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A STUDY ON FACTORS AFFECTING THE CONSTRUCTION PROJECTS SCHEDULING

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ABSTRACT

Scheduling is very important in construction industry for reducing and controlling the delay of the project. However, most of the construction projects delays in India were characterized by schedule overrun (Time). With this growing volume, the schedule overrun of the Indian construction projects is certainly a significant topic for investigation. In spite of that, the initial planning of construction schedule is often revised due to many critical activities. This study conducts an attempt to identify the critical activities responsible for schedule overrun. Data was collected through Secondary data method such as scheduling of the project and project information to assess the extent of schedule overruns. The result of the study revealed the main critical activities causing schedule overrun such as (i) pump and motor fixing design, (ii) pollution control approval, (iii) Filling for basement with quarry dust, (iv)PCC, (v) Staircase shuttering, (vi) Concreting for flooring, (vii) Lift wall shuttering, (viii) Wall shuttering and concreting, (ix) Excavation for sump, (x) Parapet wall masonry, (xi) Water proofing, (xii) supply and fixing of doors and windows, (xiii) Ground water (bore wells) and also presented a possible suggestions to get the optimum result to avoid rescheduling and to complete the project within planned duration.

Keywords: Critical activities, Delay, Duration of projects, Rescheduling, Scheduling, Schedule Overrun,.

I. INTRODUCTION

Construction industry contributes towards 40 to 50 % of India's capital expenditure on projects in various sectors such as Highways, Railways, and Buildings etc. Construction industry is the second largest industry in India and it is the main motivating force in Indian national economy (Mulla et al 2015). One of the major problems facing by the construction industry is schedule overrun. In India, most of the projects were ended with extra involvement of time, money and resources. It is a rare scene in construction industry, that a project is completed within planned duration. Construction schedule overrun are widespread in most projects all over the world. Some overrun may happen in the preconstruction phase which is defined as the period beginning of the project to signing of the contract between the owner and contractor. However, some of them may happen in the construction phase or when construction is under way. Nowadays the planned duration is one of the main criteria when judging whether a construction project is failure or not.

The main reason behind is, most of them treats task duration as deterministic but in reality the task duration are subject to considerable uncertainty and it is influenced by many critical activities. Hence, those critical activities are main reason for the time overrun of individual activity. The overrun of critical activity will extend the overall duration of the project. As consequences the time will stretch, cost will increase and similarly the quality of the project will degrade. The ability to anticipate such problem is very important because the problem can be controlled or even corrected to get the project back on track. The main objective of this paper to identify which phase of the projects where getting affected in construction project scheduling. Later study would suggest to framework the rescheduling methods of the project.

II. BACKGROUND OF THIS STUDY

Many researchers have done research on causes of delay and the identification of factors responsible for that delay in the construction projects. Such literatures were collected from the various sources such as construction management books, journals, articles, web sources etc. The relevant research was studied in detail and reviewed for identify the reasons for rescheduling in the projects. The following topic defines the various issue occurred in scheduling and causes for rescheduling and the factors that affect the planned duration and uses of its application in construction industry. Every individual paper has given the intense information about the schedule overrun of the projects in construction industry.

Chester and Hendrickson**, (2005)** stated that construction mismanagement results in multiple problems that can cascade throughout the work force chain, affecting the schedule and leading to damages to multiple parties. A case study is presented with seven different mismanagement scenarios. A description of each scenario is provided as well as a quantification of the damages that result from the problem and a construction claims section is also included that addresses many of the issues that could result from a claim for each of the seven scenarios.

Dayi, **(2010)** made an analysis to identify the impacts of construction delays on project completion duration and to allocate responsibility among the project participants for such delays. The "Time Impact Analysis Method" (TIA) was applied to the case study project using PRIMAVERA software. It was observed that the delays in the critical activities extended the project duration by 57 days in total i.e. by 15.4 % of the estimated construction period. These delays were caused due to organizational deficiencies of the owner, the bureaucracy of the provincial municipality, the lack of detailed drawings during the municipality application, the lack of experience of the contractor, problems in material procurement; unforeseeable weather conditions and shortages of qualified employees of the subcontractors and finally some recommendations are presented to minimize the construction delays.

Marzouk and Rasas, **(2012)** stated that the causes of construction delays in Egypt project by questionnaire survey and was distributed to owners, consultants, and contractor's of the organizations. Based on response the following Frequency Index, Severity Index, Importance Index and top ten delay causes of construction projects in Egypt are determined. A case study is analyzed and the test results reveal that the most important delay causes are grouped into seven groups such as owner, consultant, contractor, material, labour, equipment, project,

external and it is prioritized according to very high, high, medium, low and very low. And finally some recommendations have been made to minimize the delay.

Sweis, **(2013)** conducted a research to identify major factors for such overruns in the typical developing environment of Jordan. The top ten factors causing time overruns in construction projects were identified and treated using Principal Component and Factor Analysis (PCFA). After conducting the analysis on both the secondary and primary data, results showed agreement only on one cause, weather conditions.

Indhu and Ajai, **(2014**) stated that the delay factors and the effect of factors on the project completion by a case study. The planned and actual schedule was collected from the site office and to calculate the delay period of each activity. The test result reveals that the most important causes were delays in contractor's payments, shortage of material in construction, change in material, the weather condition, shortage of manpower (skilled, semi-skilled and unskilled labour), frequent change of staffs, poor site management and improper management of the engineers, submission of drawings, space constraints, and delay in payment by client, delay in material supply and local problems like strikes. The major effects of delay are cost impact, reduced labour productivity, postponement in work, change in labour allocation etc. And finally recommend the suggestions to minimize the delay.

Lishitha and Subramani, **(2014)** stated that to optimally allocate the resources among individual tasks, Resource tracking, Minimize the time over run and Cost Effectiveness in a case study project by using Primavera project planner enterprise. The results reveals that general re sequencing model had been proposed to overcome the delay factor from the critical area, changes in drawings, shortage of skilled labours, conflict between participants etc. And finally compares the cost variation due to the delay of the project.

Mulla and Wagmare, **(2015)** stated that the factors responsible for time and cost overruns of the construction project and suggest the suitable remedial solutions through case study and questionnaires. The result reveals that poor planning, implementation and management are the main reasons for time and cost overruns in the case study project.

Wale *et al*, **(2015)** observed that the difference between the Microsoft Project (MSP) and the Traditional Planning Techniques which speeds up Construction and also make the Project Cost Effective with Proper Planning with the help of the case study. Data collected in two part viz. Primary data and secondary. The Result reveals that efficient planning & proper execution of the project, disparate Methodologies is the remedial measures for the problem.

Bhatia and Apte, **(2016)** stated that the factors and reasons causing project schedule and cost overruns, in Pune Province of India by comparing the planned and achieved schedule and cost of the project. The actual and planned schedule of the project was compared to find the factors. The results revealed the main factors and reasons causing schedule and cost overruns in construction of residential projects are Delays in decision making; Poorly performed time estimation of the project tasks and activities; Unforeseen circumstances; Internal conflicts within the project team; Poor work organization and planning; inaccuracy of cost estimates; changes in scope, design, drawings

Multashi and Salgude**, (2016)** stated that the main reasons for the delay of Alkut Olympic stadium in Waist state in Iraq as well as the effect of the delay. By delay analysis, the planned and achieved schedule was compare to

get the reasons for the delay of the project. The reasons are changes in the design of foundation, cancelling of some important activities to decrease the construction cost, poor decision making from the client side.

The following can be concluded from the results published in the reviewed literature: Researchers found the causes for the delay, types of delay and their impact of delay in overall project duration and the responsibility of the participants of the projects to avoid the delay. The methods like MS project, Primavera, Time impact analysis method, ANOVA, and various schedule delay analysis are mostly adopted to found the construction schedule overrun. Most of the researchers were found that overall project duration increases due to the time overrun of every single activity of the projects. The most of the researchers recommended some suggestions to minimize the schedule overrun like avoid rescheduling, complete the project in planned duration, within the budget, quality and economical by both owner and contractors.

III. METHODOLOGY

The research methodology of this study was done based on case studies. There were around 30 projects was considered to identify the most critical milestones and activity prolonging to schedule overrun in the project. However the data collected only for building projects in which the limitations of projects were only small construction projects (cost of the project lies between 1-200 crores, activities of the projects should be less than 100, duration of the project lies between 1- 10 years) considered. Samples (secondary data) were collected from the esteemed organization such as Construction Company, Project Management Company, etc. Sample Collection contains collection of project information and scheduling of the project for particular project. Initially scheduling of the project (either in MS project/ Primavera), projects information and other necessary data that used to carry out this study was collected. The secondary data was collected and generate necessary inputs from MS project and Primavera to find the schedule overrun of individual activity by comparing the planned and achieved schedule for 30 projects. There were 224 activities in overall 30 projects. Among that each project has different numbers of activity. Data were compiled to develop the milestones of each project. There are about 12 milestones fixed to compile the activities for 30 projects. The lists of milestones are 1. Preconstruction Phase has 15 activities, 2. Approval has 19 activities, 3. Site Preparation holds 21 activities, 4. Sub Structure consists of 27 activities, 5. Super Structure has sub divided in to two sub milestone (i) Formwork and Reinforcement has comprise 18 activities, (ii) Concreting has 24 activities, 6. Lift works has 5 activities, 7. Retaining Wall works has 10 activities, 8. Sump/ Septic tank works contains 14 activities, 9. Brick works has 13 activities, 16. Finishing works comprise 27 activities, 11. Service works has 19 activities, 12. Other Miscellaneous works consists of 12 activities. The frequency analysis was used to identify the critical milestones and activity with the help of MS Excel application. As outcome of this data collection indicate the delay percentage for critical activity and milestone and its effect in project planned duration of the projects.

IV. RESULTS AND DISCUSSION

4.1. Project Parameters (Information) of Case Studies

The project parameters details of all projects are shown in TABLE 1. It is found that 30% of the projects were Residential Buildings, 27% of the projects were Office buildings, 20% were Commercial buildings, 17% were

Hospital buildings, 7% were Institutional Buildings in different states like Pudhucherry, Chennai, Coimbatore, Bangalore, Karnataka, Visagapatinam. It was found that 50% of projects are in between 1 – 20 months, 24% of projects are in between 21 – 40 months, 17% of projects are in between 41 – 60 months, 7% of projects are in between 61 – 80 months, 3% of projects are in between 81 – 100 months. On the whole 23 % of projects come under 51 to 150 Cr, 67% of projects come under 1 to 50 Cr, and 10% of projects come under 1 Cr are also shown in TABLE1.

Table 1 Project information of case studies

TYPE OF THE PROJECT	**PERCENT**
Office Building	27
Residential Building	30
Commercial Building	20
Institutional Building	7
Hospital Building	17
PROJECT DURATION	**PERCENT**
1 to 20 Months	50
21 to 40 Months	24
40 to 60 Months	17
61 to 80 Months	7
81 to 100 Months	3
PROJECT BUDGET	**PERCENT**
51 to 150 Cr	23
1 to 50 Cr	67
Less than 1 Cr	10
LOCATION	**PERCENT**
Pudhucherry	13
Chennai	43
Coimbatore	7
Bangalore	12
Visagapatinam	12
Karnataka	10

4.2. Occurrence of Activity Delay

From the case study of 30 projects, the schedule overrun of each activity was identified by comparing planned and achieved schedule of all projects. There are 224 different activities found from 30 projects. Later, the 224 activities are compiled together to develop a 12 numbers of milestones. The activities were ranked to arrive the top ten activities which contributing delay in project and allows schedule overrun.

TABLE 2 shows, which activity obtained higher number of delay occurrence in all 30 projects. From Table 2, shows that concreting for RCC for Plinth beam, Column, Raft up to basement under sub structure milestone marks its higher number of occurrence (19 projects out of 30 projects). Follow by filling for basement with quarry dust under site preparation milestone marks its second higher number of occurrence (18 out of 30).

Follow by brick work for ground floor under brick work milestone marks its lower number of occurrence (12 out of 30).

Table 2 Occurrence of Activity Delay

Sl.No	Name of activities obtain maximum times of delay in projects	Occurrence of activity delay	Rank
1	RCC for footing, Raft, plinth beam, column up to basement	19	1
2	Filling for basement with quarry dust	18	2
3	Earth work excavation for foundation	16	3
4	Shuttering work for footing, plinth beam, column, walls, beam, slab, machine room, water tank, head rooms, raft	16	3
5	Bar bending work for raft footing, column reinforcement, grade beam, column lapping, plinth beam, roof grade beam	15	5
6	Tiles laying work for whole building	14	6
7	Supplying and fixing doors and windows	14	6
8	Toilet and plumbing works	13	8
9	Septic tank work	12	9
10	Brick work for ground floor	12	9

4.3. Delay of Milestones

There are about 12 milestones fixed to compile the activities for 30 projects. To find the percentage delay of each milestone, the comparison made between planned and achieved schedule to find the schedule overrun of each activity under milestone of all 30 projects. The delay of particular activity under each milestone of individual project is added to get the delay of the each milestone of individual project. Then the delay of each milestone of individual project is added to get the overall delay of milestone of all 30 projects. Likewise planned duration of each milestone for individual project was calculated by adding planned duration of each activity under milestone for individual project.

Table.3. Delay of Milestones

Sl.No	Milestones	Overall %delay of milestones	Times of occurrence of milestone	Average % delay of milestones	Rank
1	Pre construction phase	100	12	8	12
2	Approval	814	23	35	10
3	Site preparation	3510	30	117	2
4	Sub structure	1377	28	49	7
5	Super structure (I) Formwork and reinforcement	898	24	37	9
	(II) concreting	2469	29	85	5
6	Lift works	95	2	48	8
7	Retaining wall works	19	4	5	13
8	Sump/ septic tank works	3039	20	152	1
9	Brick work	2765	26	106	3
10	Finishing works	2647	30	88	4
11	Service works	1656	27	61	6
12	Other miscellaneous works	630	23	27	11

The percentage delay of each milestone for individual project was calculated before to find the overall percentage delay of each milestone for all 30 projects. Finally, the average percentage delay of milestone was calculated by using the following formula.

Where Equation 2 represents the 3rd column of this table and "Equation 3 represents the 5th column of this table.

1. $$\text{"Percentage delay of milestone for individual project} = \left(\frac{\text{Delay of milestone}}{\text{Planned duration of milestone}}\right) \times 100\text{"} \quad (1)$$

2. $$\text{"Overall percentage delay of milestones for all 30 project} = \sum \text{percentage delay of milestone of all individual projects "} \quad (2)$$

3. "Average percentage delay of milestone = $\frac{\text{overall percentage delay of milestone of all 30 projects}}{\text{Times of occurence of milestone on all 30 projects}}$" (3)

The delay of milestones was ranked on the basis of average percentage delay. The top milestones were ranked to arrive the top delayed milestone contributing to major schedule overrun of all 30 projects. TABLE 3 shows that, the Sump/ Septic tank works marks its highest range of delay of about 152% for an individual project. Followed by Brick works marks its second highest range of about 106 % for an individual project consequently, Retaining wall works marks its lowest range of about 5%.

4.4. Delay of Activities

There are different activities involve under each milestone. Both planned and achieved schedule are compared to calculate the delay period of each activity and also helps to understand the causes and implications of schedule overrun. The percentage delay of each activity for individual project was calculated before to find the overall percentage delay of each activity for all 30 projects. Finally, the average percentage delay of activity was calculated by using the following formula. There are 224 activities involved in 30 projects. Among them 97 were critical activities (75 activities have more than 25% of delay occurrence, 22 activities have less than 25% of delay occurrence) and 73 were non critical activities (completed before planned duration) and 54 activities doesn't attains delay. Maximum delay of activity was considered those having more than 25% delay of occurrence. The following equations are used to derive the average percentage delay of activities.

Where Equation 5 represents the 3rd column of this table and "Equation 6" represents the 5th column of this table

1. $Percentage\ delay\ of\ activity\ for\ individual\ project = \left(\frac{Delay\ of\ activity}{Planned\ duration\ of\ activity}\right) \times 100$ (4)

2. $Overall\ percentage\ delay\ of\ Activity\ for\ all\ 30\ project = \sum percentage\ delay\ of\ particular\ activity\ of\ all\ individual\ projects$ (5) (2)

3. $Average\ percentage\ delay\ of\ activity = \frac{overall\ percentage\ delay\ of\ activity\ of\ all\ 30\ projects}{Times\ of\ occurence\ of\ activity\ on\ all\ 30\ projects}$ (6)

TABLE 4 shows that list of activity have more than 25% chances of delay. From TABLE 4 shows that list of activities obtaining delay in projects such as (i) filling for basement with quarry dust marks its higher number of delay occurrence of about 419% (extended four times of planned duration), (ii) Stair case shuttering marks its second higher number of delay occurrence of about 382% (extended three and half times of planned duration), (iii) Concrete for flooring marks its third higher number of delay occurrence of about 379% (extended three and half times of planned duration), (iv) PCC marks its fourth higher number of delay occurrence of about 350% (extended three and half times of planned duration), (v) Parapet wall masonry work marks it fifth higher number of delay occurrence of about 241% (extended two and half times of planned duration), (vi) Water proofing marks its sixth higher number of delay occurrence of about 230% (extended two and half times of planned duration), (vii) Earth work excavation for foundation marks its seventh higher number of delay occurrence of about 220%(nearly extended two times of planned duration), (viii) Supplying and fixing doors and windows marks its eighth higher number of delay occurrence of about 212% (extended two times of planned duration), (ix) Excavation for STP Sump marks its ninth higher number of delay occurrence of about 200% (extended two times of planned duration), (x) block work marks its tenth higher number of delay

occurrence of about 195% (extended one and half times of planned duration**).** Additionally internal and external painting marks its lower percentage of delay occurrence of about 25%.

Table.4. Delay of Activities

S.no	Activities	Overall percentage delay of activity of all 30 projects	Times of occurrence of activity of all 30 projects	Average percentage of delay of activities
1	Filling for basement with quarry dust	7543	18	419
2	Stair case shuttering	2293	6	382
3	Concrete for flooring	2273	6	379
4	PCC	2803	8	350
5	Parapet wall masonry work	2656	11	241
6	Water proofing	1378	6	230
7	Earth work excavation for foundation	5723	26	220
8	Supplying and fixing doors and windows	3177	15	212
9	Excavation for STP Sump	400	2	200
10	Block work	2343	12	195
11	PCC for column footing	383	2	191
12	Septic tank work	3119	17	183
13	Concrete work for sunshade and lintel	2479	14	177
14	Pollution control approval	354	2	177
15	PT slab works	333	2	167
16	Wall shuttering and concrete	313	2	157
17	PCC for Drain	309	2	155
18	Raft concrete	463	3	154
19	RCC for footing, Raft, plinth beam, column up to basement	3381	23	147
20	Bar bending work for raft footing, column reinforcement, grade beam, column lapping, plinth beam, roof grade beam	2538	18	141
21	Ground water (bore wells)	265	2	132
22	Ceiling and wall plastering for whole building	1366	11	124
23	Starter marking	247	2	123
24	Environmental clearance	244	2	122

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25	Toilet and plumbing works	1468	13	113
26	Carpentry work for whole building	1032	10	103
27	Electrical panel works	100	1	100
28	Drawing approval	199	2	99
29	pump and motors fixing drawing	91	1	91
30	Pipe laying work	91	1	91
31	Service works	176	2	88
32	Brick work in steps	667	9	74
33	Electrical conduit laying	148	2	74
34	Handing Over of Site after excavation and dressing	220	3	73
35	Tiles laying work for whole building	1313	18	73
36	Reinforcement laying	351	5	70
37	Levelling coarse	70	1	70
38	External sanitary and water supply works	406	6	68
39	Design and drawing	130	2	65
40	Tie beam shuttering	65	1	65
41	HDPE sheet laying	64	1	64
42	Planning authority approval	127	2	64
43	Brick work for ground floor	802	13	62
44	Marking of column and footing	1125	19	59
45	Masonry work with fly ash brick for foundation	58	1	58
46	Foundation, Pedestals and retaining walls works till Grade slab PCC	57	1	57
47	statutory approval	513	9	57
48	Pressed tiles laying work for terrains	391	7	56
49	Terrace water proof and heat resistant terrace tiles laying	381	7	54
50	Temporary meter box	700	13	54
51	Brick laying for grade beam	683	13	53
52	RCC work up to podium slab	52	1	52
53	Electrical works	561	11	51
54	Concrete laying	50	1	50
55	Pedestal shuttering	50	1	50
56	NOC from fire	99	2	50
57	Lime concreting	188	4	47

58	Earth Filling Up to Drain Bottom Level	46	1	46
59	Shuttering for Lift	91	2	45
60	Partition wall	89	2	45
61	Cover block laying and levelling work for ground floor roof	400	9	44
62	Lift reinforcement	85	2	43
63	Joinery works	378	9	42
64	Ceiling plastering	41	1	41
65	Tie beam concrete	119	3	40
66	Shuttering work for footing, plinth beam, column, walls, beam, slab, machine room, rooms, raft	903	24	38
67	Painting works	488	13	38
68	Temporary power supply	73	2	36
69	Stair case concrete	500	14	36
70	Road and pavement works	33	1	33
	Aluminium doors, windows, partitions and cladding	63	2	31
70	Crusher powder for filling on basement	250	8	31
71	Consolidation work in all column footing	400	13	31
72	RCC for Corbel	29	1	29
73	Motor and pump line fixings	26	1	26
74	Parapet wall	129	11	25
75	Internal / External plastering works	148	6	25

V. CONCLUSION

The study was carried out to identify the activities affecting construction project scheduling in the construction industry. This study was carried around 30 samples of data. The retrieved data were analyzed and found the top critical factor (activity) responsible for time overrun of construction schedule. There are around 224 activities in all 30 projects. The study concluded that following points.

(i) The delay of milestones was ranked on the basis of average percentage delay

(ii) The result obtained in this study mainly focussed on building projects.

(iii) The maximum 50% projects are in 1to 20 months. Hence the result of the more applicable for the project duration lies in 1to 20 months.

(iv) The maximum 67% projects are in 1to 50 Cr. Hence the result of the more applicable for the project budget lies in 1to 50 Cr.

(v) The maximum 44% projects are located in Chennai.

(vi) The maximum times of delay of activity obtained in overall project such as (i) RCC for footing, plinth beam, column, raft up to basement, (ii) filling for basement with quarry dust, (iii) earth work excavation for foundation. The remaining is shown in the Table2.

(vii) The maximum delay occurrence in the milestone is (i) sump/ septic tank works, (ii) site preparation, (iii) Brick works. The remaining milestones are shown in the Table3

(viii) The maximum delay of activity was considered those having more than 25% of delay. Table 4 shows the list of activities having more than 25% chances of occurring delay such as (i) Filling for basement with quarry dust, (ii) Stair case shuttering, (iii) Concrete for flooring, (iv) PCC, (v) Parapet wall masonry work.

VI. SUGGESTIONS & RECOMMENDATIONS

The following recommendations are only for the top most delay activity under each milestone. The identification of critical activities is to enhance the projects to achieve in planned duration and also avoid the rescheduling in construction industry.

The recommendation of this paper suggests the influencing information for the project participants to focus on critical factors to avoid the rescheduling. The suggestions to overcome schedule overrun of corresponding top most activity are given below.

(i) **Pump and motors fixing design -** It will be avoided by providing complete data and complete drawing in contract formation.

(ii) **Pollution control approval –** Most of the projects were get time overrun for getting approval. Hence this time overrun will be overcome through the clients should check all necessary approvals for the project from the relevant authority before the execution of building works. The process of approval should be started early as soon as possible.

(iii) **Filling for basement with quarry dust -**The time overrun of this activity will be control by early prediction of scarcity of filling material by site engineer during their site visit. To increase the productivity machines are used instead of labours. It will be avoided by better monitoring and controlling, proper communication among top management and labours.

(iv) **Plain cement concreting (PCC) –** The time overrun of this activity will be control by while planning consideration of labours social and cultural factors and equipment selection should be done as per its productivity and need of the project.

(v) **Staircase shuttering –** The time overrun of this activity will be control by a skilled labour because he can ensure the formwork will be in the correct place or position before the concrete is poured. If we are failing in doing all the above process, it will insist the rework. Hence the rework will insist the schedule overrun of activity.

(vi) **Concreting for flooring –** The time overrun of this activity will be control by giving reasonable planned duration (ii) Ensure that the concrete is pour it is completed as soon as possible. It should not be allowed to dry too quickly as this may produce cracks in the surface hence it will create rework.

(vii) **Lift wall shuttering –** the time overrun of this activity should be controlled by delivery schedule of materials should be adhered with proper planning like having material in place before execution and making advance payments for booking materials to avoid scarcity.

(viii) **Wall shuttering and concreting –** The time overrun of this activity will be control by al the previous works should be properly corrected prior to start of shuttering and concreting work to avoid rework and to finish with in planned duration.

(ix) **Excavation for sump -** The time overrun of this activity will be control by to employ an earthmover to level the ground and giving reasonable planned duration for site preparation. Soil investigation should be properly done prior to start of excavation work to avoid rework and handling the site on time as planned.

(x) **Parapet wall masonry work –** The time overrun of this activity will be control by material should be procured as per planned and need of the project. To avoid the scarcity it should be booked in advance. Activities should be planned by considering the impact of weather conditions due to seasonal changes. Festival holidays must be taken in to consideration while scheduling to avoid the absenteeism of labours.

(xi) **Water proofing –**It will be corrected by cost control system is performed in projects to avoid the unwanted increase of cost during rate escalation. Due to absence of skilled labour, training should be given to unskilled labour to avoid the rework, time overrun of activity.

(xii) **Supply and fixing doors and windows -** It will corrected by taking fast decision and having back up plan (vendors list) would avoid delay in supply of materials. Fixing of Window frames and door frames should be placed correctly and checked to avoid the rework.

(xiii) **Ground water (bore wells) –**The schedule overrun of this activity will be overcome by giving reasonable planned duration for excavation works and also using equipments for excavation, skilled labour will be needed to install all the pipes, pump and motors which will be under the flooring of the house or in critical areas.

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