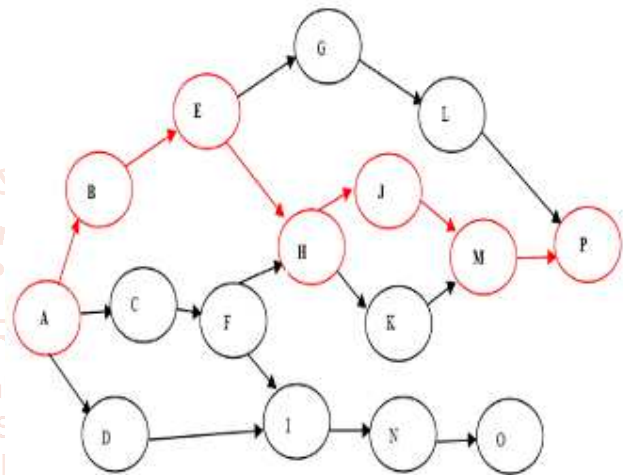


Fig. 1 Shows the project network of 761 day’s duration for which both fast-tracking crashing is performed after the client request.

Table 1 Shows the details of above Fig. 1

Activity id	Activity type	Activity name	Duration	Predecessor
119		Finishing works	450 days	
120	A	Block work	100 days	119
121	C	Pipes and conduits and fixing of window railings	40 days	121
122	F	Roof treatment and water tank	40 days	122
123	B	Internal plastering	56 days	121
124	E	External plastering	50 days	124
125	D	Internal plumbing	200 days	121
126	H	Preliminary painting works	14 days	123,125
127	L	Electrification (main)	50 days	125
128	I	External plumbing	40 days	126
129	N	External painting works	14 days	129
130	O	External fixtures and marketing	30 days	130
131	K	Internal painting	50 days	127
132	J	Flooring	140 days	127
133	L	Electric socket fixing	50 days	128
134	M	Fixing of doors and windows	60 days	133,132
135	P	Internal fixtures	30days	135,134,132

Table 2 Shows the details of project duration with 761 and 743 days respectively.

Project duration 761 days			Project duration 743 days		
Before fast-tracking			After fast-tracking		
Activity id	Duration	Total slack	Activity id	Duration	Total slack
121	100 days	0 days	121	100 days	0 days
122	40 days	26 days	122	40 days	115 days
123	40 days	26 days	123	40 days	115 days
124	56 days	0 days	124	56 days	0 days
125	50 days	0 days	125	50 days	0 days
126	200 days	66 days	126	200 days	48 days
127	14 days	0 days	127	14 days	0 days
128	50 days	114 days	128	50 days	82 days
129	40 days	66 days	129	40 days	48 days
130	14 days	66 days	130	14 days	48 days
131	30 days	66 days	131	30 days	48 days
132	50 days	90 days	132	50 days	102 days
133	140 days	0 days	133	140 days	0 days
134	50 days	114 days	134	50 days	82 days
135	60 days	0 days	135	60 days	72 days
136	30 days	0 days	136	30 days	0 days

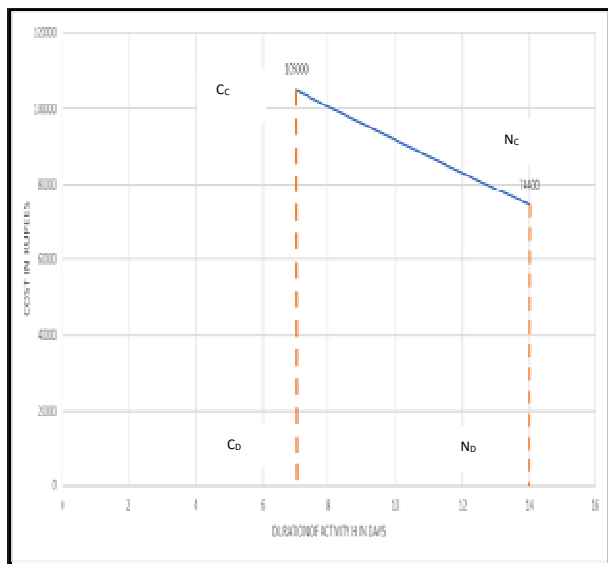


Fig. 2 Shows the time cost graph for activity H which is plotted to determine crash time and crash cost assuming time cost relationship to be linear.

From the above graph shown in Fig. 6.18

1. Normal duration (N_D) of activity H = 14 days.
2. Normal cost (N_C) of activity H = 74400 rupees.
3. Crash duration (C_D) for activity H is determined as = 7 days.
4. Crash cost (C_C) for activity H is determined as = 105000 rupees.
5. Maximum reduction time = $N_D - C_D = 14 - 7 = 7$ days
6. Crash cost per day is determined by $= (C_C - N_C) / (N_D - C_D) = (105000 - 74400) / (14 - 7) = 4371.42$ rupees.

Table 3 Shows the results for each activity after performing time cost trade off analysis.

Sl No	Activity name	Normal duration	Normal cost (Rs)	Crash duration	Crash cost (Rs)	Maximum reduction of time	Crash cost (Rs) per day
1	A	100	970050	50	1400000	50	8599
2	B	56	595200	28	890000	28	10528.57
3	C	40	643600	20	950000	20	15320
4	D	200	1203600	100	1840000	100	6364
5	E	50	524900	25	790000	25	10604
6	F	40	522100	20	830000	20	15395
7	G	50	683600	25	1100000	25	22944
8	H	14	74400	7	105000	7	4371.42
9	I	40	243600	20	360000	20	5820
10	J	140	1851600	70	2780000	70	13856
11	K	50	293600	25	430000	25	5456
12	L	50	683600	25	1030000	25	13262.85
13	M	60	567000	30	840000	30	9080
14	N	14	104400	7	180000	7	10800
15	O	30	563100	15	840000	15	18460
16	P	30	149100	15	240000	15	6060
Total		450	9674050		13615000		

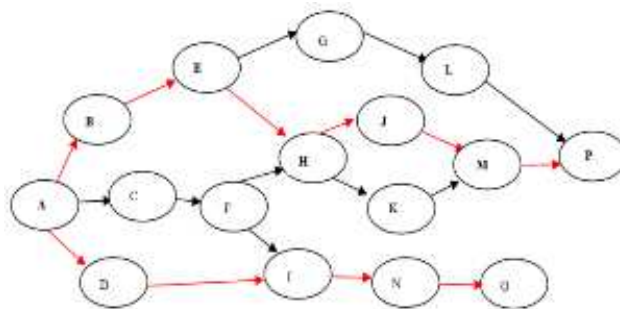


Fig. 4 Shows the network with two critical paths after crashing activity B and E which is indicated by red colour.

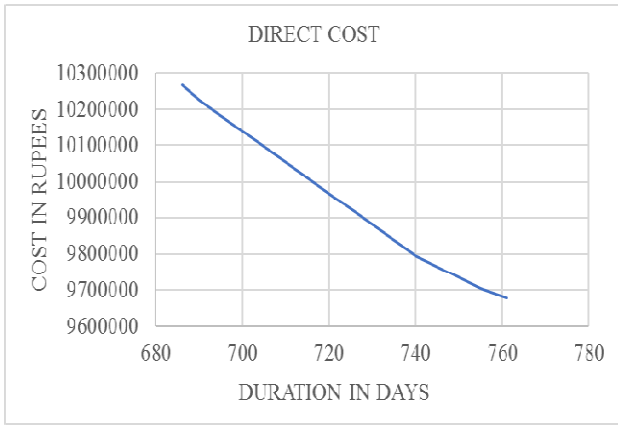


Fig. 5 Shows the direct cost values goes increasing with decrease in project duration.

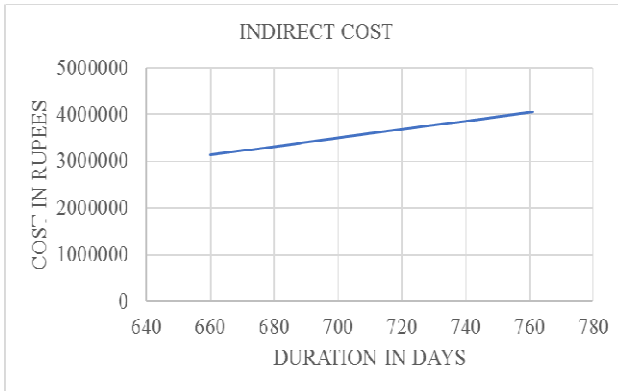


Fig. 6 Shows the indirect costs decreases with decrease in project schedule.

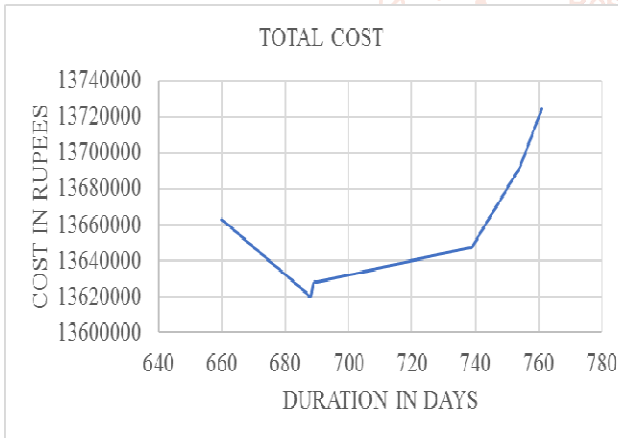


Fig. 7 Shows the schedule to which project can be reduced with minimum cost.

A. CONCLUSION

Table 1 Shows the summary of results for fast-tracking.

Before fast-tracking		After fast-tracking			
Original duration of project in days	Overall budget of labours for finishing works in rupees	Duration reduced of project in days	Total number of days reduced	Total Indirect cost reduced in rupees or saved	Overall budget of labours for finishing works in rupees
761	9674050.00	743	18	162000	9674050.00

Table 2 Shows the summary of results for crashing.

Before crashing		After crashing			
Original duration of project in days	Overall budget of labours for finishing works in rupees	Reduced Duration of project in days	Total number of days reduced	Total Indirect cost reduced in rupees or saved	Overall budget of labours for finishing works in rupees
761	9674050.00	688	73	657000	10236028.51

B. RECOMMENDATIONS

1. The risk associated with fast track construction is higher and hence the fast track construction should be considered only by experienced clients and experienced project teams.
2. Even if a single element goes wrong there will be a chance of misunderstandings within the team members and also anytime that might may cause to lose the savings.
3. Early appointment of the contractors, necessary team members, labours or employees, resources etc. is very important when these types of decisions taken.
4. It should only be attempted when risk are fully understood and when there is strong justification.
5. Before execution of crashing technique it is recommended and it is responsibility of respective person to clear that whether the additional costs are bared by client or not.
6. Finally, human beings are the ones who operate behind the system hence they should be well experienced knowledgeable and they must be aware of tools of software very well so that manual errors can be avoided.

XI. APPLICATION OF THE PRESENT STUDY

1. This type of approach can be projected to similar construction projects of same size.
2. Whenever project is found to be behind schedule or they are facing delay due to various risks or uncertainties during such situations these techniques can be used as one of solution to overcome such delay and uncertainties.

XII. FUTURE SCOPE OF THE PRESENT STUDY

The present study was carried out on crashing and fast-tracking concepts assuming labours or employees as extra resources using Microsoft Project 2010. In future, there is a scope for the present study which also can be performed with the use of equipment's, machinery or with the use of recent advanced

construction technologies by using advanced project management software.

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