MATURING THE CONSTRUCTION MANAGEMENT OF DELAYED PROJECTS USING BIM MODEL AND RESCHEDULING USING PRIMAVERA

A

PROJECT REPORT

Submitted in partial fulfilment of the requirements for the award of the degree

of

MASTER OF TECHNOLOGY

IN

CIVIL ENGINEERING

With specialization in

CONSTRUCTION MANAGEMENT

Under the supervision

of

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Professor

by

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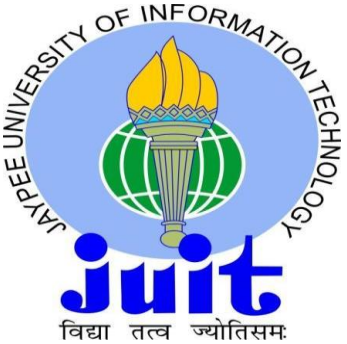

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HIMACHAL PRADESH, INDIA

MAY 2019

STUDENT'S DECLARATION

I hereby declare that the work presented in the Project report entitled **"Maturing Construction Management of delayed projects using BIM model and rescheduling using Primavera"** submitted for partial fulfilment of the requirements for the degree of Master of Technology with specialization in Construction Management in Civil Engineering at **Jaypee University of Information Technology, Waknaghat** is an authentic record of my work carried out under the supervision of **Dr. Ashish Kumar**. This work has not been submitted elsewhere for the reward of any other degree/diploma. I am fully responsible for the contents of my project report.

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CERTIFICATE

This is to certify that the work which is being presented in the project report titled "**Maturing the Construction Management of Delayed Projects using BIM Model and Rescheduling using Primavera**" in partial fulfilment of the requirements for the award of the degree of Master of Technology with specialization in Construction Management in Civil Engineering submitted to the Department of Civil Engineering, **Jaypee University of Information Technology, Waknaghat** is an authentic record of work carried out by **Akarshan Uppal (172601)** during a period from August, 2018 to March, 2019 under the supervision of **Dr. Ashish Kumar** Department of Civil Engineering, Jaypee University of Information Technology, Waknaghat. The above statement made is correct to the best of our knowledge.

Date: May 2019

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ACKNOWLEDGEMENT

I take this opportunity to acknowledge all who has been great sense of support and inspiration throughout the project work. There are lots of people who inspired me and helped, worked for me in every possible way to provide the detail about various related topics, thus, making of report work success. My first gratitude goes to our head of department **Dr. Ashok Kumar Gupta** for his guidance, encouragement and support.

I am very grateful to **Dr. Ashish Kumar (**Professor), for all his diligence, guidance, and encouragement and helped throughout the project work. I also thank him for the time that he spared for me, from his extreme busy schedule. His insight and creative ideas are always the inspiration for me during the dissertation work.

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ABSTRACT

The construction industry has been facing many problems due to which there is delay in the construction projects and such that they are not completed in the given time. The delay is a major problem in the construction industry. So first, we have to examine the cause due to which the project is not completed in the time. For examine the causes of delays a questionnaire survey was conducted. There was a total of 17 responses for the questionnaire survey and also there were total 61 causes of delay and then rank the delays with the help of the relative important index and then with the application of the BIM model visualize the project and after that with the application of the primavera we can minimize the delays and also the cost of the project optimizes. Primavera is used for the rescheduling the project.

Keywords- Causes of delays, Planning and rescheduling, Primavera software

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LIST OF ABBREVATIONS

BIM	Building Information Modelling
LOi	Letter of intent
R.I.I	Relative important Index

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CHAPTER 1

INTRODUCTION

1.1General

There are numerous construction projects which are not finished inside the given time. There are numerous kinds of delays because of which the development projects are not finished inside the given time. Right off the bat, we need to think about reason for delays of the project after recognized the reason we need to limit the reasons for delays and reschedule the task.

1.2 Delays types

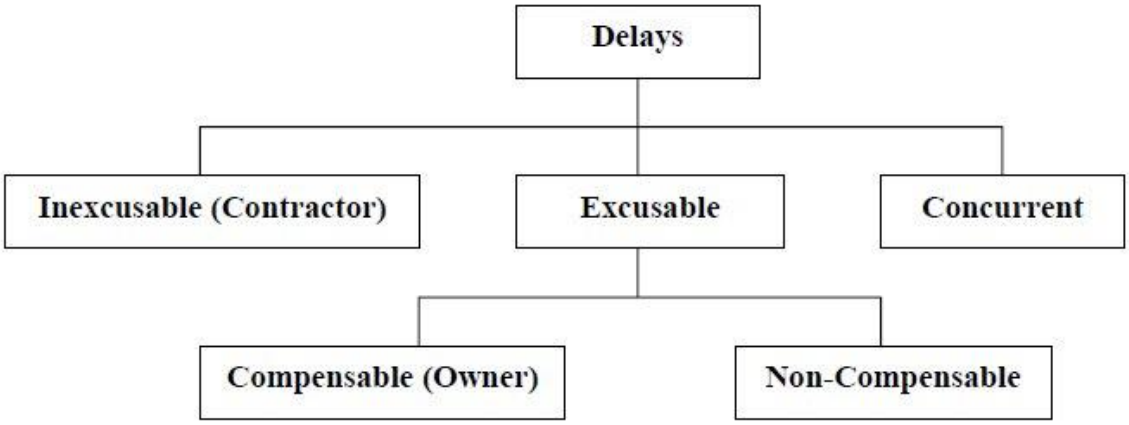


Fig1.1: Types of delays (Odeh et.al. (2002))

Generally, there are four major types of delays,

1. Excusable and non-excusable
2. Compensable and non-compensable
3. Concurrent delays
4. Critical and Non-critical delays.

The explanation of the delays is given below:

1. Excusable and non-excusable delays:

Excusable delays are the delays in which the contractor is entitled for the both time and the money. In this type of delays the contractor does not have any control over the situation or the

delays where the contractor is liable for both the time and money are known as excusable delays. The some of the cause for excusable delays may be given below:

a. Force Measure
b. Natural Climates
c. Political/Social unrest
d. Terrorist attacks
e. Delay from client

Non excusable delays are the delays in which the contractor is no liable for both the time and the money. The some of the causes for the non-excusable delays are

a. Delayed Mobilization
b. Planning and scheduling
c. Critical events that are not highlighted to client at right time.

2. Concurrent Delays:

A concurrent delay is a type of delay in which more than one event occur at a time and the contractor is not liable for time loss and money expense. This type of delays generally happens because of the fault of the contractor.

3. Compensable or non-compensable Delays;

Compensable delays are the delays in which the contractor is entitled for both the time extension and money and on the other hand if the contractor is not entitled for time and the money is known as the non-compensable delays.

4. Critical and non-critical delays:

A delay that is in charge of expanding project length is a basic delay. Barely any outcomes are referenced beneath:

a. Extended in field overhead
b. Idle labour and the equipment cost
c. Labour and material cost escalation.

A delay that isn't the reason for broadened project span is a non-basic postponement; in any case, it will have an impact as far as exercises getting finished late than planned culmination. These exercises will likewise influence venture cost appraises as repeated underneath:

a. Labour and material cost
b. Equipment unavailability
c. Equipment cost

1.2 Application of BIM MODEL

The construction industry has been confronting numerous issues, for example, time of delay, cost overrun, debate and so forth. To improve creation of the construction industry distinctive arrangements, for example, advanced development, are watched. Advanced development intends to address the developing discontinuity issues and improve profitability by utilizing advances, for example, Building Information Model for coordinating procedures all through the whole life cycle of construction project. With the utilization of the Building Information model we can lessen the cost overrun and the project delay time.

Applications of the Building Information Model;

1. Visualization
2. Shop drawings
3. Code reviews
4. Cost estimating
5. Construction sequencing
6. Facilities management.

The important advantage of a building information model is its accurate geometrical portrayal of the pieces of a structure in a coordinated information condition. A portion of different advantages of the BIM are;

1. Faster and more effective processes
2. Better Design
3. Controlled whole life costs and environmental data
4. Better Production quality
5. Automated assembly

1.3Application of primavera

1. Diminish risk along with cost connected with scheduled primavera.
2. It helps easily prepare and control project things to do.

3. It optimizes management off resources.
4. It offers clear field of vision what’s taking in the particular project.

CHAPTER 2

LITERATURE REVIEW

2.1GENERAL

There is numerous construction project which are not finished inside the given time. There are numerous sorts of delays because of which the construction project is not finished inside the given time. Right off the bat, we need to think about reason for delays or deferrals and reschedule the project.

2.2HISTORICAL DEVELOPMENT

Construction delays in private and light development are regularly the aftereffect of miscommunication between temporary workers, subcontractors and property proprietors. In the more intricate tasks, the delays are not seen the first project so the other lawful development shapes are presented, for example, change of request. In a construction project a timetable is made and if the work isn't finished by the calendar the postponements occur at constantly.

2.3LITERATURE REVIEW

Various examinations have been led for discovering the reasons for delays and furthermore the no of studies has been directed under the BIM with the assistance of which we can limit the reasons for delays. The clarification of writing survey is given underneath for the distinctive sorts of studies.

2.3.1 The some of the reviews of causes of delays in general construction projects are as follows;

Amoatey et.al. [2014] this study serves to distinguishes the different reasons for delays and impacts of postponements in open segment lodging ventures in Ghana. In this investigation a testing approach was utilized in choosing the respondents for the examination. These were specialists taking a shot at different state lodging development extends in Ghana. in this investigation the basic factors that adds to extend delays in Ghana are, delay in installments to temporary worker, provider expansion, cost vacillation, cost increment in materials, deficient assets from support, customers, variety requests and poor monetary/capital market. The basic impacts of postponements are cost invaded, prosecution, time over run, absence of congruity

by customer and mediation. Measures went for lessening cost of lodging ventures in Ghana can make an interpretation of into noteworthy advantages to poor and bolster accomplishment pf government target of giving reasonable lodging to low pay resident. This paper hosts exhibited the view of activities gatherings on the recurrence of exactness and level of effect of different reasons for postponement and consequences for tasks and undertaking parties in GHANA.

James et.al. [2014] Delays is one of the most concerning issues regularly experienced on construction project site. In this strategy the arbitrary testing procedure is utilized for discovering the reasons for impacts of delays on structure construction project conveyance time. The result of investigation from this examination can be said to be of incredible significance to the development business. There are numerous components that incorporate delays on construction project, anyway in this investigation the variables are constrained to 15 factors causing delays and they were positioned by mean list score. Investigation was likewise completed on the impact of deferral on the task work. Time over run, in definite expense of project, wastage and under use of labour and assets.

Megha et.al [2013] delays are diverse one in everything about issues that organizations are confronting today defers will result in a few impacts. In this examination we talk about the normal reasons for deferral in the construction project. In these present examination diagram, the real reasons for delays in the development business. From the above examination the writing view ponder and the from the master, there were principally 59 causes were distinguished under 9 majors' gatherings.

Shanmugapriya et.al. [2013] time over run and cost overrun is a major issue in the construction industry. The fruitful execution of construction projects and keeping them inside endorsed calendar and cost is significant for viable time execution and cost execution. This study work is examining an important factor in causing time overrun and increases in the cost. For this a legitimate survey is created. The elements are assembled into 12 classes for time over run and 8 cost overwhelm and dispersed to specialists and proprietor of Indian construction industry. The outcome achieved from the review uncovered that the significant reasons for time over run or material market rate, contract alteration, and abnormal state of value prerequisites and the real foundations for expense.

Salunkhe et. al. [2012] in this investigation the kind of construction delays is featured because of which the task endure and the cost invade additionally about 60% of the Indian undertaking

are experienced postponement and the cost overwhelm. In this we additionally think about the outside and inside variables that impact the development procedure and diagram the impact of delays in expansive development extends in this deferral are because of the land obtaining , delay in hardware erection ,insufficient activation by the contractual worker , delay in the backwoods leeway , subsidize obliges ,change in extent of work , scratch-off of delicate ,law and request issue, delay in supply gear, moderate advancement of common work, heightening in expense likewise the temporary workers inappropriate arranging and planning have more effect on the venture length just as absence of experience will influence the capacity of basic leadership.

Doloi et.al. [2011] the vast majority of the activities in India just as worldwide delayed. For the unmistakable comprehension of the time over run and the cost overwhelm we need to discover the reasons for delays in the construction industry in the examination by utilizing , the 45 properties , in this exploration we previously distinguished the key variables affecting deferrals in the Indian development industry and then settled the connection between the basic ascribed for creating expectation models for surveying the effects on these components of delays, In this investigation poll and individual meetings have shaped the premise of this examination this examination uncovers that a standout amongst the most basic elements of delays is the absence of responsibility.

Hoai et.al. [2008] in the task the executives with the assistance of the correct time the executives and arranging we can effectively accomplish our objectives. In the event that the arranging and booking not done appropriately, at that point there will be time deferral and cost overwhelmed. These explores have accentuations a questionaries' overview to evoke the reasons for this circumstance by talking the 87 Vietnamese construction specialists. Twenty-one reason for deferral and cost overwhelm proper with structure and modern development venture were gathered and positioned as for recurrence, seriousness and significant files' correlation of reasons for time and cost invade was finished with different chose development businesses in Asia and Africa. There are 7 factors that come about by the correlation of different nations are inadequacy, structure, showcase, gauge, monetary capacity, government and specialist

Aibinu et.al. [2006] thinks about the reasons for delays by concentrating on the activities and inaction of the members and the different outer components. They distinguished the 44 reasons

for postponement. For the ID of the reasons for the delay a poll study had been directed. The questionnaires' overview was executed into two sections. In the initial segment

evaluating the degree of deferrals and assembled data of finished structure extends that were gotten from the design and designer, amount surveyor and contracting associations. In the second section an evaluation of delay factors and their appropriation design was researched.

Faridi et.al. [2006] in this investigation we have consider the different critical elements causing the delays as we probably are aware postponements is most repeating issues in the construction industry. A point by point questionaries' was created and used to get contribution from expert related with the UAE development industry. At that point a viewpoint of temporary workers and consultancy has been broke down to rank the reasons for postponement on their relative significance list. In this exploration half of the development extends in UAE experience delays are not finished in time. in this investigation just top 10 most noteworthy construction delays have been distinguished. endorsement off illustrations, deficiently early arranging and gradualness of the proprietors, basic leadership process are the top reasons for postponement in the UAE development industry.in this investigation the aggregate of 93 development expert the UAE development industry took an interest and the majority of the expert imagines that it is because of the deferral because of moderate endorsement of illustrations, basic leadership process and lacking arranging.

Sambasi van et.al. [2006] in this investigation we need to discover the different reasons for delays in the Malaysian construction industry. The primary reason for this examination is to recognizes the defer factors and their effect on the venture fruition. This examination distinguishes the 10 most significant reasons for delays from customers, consultancies and contractors.in this investigation the survey was structured and disseminated among the three noteworthy gatherings of members. We recognizes fundamental driver of deferral and 10 most significant causes were: temporary worker ill-advised arranging, contractual worker poor site the board, deficient contract based worker experience, insufficient customers account and installments for finished work, issue with sub-contractual worker, deficiency in material, work supply, gear accessibility and disappointment, absence of correspondence between gatherings, botch amid contract based worker star. Additionally, the principle impacts of postponement are: time over run, cost invade, debate, assertion, suit.

Assaf et.al. [2006] contemplated the reasons for delays in the huge construction extends in Saudi Arabia by every one of the members for example proprietor, specialist and the

contractual worker. They found that there were 73 reasons for the delays and the most widely recognized defer found by every one of the members was change of request. A questionaries' was created for the discovering the significance of the causes. The survey is for the most part separated into two sections. Section one incorporates the general data about the organization and the respondent. Section two incorporates the rundown of the distinguished reasons for deferral in development venture. From the above examination 76% of temporary workers have reasoned that time overwhelmed is somewhere in the range of 10% and 30% of unique term while about 56% of advisor have determined a similar rate and 25% of experts have closed from 30% to half average time invade and furthermore the most well-known reason by every one of the members is change of request.

Frimpog et.al. [2003] in this study we read the different under grounds construction projects, which influences development timetable and cost over runs. This paper means to inspect and assess the overall significance of the fundamental factors that causes delays and cost invade in ground water development ventures. For discovering the reasons for delays in the development extends a survey was led. The information was investigated and positioned, in view of the calling of the respondents and their job in the business. The questionaries' overview comprised of 49 factors which were assembled into 9 noteworthy classes, the dimension of significance of classifications was estimated and positioned by the relative significant loads. The primary overview of contractual workers, proprietors and advisors as talked about in this examination are identified with the development of ground water extends in GHANA.

Alwi et.al. (2003) action delays are a typical issue in the construction project and can expand project is plans and rates. In this investigation we have concentrated on the quantitative assessment of defer impacts the paper adds to a procedure to look at the subjective and quantitative element of the delays issue the paper proposes two marker as pursues or: purpose behind as a pointer that portray booking disappointments, and (2) postpone file arranging was most destructive postpone causes on time execution . in this investigation we talk about the separation between defer sway on both worldwide exercises and basic exercises. For this situation contemplate, the primary outcomes demonstrated that arranging and subcontractors' positions are the more regular defer causes and furthermore the bigger effect as far as time execution.

Odeh et. al. [2002] numerous undertakings experience delays and due which there is cost overrun. In this paper our went for distinguishing the most significant reason for delays in

construction project with conventional sort contracts from the view purpose of construction contracts and experts. Consequences of the overview show that contractual workers and consultancy concurred that proprietor interface, insufficient temporary worker experience, accounts and instalments, work efficiency, moderate basic leadership, inappropriate arranging, and subcontractors are among the main ten most significant variables. Concurring, work profitability was the most significant delay factor.

Momani [2000] This paper studies a dual theme. This paper examines the causes of delays on 130 public projects in the Jordan and evaluation of this study is conducted with the help of the quantitative analysis. There are various types of buildings include in this study like residential, office, administrative, school, medical, and communication facilities. The some of the major cause of delays in this construction public project is dur to the designer, use changes, delay in deliveries, climatic conditions, economic conditions and quantity increase. Due to these factors there is impact on the project. The implementation of oriented research is helpful in the management and the completion of the projects.

Chan et.al. [1996] This study has been carried out for the determine and evaluation of the causes of delays with the help of the relative important index in the Hongkong construction industry. This study includes a total 83 delayed factors and these factors were grouped in to nine major groups. In this firstly we analyse the major factors for finding out the causes of delays and then ranked these factors on the basis of the

1. The role of various types of parties in the construction industry i.e. clients, contractors, consultants.

2. Type of the project.

The result of these study includes the five cause of the delays i.e. poor site management, negligence in ground conditions, low speed of decision making, client contractor relationship, and necessary variation of works.

2.3.2 The some of the reviews of the authors of causes of delays in building construction projects are as follows;

Alaghbari et.al. [2007] Distinguish the significant reasons for delays in the undertakings. There are essentially 31 reasons for delays happen in the undertaking and these causes are additionally isolated in to four classifications. The methodologies that utilized for the information gathering of this examination were inspecting casing of the investigation,

questionaries' structure, populace and testing size, information handling and examination, positioning the defers factors. The consequence of this investigation incorporates the temporary workers' factor, proprietors' factor, expert factor, outer variables, causing delay in the construction project. The basic reason for the delays in this investigation was the money related issue. Poor people the board is the second reason for delays in the task.

Assaf et.al. [1995] examined the reasons for the delays in the expansive structure development extends in Saudi Arabia and their significance. There were essentially 56 reasons for delays in the task and these brings on additional gathered into 9 classifications for example materials, labour, hardware, financing, condition, changes, government relations, authoritative relations, and booking and controlling systems. The examination of the task is happened into two stages. The primary stage incorporated the writing audit and the meetings and the second stage incorporated the advancement of questionnaires' utilizing the defers that referenced in the undertakings. The gathered information was breaking down utilizing a significant file. With the assistance of the significant list we can rank the classes of delays from high to low. From the above investigation we can without much of a stretch distinguish the reason for delays and furthermore rank.

2.3.3 The some of the reviews of the authors of causes of delays in road construction projects are as follows;

Kamanga et.al. (2013) this examination was directed to distinguish the reasons for delays in street development extends in Malwai this investigation recognizes the 72 reasons for postponement for which a questionnaire' was sent to customer, temporary worker and advisers. The aftereffects of this undertaking were examined utilizing the relative significance list and spear-man rank connection coefficients the reasons for delays are huge ought to be given consideration by customer, associations, advisers and temporary workers. There are top 10 reason for deferral are

1. Shortage of fuel.
2. Insufficient contractor cash-flow/ difficulties in financing projects.
3. Shortage of foreign currency for importation of materials and equipment.
4. Slow payment procedure adopted by the client in making progress payments.
5. Insufficient equipment.
6. Delay in relocating utilities.
7. Shortage of construction materials such as bitumen, cement and steel.

8. Delay in paying compensations to land owners.
9. Shortage of technical personnel.
10. Delay in site mobilization.

Mahamid et.al. [2012] in this we have discover the different reasons for delay in the street construction project. In this investigation a sum of 2 reasons for delay were recognized in the exploration. The overview closed top five separate defers causes are political circumstance, division and constrained minute between territories and the honor project to most reduced offer we have, advance delay be proprietor, and lack of gear. The investigation of the contractual worker and reactions in regards to the normal time over keep running in a street construction project that they have encountered amid the most recent five years level likewise there are exactly five base reasons for delays as observed from the joined perspective on temporary workers and consultancy are, poor ground condition, inadequate controllers, improper structure syndication, catastrophic event.

Enshassiet.al. (2006) the construction industry has one of a kind quality the forcefully recognize it from different divisions of the economy. It is divided, exceptionally touchy to the monetary cycles and political condition and has an altogether high rate of construction disappointment. The examination results demonstrate the reason for construction disappointment are delay in gathering obligation from customers, outskirt conclusion, substantial reliance on these advances, absence of capital, nonattendance of industry guidelines, low net revenue because of high fruition. Huge factors and causing impacts of postponements izmel delays are one of the principle issues in development extends in creating nations, as cause a negative impact on the venture. Delays must be limited when they are perceived. A questionnaire was led for the causing of deferral. There are basically 27 distinctive reason for deferral and out of which diverse site of delays.

2.3.4. The some of the reviews of the authors of the Application and benefits of BIM are as follows;

Volk et.al. [2014] this examination is about the key advantages of the BIM in the construction project and the current structures with the assistance of BIM we can likewise kept up the current structures. Because of quick improvements in BIM look into, included partners request a best in class diagram of BIM execution and research in existing structures. Results show alarm BIM execution in existing structure yet, because of difficulties of: high demonstrating,

transformation exertion from caught incorporating information with semantic BIM ventures, refreshing of data in BIM, treatment of specific information, items and connection in BIM collecting existing structures

Bryde et.al.[2012] Hypothetical advancement in BIM recommend that in addition to the fact that it is helpful for geometric displaying of a structure exhibition that it can aid the administration of development extends the propose of the paper is to investigate the degree to which the utilization of BIM has brought about revealed rewards on a cross segment of development ventures cost , benefits examination , mindfulness rising and instruction and preparing are significant exercises to address the difficult BIM use.

Azhar et.al. [2011] this investigation gives the client valuable data for the execution of the Building Information Model innovation in their tasks. With the assistance of the Building Information Model a precise virtual model of a structure is carefully built. The report anticipated that construction capacities of BIM would be broadly used to diminish costs and improve the nature of work. With the utilization of the BIM the joint effort of the groups expands which will prompt beneficial capacity, decreased costs, better time the executives.

Nadeem et.al. [2008] the construction industry has numerous methods to diminish the task cost and lessen venture conveyance time. Building Information Modelling offers an incredible potential to accomplish these goals. Building Information Model uses n dimensional models for the arranging structure and the development of the task. In this the creator considered the advantages of the BIM with the assistance of the two contextual investigations. A BIM can be utilized for representation, creation, code audits, offices the executives, cost assessing, development systems, struggle interfacing and impact identification. The key advantages of the BIM are quicker and increasingly successful procedure, better plan, controlled entire life cycle costs and ecological information, computerized get together, better client administration, lifecycle information.

2.3.5. The some of the reviews of the authors of the Application and benefits of PRIMAVERA are as follows;

Smith et.al. (2001) Liberatore this paper centres around future research and the utilization of venture the board programming in development industry. Information are drawn from an exact investigation of undertaking the executives proficient that yielded 240 replies,42 of which were from the development business. Information were gathered on: socioeconomics and workplace, venture the executives programming utilization designs, logical use, information the

executives, and proposal for future research. The outcomes show that development experts are more experienced and taught than the respondents in the general example. The investigation demonstrates that developments experts will in general work on less undertakings with bigger number of exercises, and they are bound to utilize primavera than Microsoft venture. The aftereffect of this investigation affirms that development proficient are substantial clients of PM programming and contrast from the respondents in the general examples. Examination of noteworthy variables affecting time and cost invade in Indian development ventures.

2.4 Concluding Remarks

There are a number of construction projects which are not completed in the given time due to the many causes and delays. The delays are of various types. From the above study we find out the various causes of delays due to which the construction project is not completed within time. Then with the application of the BIM the factors which causes delays can be minimized. The BIM is a tool which have the benefits of the cost reduction, time reduction. Digital construction aims to address the growing fragmentation problems and improve productivity by using technologies such as Building Information Model for integrating processes throughout the entire lifecycle of construction.

2.5OBJECTIVES

1. To study the various causes of delays in construction projects.
2. To study a real time building construction project and find out the causes of the delays using questionnaire and reschedule the project.
3. Application of the BIM Model for visualization of the project and rescheduling of construction projects using primavera.

CHAPTER 3

METHODOLOGY

3.1General

There are various types of delays due to which the project is not completed in time. The delays can be only minimized when their cause is to be identified.

3.1.2Collection of Data of a real time project

Firstly, in this we collect a data of a building of a real time project. After collecting the data identify the cause of delay. After finding the cause of delay we have to minimize these delays and reschedule the project.

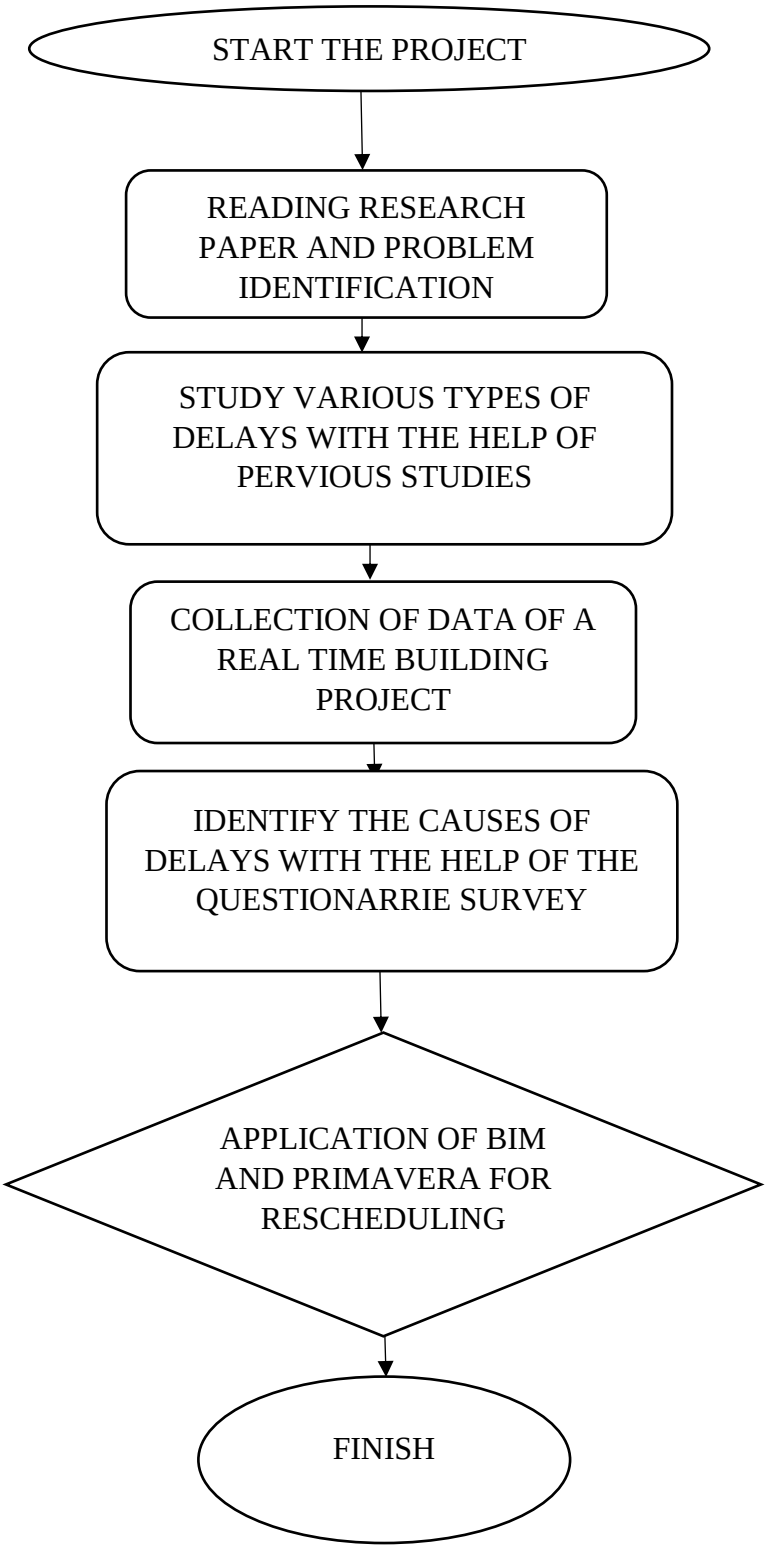
3.1.3Use of BIM Model

With the help of BIM model, visualize the project.

3.1.4Use of primavera

With the help of the primavera rescheduling the activities.

3.2 METHODOLOGY CHART



3.3Collection of data of a real-time building project

Maturity in the construction management refers to the progressive development of the project by considering the various factors like planning, scheduling, and a successful strategy for achieving the goals. The strategy for achieving the goals vary company to company according to their goals. If the project is not completed within the planning and strategy then there should be delays in the project. In this work we are working on the minimizing the risk in the delayed projects. For that we have study a lot of literature reviews of the previous study of the causes of delays. Because the delay can only be minimized when their cause is identified. For that we choose a real time building project. There are 80 no's villas which are delayed. these villas are constructed in GT road Ludhiana (Punjab). The contract value and revised contract value for the project is given below.

Table3.1: Project data

Start of the project	23rd January 2018
Contract value	RS120956789
Revised contract value	RS127092688
Date of completion	31st March 2018
Extended date of completion	25th April 2019

Fig 3.1: Construction of Villa in the Ludhiana GT road (Punjab)

3.4 Questionnaire Survey

Now after collecting the data we have to find out the causes of delays with the help of a questionnaire.

This questionaries' survey is conducted by the project manager, site engineer, billing engineer, foreman, contractors and field workers.

Table3.2: Questionnaire Survey Format

Questionnaire Survey for identifying the causes of Delays of a construction Project This study is carried out for identifying the various causes of delays of a building project i.e. required for the completion of my project work.
Name;
Designation:
Experience;

3.4.1Analysis of delay factors

There are total 17 responses collected from the questionnaire survey data.

In this analysis we used a factor known as Relative Important Index. With the help of this factor we can rank the delays according to their analysis. The formula for the relative important index is given below:

Relative important Index

$$RII = \Sigma w/AN$$

Where w = weighting given to each factor by the respondents and ranges from 1 to 4 where

1 is 'not important'

2 is 'somewhere important'

3 is 'important'

4 is 'very important'

N= total no of respondents i.e. 17

A=highest weight in this case

The 61 delays were grouped in to 9 major factors. The table given below consists of the number of delays, no of responses to each delay according to the questionnaire survey data, and groups of delays. With the help of this data we calculate the relative important index.

Table3.3: List of causes of delay in project

		No. of responses	No. of responses	No. of responses	No. of responses	Groups	R.I.I	Rank
Sr. No.	Causes of delays	Not important (1)	Somewhere Important (2)	Important (3)	Very Important (4)			
1	Increase in scope of work	5	8	4	0	Project	0.485	55
2	Unrealistic time schedule imposed in contract	3	7	6	1	Project	0.573	31
3	Non-availability of design on time	7	4	3	0	Project	0.428	60
4	Delay in progress	0	4	10	3	Owner	0.735	2

	payments by owner							
5	Delay to furnish and deliver the site to the contractor by owner	10	4	3	0	Owner	0.393	61
6	Change of order by owner during construction	0	3	10	4	Owner	0.705	5
7	Delay in approving shop drawings	5	5	7	0	Owner	0.521	51
8	Slowness in decision making process by owner	0	5	10	2	Owner	0.705	6
9	Suspension of work	4	4	8	1	Owner	0.588	27
10	Difficulties in financing project by contractor	2	6	6	3	Contractor	0.643	19
11	Conflicts in suubcontractor schedule	4	5	8	0	Contractor	0.558	33
12	Rework due to error during construction	3	3	9	0	Contractor	0.6	26
13	Conflicts between	4	5	7	0	Contractor	0.546	41

	contractor and other parties							
14	Delay in approving major changes	2	4	10	1	Contractor	0.64	20
15	Poor communication and coordination by contractor	5	5	5	2	Contractor	0.558	34
16	Ineffective planning and scheduling of project by contractor	4	6	5	2	Contractor	0.575	30
17	Improper construction methods implemented by contractor	3	10	3	1	Contractor	0.529	45
18	Delays in sub-contractor’s work	2	3	8	4	Contractor	0.588	28
19	Inadequate contractor's work	0	6	9	2	Contractor	0.69	7
20	Poor qualification of contractor's technical staff	5	5	6	0	Contractor	0.555	39
21	Delay in site mobilization	4	5	5	0	Contractor	0.517	52
22	Poor site management	0	9	6	2	Contractor	0.647	14

	and supervision by the contractor							
23	Late in reviewing and approving design documents	5	6	3	0	Contractor	0.462	59
24	Conflicts between consultant and designer	6	4	6	1	Contractor	0.529	46
25	Inadequate experience of consultant	2	5	7	2	Contractor	0.602	25
26	Restricted access at site	5	5	7	0	Site	0.529	47
27	Site accidents due to lack of safety measures	2	4	9	2	Site	0.529	48
28	Delay in material delivery	3	8	6	0	Site	0.544	42
29	Site accidents due to negligence	4	6	7	0	Site	0.544	43
30	Hot weather effect on construction activities	2	8	5	1	Site	0.558	35
31	Rain effect on construction activities	0	7	8	2	Site	0.676	9

32	Different site condition	5	6	6	0	Site	0.514	53
33	Delay in providing services from utilities	1	8	8	0	Site	0.588	36
34	Delay in material to be supplied by the owner	0	5	9	3	Process	0.721	3
35	Delay in approval of completed work by client	5	7	5	0	Process	0.5	55
36	Delay in running bill payments to the contractor	0	9	6	2	Process	0.647	15
37	Delay in finalisation of rates of extra items	0	5	9	3	Process	0.588	29
38	Improper storage of materials leading to damage	4	5	8	0	Process	0.558	38
39	Equipment breakdown	5	5	6	0	Equipment	0.55	40
40	Shortage of equipment	2	8	7	0	Equipment	0.573	32

41	Low level of equipment operator's skill	0	8	8	1	Equipment	0.647	16
42	Delay in approving design documents	0	7	9	0	Equipment	0.683	8
43	Lack of high technology mechanical equipment	5	9	3	0	Equipment	0.47	58
44	Shortage of labours	0	6	8	3	Labour	0.706	4
45	Unqualified workforce	0	8	9	0	Labour	0.632	21
46	Nationality of labours	5	5	7	0	Labour	0.531	44
47	Personnel conflicts among labours	2	7	5	3	Labour	0.632	22
48	Obtaining permission from local authorities	0	8	8	1	Authority	0.647	17
49	Bureaucracy in client's organisation	5	5	7	0	Authority	0.528	50
50	Lack of control over subcontractor	4	8	5	0	Authority	0.514	54
51	Poor means of contracting	0	7	8	2	Authority	0.676	10

52	Lack of motivation by contractor for early finish	0	7	8	2	Technical	0.674	13
53	Improper planning of contractor during bidding stage	5	5	6	0	Technical	0.485	57
54	Financial constraints of contractor	0	7	8	2	Technical	0.676	11
55	Delay in payment	0	3	9	5	Technical	0.779	1
56	Poor labour productivity	0	8	8	1	Technical	0.647	18
57	Inadequate experience	2	8	5	2	Technical	0.602	25
58	Change in material prices	2	5	9	1	Technical	0.632	23
59	Use of improper construction methods	0	7	8	2	Technical	0.676	12
60	Inefficient use of equipment's	5	5	7	0	Technical	0.529	49
61	Unrealistic inspection and testing methods proposed in contract	4	5	8	0	Technical	0.558	37

3.4.2Ranking of delays;

The table given below consists of the relative important index factor and with the help of this factor we rank the delays. The highest value of RII factor contains the top rank delay and the lowermost value of the RII facto contains the lowermost rank delay.

Table3.4: Ranking of delay causes

Sr. No.	Causes of delay	R.I.I.	Rank
55	Delay in payment	0.779	1
4	Delay in progress payments by owner	0.735	2
34	Delay in material to be supplied by the owner	0.721	3
44	Shortage of labours	0.706	4
6	Change of order by owner during construction	0.705	5
8	Slowness in decision making process by owner	0.705	6
19	Inadequate contractor's work	0.69	7
42	Delay in approving design documents	0.683	8
31	Rain effect on construction activities	0.676	9
51	Poor means of contracting	0.676	10
54	Financial constraints of contractor	0.676	11
59	Use of improper construction methods	0.675	12
52	Lack of motivation by contractor for early finish	0.674	13
22	Poor site management and supervision by the contractor	0.647	14
36	Delay in running bill payments to the contractor	0.647	15
41	Low level of equipment operator’s skill	0.647	16
48	Obtaining permissions from local authorities	0.647	17
56	Poor labour productivity	0.647	18
10	Difficulties in financing project by contractor	0.643	19
14	Delay in approving major changes	0.64	20
45	Unqualified workforce	0.632	21
47	Personnel conflicts among labours	0.632	22
58	Change in material prices	0.632	23
25	Inadequate experience of consultant	0.602	24
57	Inadequate experience	0.602	25
12	Rework due to error during construction	0.6	26

9	Site accidents due to lack of safety measures	0.588	27
18	Delays in sub-contractor's work	0.588	28
37	Delay in finalisation of rates of extra items	0.585	29
16	Ineffective planning and scheduling of project by contractor	0.578	30
2	Unrealistic time schedule imposed in contract	0.573	31
40	Shortage of equipment	0.573	32
11	Conflicts in subcontractor schedule	0.558	33
15	Poor communication and coordination by contractor	0.558	34
30	Hot weather effect on construction activities	0.558	35
33	Delay in providing services from utilities	0.558	36
61	Unrealistic inspection and testing methods proposed in contract	0.558	37
38	Improper storage of materials leading to damage	0.558	38
20	Poor qualification of contractor's technical staff	0.555	39
39	Equipment breakdown	0.555	40
13	Conflicts between contractor and other parties	0.546	41
28	Delay in material delivery	0.544	42
29	Site accidents due to negligence	0.544	43
46	Nationality of labours	0.531	44
17	Improper construction methods implemented by contractor	0.529	45
24	Conflicts between consultant and designer	0.529	46
26	Restricted access at site	0.529	47
27	Site accidents due to lack of safety measures	0.529	48
60	Inefficient use of equipment's	0.529	49
49	Bureaucracy in client's organisation	0.528	50
7	Delay in approving shop drawings	0.521	51
21	Delay in site mobilization	0.517	52
32	Different site condition	0.514	53
50	Lack of control over subcontractor	0.514	54
35	Delay in approval of completed work by client	0.5	55
1	Increase in scope of work	0.485	56
53	Improper planning of contractor during bidding stage	0.485	57

43	Lack of high technology mechanical equipment	0.471	58
23	Late in reviewing and approving design documents	0.462	59
3	Non-availability of design on time	0.42	60
5	Delay to furnish and deliver the site to the contractor by owner	0.39	61

3.5Application of BIM

There are basically three major software's under BIM

1 AutoCAD

2 REVIT

3BIMx

Here we are using the REVIT for the visualization of the project.

With the help of revit we make a 2d view and 3d view of the villa. Revit is useful for visualizing the drawings in 2d as well as 3d.

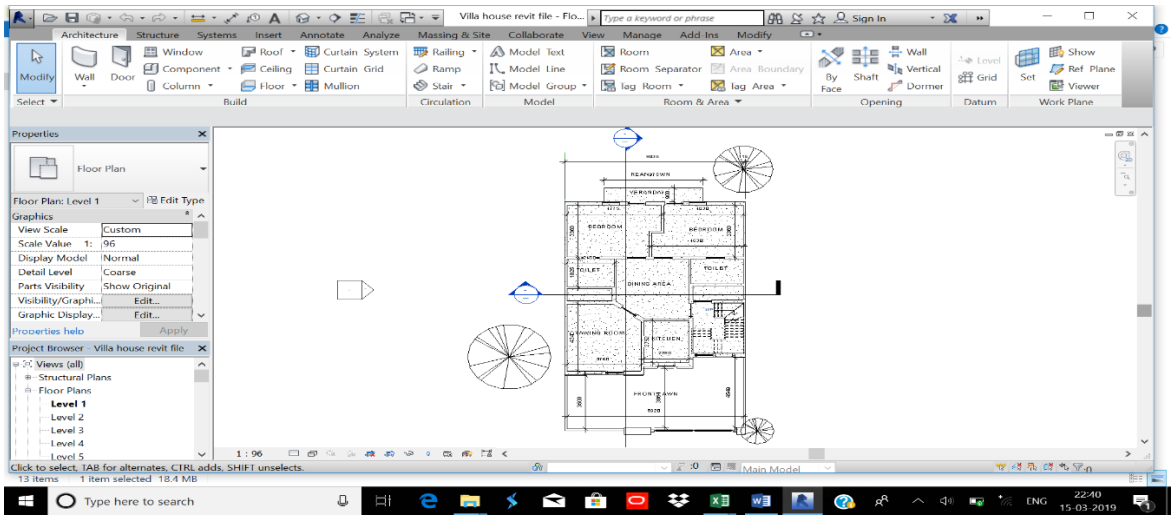


Fig3.2: 2d view of villa with the help of the revit

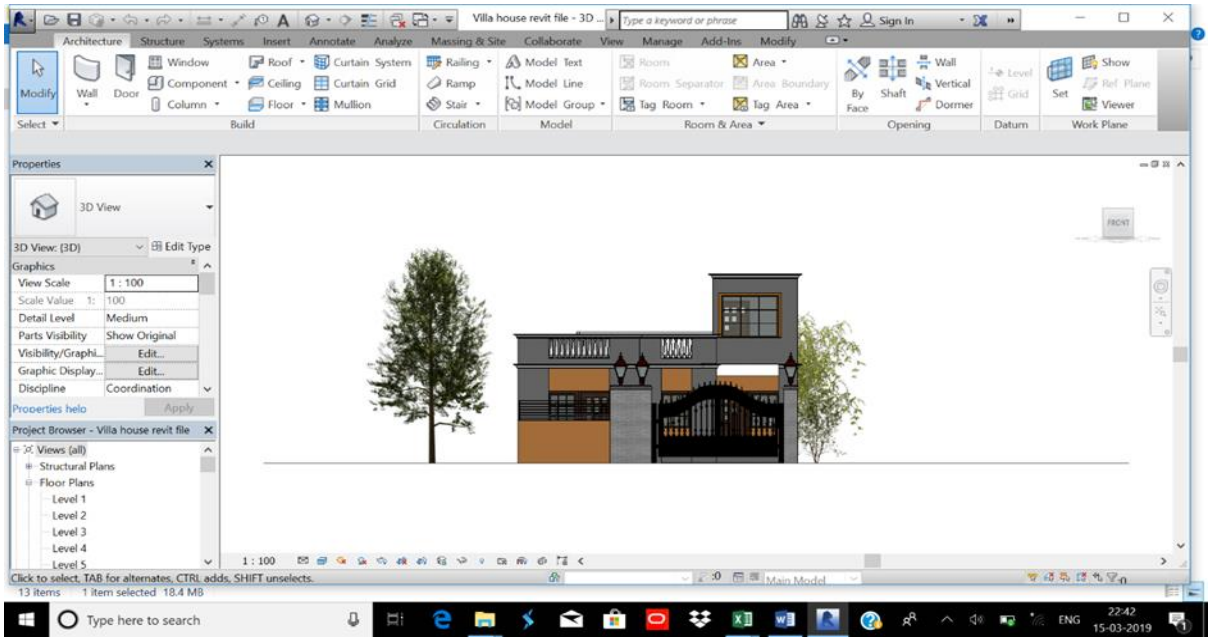


Fig3.3: 3d view of the villa with the help of the revit

This is the realistic 3d view of the project or villa i.e made with the help of the revit.

Fig3.4: Realistic view of the villa with the help of the revit

3.6Application of primavera;

Primavera is used for rescheduling of the project.

1.Diminished risk along with cost connected with schedule overrun.

2 It helps easily prepare and control project things to do.

3.It optimizes management off resources.

4.It offers clear field of vision of what's taking in the particular project.

This are the some of the key benefits of the primavera.

With the help of the primavera we rescheduled the activities that are delayed and reduces the delay and made a comparison between the delayed activities and reschedule activities which is given below in the table form

CHAPTER 4

RESULT AND DISCUSSION

4.1 Top ranking of delays

There are total 17 responses have been collected from the site and relative important index has been used for the ranking of the delays. There are total 63 delays of causes. and the top ten ranked delayed causes is given below

TABLE4.1: Top ten ranking of delays

Sr. No.	Causes of delay	R.I.I.	Rank	Group
55	Delay in payment	0.779	1	Technical
4	Delay in progress payments by owner	0.735	2	Owner
34	Delay in material to be supplied by the owner	0.721	3	Process
44	Shortage of labours	0.706	4	Labour
6	Change of order by owner during construction	0.705	5	Owner
8	Slowness in decision making process by owner	0.705	6	Owner
19	Inadequate contractor's work	0.69	7	Contractor
42	Delay in approving design documents	0.683	8	Process
31	Rain effect on construction activities	0.676	9	Site
51	Poor means of contracting	0.676	10	Authority

4.2Time optimization of Villas With the help of the primavera

This table includes the time of completion of each activity after rescheduled which is done by the contractor and the time of completion of each activity rescheduled as per primavera which is presently scheduled. There are total 80 no villas and these villas divided in to four phases each phase consists of the 20 villas. The villas are divided in to four phases because there are only five no of repetitions of shuttering are available in this project. After that with the help of time of completion as per tender and the time of completion after rescheduled which is done by the contractor and the time of completion of presently scheduled which is done with the

help of the primavera we find out the no of delays occurred in the project and the no of delays reduced.

Table 4.2: Time optimization of the project

	Villa No-4013 To 4032 (Ph-1)		
Sr. No.	**Activities**	**Completion of Rescheduled as per Primavera (Presently scheduled)**	**Completion of each activity after rescheduled (done by the contractor)**
1	Layout for Excavation	14-Mar-18	19-Mar-18
2	Excavation for Pcc	15-Mar-18	15-Mar-18
3	Footing Pcc	16-Mar-18	18-Mar-18
4	Footing Layout	28-Mar-18	31-Mar-18
5	Steel Cutting & Binding	24-Mar-18	25-Mar-18
6	Footing Shuttering	21-Mar-18	24-Mar-18
7	Footing Casting	22-Mar-18	27-Mar-18
8	Pedestal Layout	24-Mar-18	27-Mar-18
9	Pedestal Shuttering	26-Mar-18	30-Mar-18
10	Pedestal Casting	30-Mar-18	05-Apr-18
11	Backfilling	09-Apr-18	18-Apr-18
12	Layout + Ramming & Dressing for Plinth Beam	13-Apr-18	20-Apr-18
13	Pcc Plinth Beam	16-Apr-18	26-Apr-18
14	Plinth Beam Steel Cutting & Binding	18-Apr-18	25-Apr-18
15	Plinth Beam Shuttering	23-Apr-18	30-Apr-18
16	Plinth Beam Casting	23-Apr-18	30-Apr-18
17	Column Layout & Starter Making	28-Apr-18	06-May-18
18	Column Steel Cutting & Binding	01-May-18	08-May-18
19	Column Shuttering	07-May-18	14-May-18
20	Column Casting	09-May-18	18-May-18
21	Slab+ Stair Case Shuttering	14-May-18	21-May-18

22	Slab+ Stair Case Steel Cutting & Binding	18-May-18	26-May-18
23	Slab Conduiting (Electrical)	20-May-18	29-May-18
24	Slab+ Stair Case Casting	22-May-18	01-Jun-18
25	Parapet+Mumty Column Steel Binding	27-May-18	04-Jun-18
26	Parapet+Mumty Column Shuttering	29-May-18	06-Jun-18
27	Parapet+Mumty Column Casting	31-May-18	08-Jun-18
28	Mumty Slab Shuttering	02-Jun-18	10-Jun-18
29	Mumty Slab Steel Cutting & Binding +Electrical Conduiting	04-Jun-18	13-Jun-18
30	Mumty Slab Casting	07-Jun-18	17-Jun-18
31	Layout for Block Work	10-Jun-18	18-Jun-18
32	Block Work + Lintel Fixing	14-Jun-18	23-Jun-18
33	Electrical Wall Conduiting	21-Jun-18	02-Jul-18
34	Plumbing Work (Under Ground) Including Chamber Making	21-Jun-18	06-Jul-18
35	Door Frame Fixing	24-Jul-18	10-Apr-18
36	Compacting, Ramming & Dressing Gf for Pcc	29-Jun-18	11-Jul-18
37	Antitermite& Pcc Gf	04-Jul-18	16-Jul-18
38	Internal Plaster	09-Jul-18	22-Jul-18
39	Staircase Marble Fixing	14-Jul-18	27-Jul-18
40	Internal Tile Fixing	19-Jul-18	01-Aug-18
41	External Plastering	19-Jul-18	07-Aug-18
42	Brick Coba Gf Slab	23-Jul-18	11-Aug-18
43	Unistone Brick Tile Fixing External	28-Jul-18	13-Aug-18
44	Internal Painting	09-Aug-18	09-Aug-18
45	Door Shutter & Hardware Fixing	25-Aug-18	25-Aug-18
46	Cp & Chinaware Fixing	31-Aug-18	31-Aug-18
47	Internal Wiring + Switches & Socket	31-Aug-18	31-Aug-18
48	Paint Final Coat	05-Sep-18	25-Sep-18

	Villa N0-4033 To 4052(Ph-2)		
Sr. No.			
1	Layout for Excavation	06-May-18	18-May-18
2	Excavation for Pcc	07-May-18	15-May-18
3	Footing Pcc	08-May-18	17-May-18
4	Footing Layout	22-May-18	03-Jun-18
5	Steel Cutting & Binding	22-May-18	29-May-18
6	Footing Shuttering	22-May-18	29-May-18
7	Footing Casting	24-May-18	02-Jun-18
8	Pedestal Layout	24-May-18	04-Jun-18
9	Pedestal Shuttering	26-May-18	06-Jun-18
10	Pedestal Casting	30-May-18	08-Jun-18
11	Backfilling	09-Jun-18	22-Jun-18
12	Layout + Ramming & Dressing For Plinth Beam	15-Jun-18	26-Jun-18
13	Pcc Plinth Beam	18-Jun-18	28-Jun-18
14	Plinth Beam Steel Cutting & Binding	20-Jun-18	02-Jul-18
15	Plinth Beam Shuttering	25-Jun-18	06-Jul-18
16	Plinth Beam Casting	25-Jun-18	08-Jul-18
17	Column Layout & Starter Making	29-Jun-18	12-Jul-18
18	Column Steel Cutting & Binding	04-Jul-18	18-Jul-18
19	Column Shuttering	19-Jul-18	03-Aug-18
20	Column Casting	23-Jul-18	05-Aug-18
21	Slab+ Stair Case Shuttering	01-Aug-18	17-Aug-18
22	Slab+ Stair Case Steel Cutting & Binding	05-Aug-18	20-Aug-18
23	Slab Conduiting (Electrical)	06-Aug-18	21-Aug-18
24	Slab+ Stair Case Casting	08-Aug-18	23-Aug-18
25	Parapet+Mumty Column Steel Binding	13-Aug-18	27-Aug-18
26	Parapet+Mumty Column Shuttering	15-Aug-18	01-Sep-18
27	Parapet+Mumty Column Casting	17-Aug-18	03-Sep-18

28	Mumty Slab Shuttering	19-Aug-18	03-Sep-18
29	Mumty Slab Steel Cutting & Binding +Electrical Conduiting	21-Aug-18	09-Sep-18
30	Mumty Slab Casting	24-Aug-18	12-Sep-18
31	Layout for Block Work	25-Aug-18	11-Sep-18
32	Block Work + Lintel Fixing	29-Aug-18	18-Sep-18
33	Electrical Wall Conduiting	05-Sep-18	24-Sep-18
34	Plumbing Work (Under Ground) Including Chamber Making	05-Sep-18	28-Sep-18
35	Door Frame Fixing	08-Oct-18	02-Nov-18
36	Compacting, Ramming & Dressing Gf for Pcc	15-Sep-18	05-Oct-18
37	Antitermite& Pcc Gf	20-Sep-18	12-Oct-18
38	Internal Plaster	25-Sep-18	16-Oct-18
39	Staircase Marble Fixing	30-Sep-18	23-Oct-18
40	Internal Tile Fixing	04-Oct-18	27-Oct-18
41	External Plastering	04-Oct-18	04-Nov-18
42	Brick Coba Gf Slab	08-Oct-18	06-Nov-18
43	Unistone Brick Tile Fixing External	14-Oct-18	04-Nov-18
44	Internal Painting	30-Oct-18	20-Nov-18
45	Door Shutter & Hardware Fixing	12-Nov-18	01-Dec-18
46	Cp & Chinaware Fixing	19-Nov-18	08-Dec-18
47	Internal Wiring + Switches & Socket	19-Nov-18	08-Dec-18
48	Paint Final Coat	25-Nov-18	27-Dec-18
	Villa No-4053 To 4072(Ph-3)		
Sr. No.			
1	Layout for Excavation	01-Jul-18	16-Jul-18
2	Excavation for Pcc	02-Jul-18	14-Jul-18
3	Footing Pcc	02-Jul-18	17-Jul-18
4	Footing Layout	16-Jul-18	01-Aug-18
5	Steel Cutting & Binding	16-Jul-18	29-Jul-18
6	Footing Shuttering	16-Jul-18	29-Jul-18

7	Footing Casting	18-Jul-18	02-Aug-18
8	Pedestal Layout	17-Jul-18	02-Aug-18
9	Pedestal Shuttering	19-Jul-18	06-Aug-18
10	Pedestal Casting	24-Jul-18	12-Aug-18
11	Backfilling	02-Aug-18	25-Aug-18
12	Layout + Ramming & Dressing For Plinth Beam	11-Aug-18	31-Aug-18
13	Pcc Plinth Beam	13-Aug-18	03-Sep-18
14	Plinth Beam Steel Cutting & Binding	15-Aug-18	04-Sep-18
15	Plinth Beam Shuttering	25-Aug-18	14-Sep-18
16	Plinth Beam Casting	25-Aug-18	17-Sep-18
17	Column Layout & Starter Making	30-Aug-18	21-Sep-18
18	Column Steel Cutting & Binding	04-Sep-18	27-Sep-18
19	Column Shuttering	21-Sep-18	16-Oct-18
20	Column Casting	30-Sep-18	22-Oct-18
21	Slab+ Stair Case Shuttering	16-Oct-18	05-Nov-18
22	Slab+ Stair Case Steel Cutting & Binding	20-Oct-18	09-Nov-18
23	Slab Conduiting (Electrical)	22-Oct-18	14-Nov-18
24	Slab+ Stair Case Casting	24-Oct-18	17-Nov-18
25	Parapet+Mumty Column Steel Binding	29-Oct-18	24-Nov-18
26	Parapet+Mumty Column Shuttering	31-Oct-18	26-Nov-18
27	Parapet+Mumty Column Casting	02-Nov-18	27-Nov-18
28	Mumty Slab Shuttering	04-Nov-18	29-Nov-18
29	Mumty Slab Steel Cutting & Binding +Electrical Conduiting	05-Nov-18	01-Dec-18
30	Mumty Slab Casting	08-Nov-18	06-Dec-18
31	Layout for Block Work	09-Nov-18	08-Dec-18
32	Block Work + Lintel Fixing	13-Nov-18	29-Sep-18
33	Electrical Wall Conduiting	21-Nov-18	11-Oct-18
34	Plumbing Work(Under Ground)Including Chamber Making	21-Nov-18	11-Oct-18

35	Door Frame Fixing	24-Dec-18	16-Oct-18
36	Compacting, Ramming & Dressing Gf For Pcc	01-Dec-18	22-Oct-18
37	Antitermite& Pcc Gf	06-Dec-18	26-Oct-18
38	Internal Plaster	11-Dec-18	31-Oct-18
39	Staircase Marble Fixing	16-Dec-18	06-Nov-18
40	Internal Tile Fixing	22-Dec-18	10-Nov-18
41	External Plastering	22-Dec-18	29-Jan-19
42	Brick Coba Gf Slab	26-Dec-18	01-Feb-18
43	Unistone Brick Tile Fixing External	01-Jan-19	01-Feb-19
44	Internal Painting	15-Jan-19	11-Feb-19
45	Door Shutter & Hardware Fixing	29-Jan-19	04-Mar-19
46	Cp & Chinaware Fixing	04-Feb-19	04-Mar-19
47	Internal Wiring + Switches & Socket	05-Feb-19	08-Mar-19
48	Paint Final Coat	08-Feb-19	18-Mar-19
	Villa No-4073 To 4092(Ph-4)		
Sr. No.			
1	Layout for Excavation	26-Aug-18	13-Sep-19
2	Excavation for Pcc	27-Aug-18	14-Sep-18
3	Footing Pcc	27-Aug-18	15-Sep-18
4	Footing Layout	10-Sep-18	30-Sep-18
5	Steel Cutting & Binding	10-Sep-18	27-Sep-18
6	Footing Shuttering	11-Sep-18	28-Sep-18
7	Footing Casting	13-Sep-18	02-Oct-18
8	Pedestal Layout	13-Sep-18	02-Oct-18
9	Pedestal Shuttering	15-Sep-18	04-Oct-18
10	Pedestal Casting	18-Sep-18	10-Oct-18
11	Backfilling	27-Sep-18	24-Oct-18
12	Layout + Ramming & Dressing For Plinth Beam	06-Oct-18	29-Oct-18
13	Pcc Plinth Beam	08-Oct-18	03-Nov-18
14	Plinth Beam Steel Cutting & Binding	10-Oct-18	04-Nov-18

15	Plinth Beam Shuttering	24-Oct-18	15-Nov-18
16	Plinth Beam Casting	24-Oct-18	15-Nov-18
17	Column Layout & Starter Making	28-Oct-18	19-Nov-18
18	Column Steel Cutting & Binding	02-Nov-18	25-Nov-18
19	Column Shuttering	24-Nov-18	13-Dec-18
20	Column Casting	05-Dec-18	25-Dec-18
21	Slab+ Stair Case Shuttering	17-Dec-18	06-Jan-19
22	Slab+ Stair Case Steel Cutting & Binding	21-Dec-18	10-Jan-19
23	Slab Conduiting (Electrical)	22-Dec-18	11-Jan-19
24	Slab+ Stair Case Casting	24-Dec-18	13-Jan-19
25	Parapet+Mumty Column Steel Binding	29-Dec-18	18-Jan-19
26	Parapet+Mumty Column Shuttering	01-Jan-19	23-Jan-19
27	Parapet+Mumty Column Casting	03-Jan-19	23-Jan-19
28	Mumty Slab Shuttering	06-Jan-19	26-Jan-19
29	Mumty Slab Steel Cutting & Binding +Electrical Conduiting	08-Jan-19	30-Jan-19
30	Mumty Slab Casting	11-Jan-19	03-Feb-19
31	Layout for Block Work	12-Jan-19	01-Feb-19
32	Block Work + Lintel Fixing	16-Jan-19	07-Feb-19
33	Electrical Wall Conduiting	24-Jan-19	14-Feb-19
34	Plumbing Work (Under Ground) Including Chamber Making	24-Jan-19	19-Feb-19
35	Door Frame Fixing	26-Feb-19	26-Mar-19
36	Compacting, Ramming & Dressing Gf for Pcc	03-Feb-19	26-Feb-19
37	Antitermite& Pcc Gf	08-Feb-19	03-Mar-19
38	Internal Plaster	14-Feb-19	08-Mar-19
39	Staircase Marble Fixing	19-Feb-19	13-Mar-19
40	Internal Tile Fixing	25-Feb-19	16-Mar-19
41	External Plastering	25-Feb-19	25-Mar-19
42	Brick Coba Gf Slab	28-Feb-19	27-Mar-19

43	Unistone Brick Tile Fixing External	06-Mar-19	27-Mar-19
44	Internal Painting	21-Mar-19	11-Apr-19
45	Door Shutter & Hardware Fixing	03-Apr-19	03-May-19
46	Cp & Chinaware Fixing	09-Apr-19	10-May-19
47	Internal Wiring + Switches & Socket	09-Apr-19	14-May-19
48	Paint Final Coat	25-Apr-19	27-May-19

Completion of project as per tender scheduled is 31st March 2019 i.e. 432 days from the starting of project.

Completion of project as per revised scheduled is 27th May 2019 i.e. 489 days from the starting of the project.

Completion of the project as per rescheduled using primavera is 25th April 2019 i.e. 458 days from the starting of the project.

No. delays occurred = Completion of tender scheduled – completion of revised scheduled

= 489- 432

= 57 days

No of delays reduced= Completion of revised scheduled – completion of project as pre rescheduled using primavera

= 489-458

= 31 days

4.3Cost optimization of project with the help of the primavera

This table includes the cost of the 80 no. of villas and the cost of each activity of villa as per rescheduling using primavera and the cost after the rescheduled the project using by the contractor.

Table4.3: Cost optimization

Sr. No.	**Villas 4013 to 4092**		

	Activities	**Completion of Rescheduled as per Primavera (Presently scheduled) (RS)**	**Completion of each activity after rescheduled (done by the contractor) (RS)**
1.	Layout for Excavation	600000	552940
2.	Excavation for Pcc	384000	384000
3.	Footing Pcc	929944	910964
4.	Footing Layout	182928	173780
5.	Steel Cutting & Binding	97920	92376
6.	Footing Shuttering	287592	287592
7.	Footing Casting	2319200	2222568
8.	Pedestal Layout	467968	419224
9.	Pedestal Shuttering	859560	779560
10.	Pedestal Casting	378000	346000
11.	Backfilling	638976	570512
12.	Layout + Ramming & Dressing for Plinth Beam	800000	720000
13.	Pcc Plinth Beam	112000	108000
14.	Plinth Beam Steel Cutting & Binding	546960	522960
15.	Plinth Beam Shuttering	1939728	1859728
16.	Plinth Beam Casting	1870536	1870536
17.	Column Layout & Starter Making	480000	440000
18.	Column Steel Cutting & Binding	1093920	1013920
19.	Column Shuttering	2063120	1942320
20.	Column Casting	1045152	1005152
21.	Slab+ Stair Case Shuttering	2209832	2209832
22.	Slab+ Stair Case Steel Cutting & Binding	1805208	1684000
23.	Slab Conduiting (Electrical)	560000	440000

24.	Slab+ Stair Case Casting	3726680	3684000
25.	Parapet+Mumty Column Steel Binding	102280	98280
26.	Parapet+Mumty Column Shuttering	197000	181000
27.	Parapet+Mumty Column Casting	185144	177144
28.	Mumty Slab Shuttering	163888	103776
29.	Mumty Slab Steel Cutting & Binding +Electrical Conduiting	120000	80000
30.	Mumty Slab Casting	278208	266000
31.	Layout for Block Work	400000	380000
32.	Block Work + Lintel Fixing	2400000	2300000
33.	Electrical Wall Conduiting	1944000	1724000
34.	Plumbing Work(Under Ground)Including Chamber Making	17150200	16550200
35.	Door Frame Fixing	15002816	14602816
36.	Compacting, Ramming & Dressing Gf For Pcc	3536000	3136000
37.	Antitermite& Pcc Gf	408000	363600
38.	Internal Plaster	10320000	9520000
39.	Staircase Marble Fixing	3200000	2900000
40.	Internal Tile Fixing	13741776	13545332
41.	External Plastering	2148800	2028000
42.	Brick Coba Gf Slab	15103768	14803768
43.	Unistone Brick Tile Fixing External	2704912	2504912
44.	Internal Painting	4092440	3609200
45.	Door Shutter & Hardware Fixing	2397816	1997816
46.	Cp & Chinaware Fixing	3991056	3900000

47.	Internal Wiring + Switches & Socket	6024880	5624880
48.	Paint Final Coat	2656000	2456000

Cost of the project as per tender = 120956789RS

Cost of the project after revised schedule=127092688RS

Cost of the project after rescheduling using primavera=133128208RS

In this we seen that the cost of the project has been increased if we reduced the delayed our project cost is increased. Also, in this if the project is completed within given time as per the tender schedule then there is no need to be the finding out the delays.

CHAPTER 5

CONCLUSION

5.1 Conclusion

This study has been identified the 61 causes of delays in the construction industry of a project of villas, which were divided in to the nine major groups with the help of the literature review and a questionaries' survey data of 17 responses. This study gives us the all the delay factors. The relative important index is used for the ranking of delays with the help of the questionnaire survey data. After that the BIM model is used for the visualization of the project of the villa. After that a time optimization and the cost optimization are done with the help of the primavera. A total of the 31 delays reduced, if we reduced the delay the cost of the project increases. This study is carried if the contractor needs the work as soon as possible.

5.2 Future Scope

In this study the delay factors analysed with the help of the relative important index. Rescheduling is done with the help of the primavera software. Some other type of methodology can be adopted for the delay analysis in construction projects but Integrated approach is adopted for the delay section.

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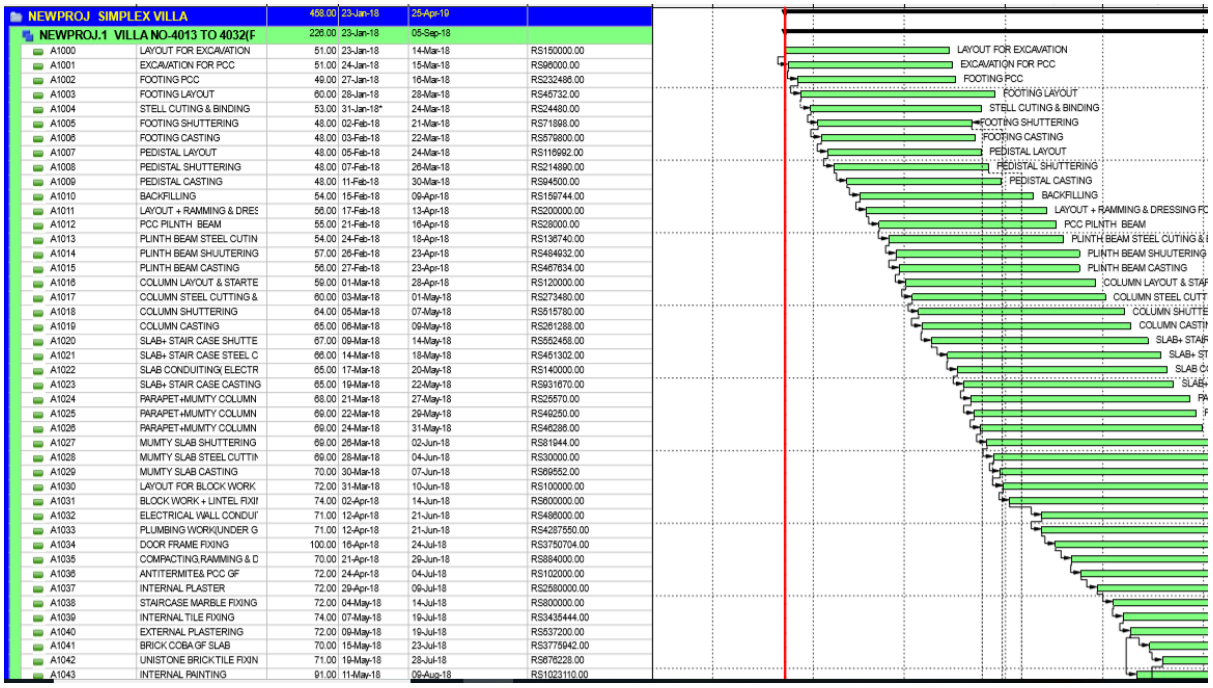
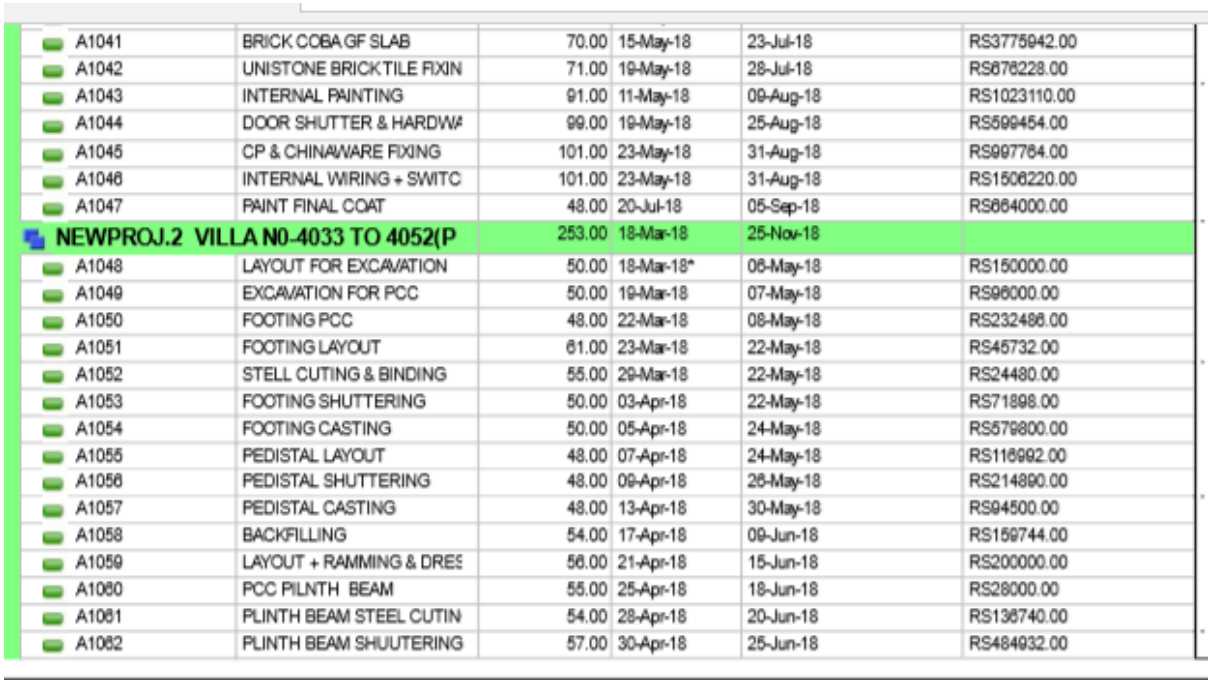
Annexure

This includes the rescheduling of the project with the help of the primavera software



NEWPROJ SIMPLEX VILLA		468.00	23-Jan-18	25-Apr-19	
NEWPROJ.1 VILLA NO-4013 TO 4032(F		226.00	23-Jan-18	05-Sep-18	
A1000	LAYOUT FOR EXCAVATION	51.00	23-Jan-18	14-Mar-18	RS150000.00
A1001	EXCAVATION FOR PCC	51.00	24-Jan-18	15-Mar-18	RS96000.00
A1002	FOOTING PCC	49.00	27-Jan-18	16-Mar-18	RS232486.00
A1003	FOOTING LAYOUT	60.00	28-Jan-18	28-Mar-18	RS45732.00
A1004	STELL CUTING & BINDING	53.00	31-Jan-18*	24-Mar-18	RS24480.00
A1005	FOOTING SHUTTERING	48.00	02-Feb-18	21-Mar-18	RS71898.00
A1006	FOOTING CASTING	48.00	03-Feb-18	22-Mar-18	RS579800.00
A1007	PEDISTAL LAYOUT	48.00	05-Feb-18	24-Mar-18	RS116992.00
A1008	PEDISTAL SHUTTERING	48.00	07-Feb-18	26-Mar-18	RS214890.00
A1009	PEDISTAL CASTING	48.00	11-Feb-18	30-Mar-18	RS94500.00
A1010	BACKFILLING	54.00	15-Feb-18	09-Apr-18	RS159744.00
A1011	LAYOUT + RAMMING & DRES	56.00	17-Feb-18	13-Apr-18	RS200000.00
A1012	PCC PILNTH BEAM	55.00	21-Feb-18	16-Apr-18	RS28000.00
A1013	PLINTH BEAM STEEL CUTIN	54.00	24-Feb-18	18-Apr-18	RS136740.00
A1014	PLINTH BEAM SHUUTERING	57.00	26-Feb-18	23-Apr-18	RS484932.00
A1015	PLINTH BEAM CASTING	56.00	27-Feb-18	23-Apr-18	RS467634.00
A1016	COLUMN LAYOUT & STARTE	59.00	01-Mar-18	28-Apr-18	RS120000.00
A1017	COLUMN STEEL CUTTING &	60.00	03-Mar-18	01-May-18	RS273480.00
A1018	COLUMN SHUTTERING	64.00	05-Mar-18	07-May-18	RS515780.00
A1019	COLUMN CASTING	65.00	06-Mar-18	09-May-18	RS261288.00
A1020	SLAB+ STAIR CASE SHUTTE	67.00	09-Mar-18	14-May-18	RS552458.00
A1021	SLAB+ STAIR CASE STEEL C	66.00	14-Mar-18	18-May-18	RS451302.00
A1022	SLAB CONDUITING ELECTR	65.00	17-Mar-18	20-May-18	RS140000.00
A1023	SLAB+ STAIR CASE CASTING	65.00	19-Mar-18	22-May-18	RS931670.00
A1024	PARAPET+MUMTY COLUMN	68.00	21-Mar-18	27-May-18	RS25570.00
A1025	PARAPET+MUMTY COLUMN	69.00	22-Mar-18	29-May-18	RS49250.00
A1026	PARAPET+MUMTY COLUMN	69.00	24-Mar-18	31-May-18	RS46286.00
A1027	MUMTY SLAB SHUTTERING	69.00	26-Mar-18	02-Jun-18	RS81944.00
A1028	MUMTY SLAB STEEL CUTTI	69.00	28-Mar-18	04-Jun-18	RS30000.00
A1029	MUMTY SLAB CASTING	70.00	30-Mar-18	07-Jun-18	RS69552.00
A1030	LAYOUT FOR BLOCK WORK	72.00	31-Mar-18	10-Jun-18	RS100000.00
A1031	BLOCK WORK + LINTEL FIXI	74.00	02-Apr-18	14-Jun-18	RS600000.00
A1032	ELECTRICAL WALL CONDUI	71.00	12-Apr-18	21-Jun-18	RS486000.00
A1033	PLUMBING WORK(UNDER G	71.00	12-Apr-18	21-Jun-18	RS4287550.00
A1034	DOOR FRAME FIXING	100.00	16-Apr-18	24-Jul-18	RS3750704.00
A1035	COMPACTING,RAMMING & D	70.00	21-Apr-18	29-Jun-18	RS884000.00
A1036	ANTITERMITE& PCC GF	72.00	24-Apr-18	04-Jul-18	RS102000.00
A1037	INTERNAL PLASTER	72.00	29-Apr-18	09-Jul-18	RS2580000.00
A1038	STAIRCASE MARBLE FIXING	72.00	04-May-18	14-Jul-18	RS800000.00
A1039	INTERNAL TILE FIXING	74.00	07-May-18	19-Jul-18	RS3435444.00
A1040	EXTERNAL PLASTERING	72.00	09-May-18	19-Jul-18	RS537200.00
A1041	BRICK COBA GF SLAB	70.00	15-May-18	23-Jul-18	RS3775942.00
A1042	UNISTONE BRICK TILE FIXIN	71.00	19-May-18	28-Jul-18	RS676228.00
A1043	INTERNAL PAINTING	91.00	11-May-18	09-Aug-18	RS1023110.00

Fig6: Rescheduling done by primavera



A1041	BRICK COBA GF SLAB	70.00	15-May-18	23-Jul-18	RS3775942.00
A1042	UNISTONE BRICK TILE FIXIN	71.00	19-May-18	28-Jul-18	RS676228.00
A1043	INTERNAL PAINTING	91.00	11-May-18	09-Aug-18	RS1023110.00
A1044	DOOR SHUTTER & HARDWA	99.00	19-May-18	25-Aug-18	RS599454.00
A1045	CP & CHINAWARE FIXING	101.00	23-May-18	31-Aug-18	RS997764.00
A1046	INTERNAL WIRING + SWITC	101.00	23-May-18	31-Aug-18	RS1506220.00
A1047	PAINT FINAL COAT	48.00	20-Jul-18	05-Sep-18	RS664000.00
NEWPROJ.2 VILLA N0-4033 TO 4052(P		253.00	18-Mar-18	25-Nov-18	
A1048	LAYOUT FOR EXCAVATION	50.00	18-Mar-18*	06-May-18	RS150000.00
A1049	EXCAVATION FOR PCC	50.00	19-Mar-18	07-May-18	RS96000.00
A1050	FOOTING PCC	48.00	22-Mar-18	08-May-18	RS232486.00
A1051	FOOTING LAYOUT	61.00	23-Mar-18	22-May-18	RS45732.00
A1052	STELL CUTING & BINDING	55.00	29-Mar-18	22-May-18	RS24480.00
A1053	FOOTING SHUTTERING	50.00	03-Apr-18	22-May-18	RS71898.00
A1054	FOOTING CASTING	50.00	05-Apr-18	24-May-18	RS579800.00
A1055	PEDISTAL LAYOUT	48.00	07-Apr-18	24-May-18	RS116992.00
A1056	PEDISTAL SHUTTERING	48.00	09-Apr-18	26-May-18	RS214890.00
A1057	PEDISTAL CASTING	48.00	13-Apr-18	30-May-18	RS94500.00
A1058	BACKFILLING	54.00	17-Apr-18	09-Jun-18	RS159744.00
A1059	LAYOUT + RAMMING & DRES	56.00	21-Apr-18	15-Jun-18	RS200000.00
A1060	PCC PILNTH BEAM	55.00	25-Apr-18	18-Jun-18	RS28000.00
A1061	PLINTH BEAM STEEL CUTIN	54.00	28-Apr-18	20-Jun-18	RS136740.00
A1062	PLINTH BEAM SHUUTERING	57.00	30-Apr-18	25-Jun-18	RS484932.00

Fig7: Rescheduling done by primavera

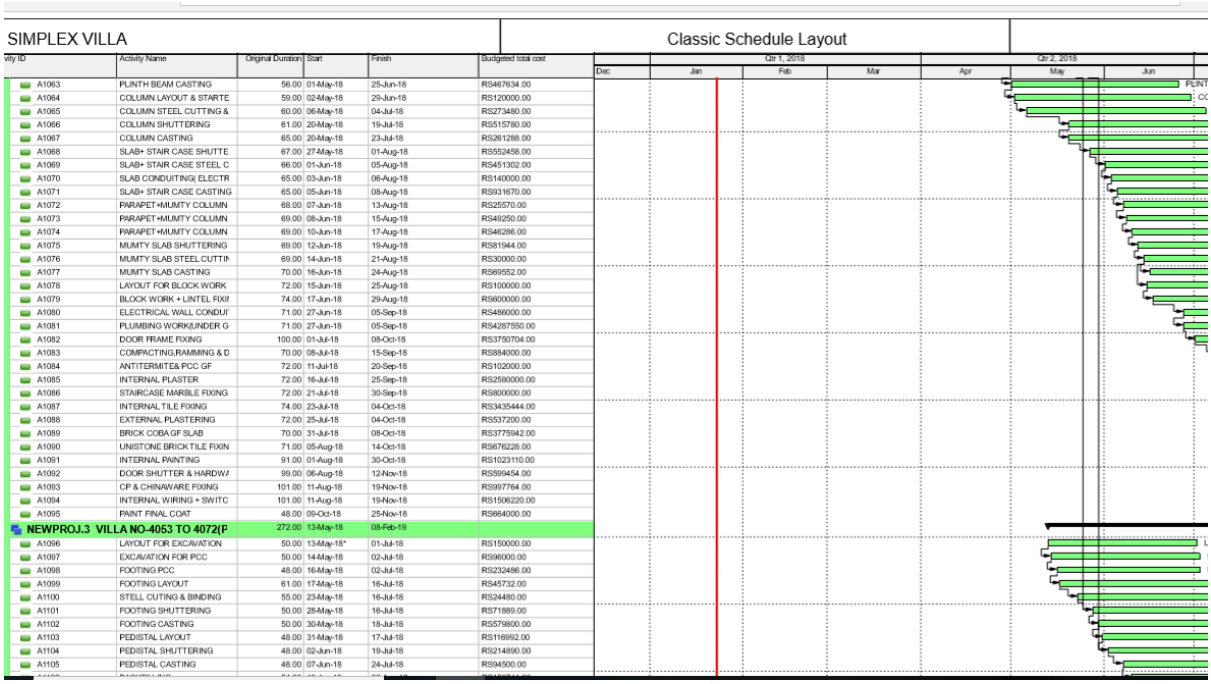


Fig8: Rescheduling done by primavera

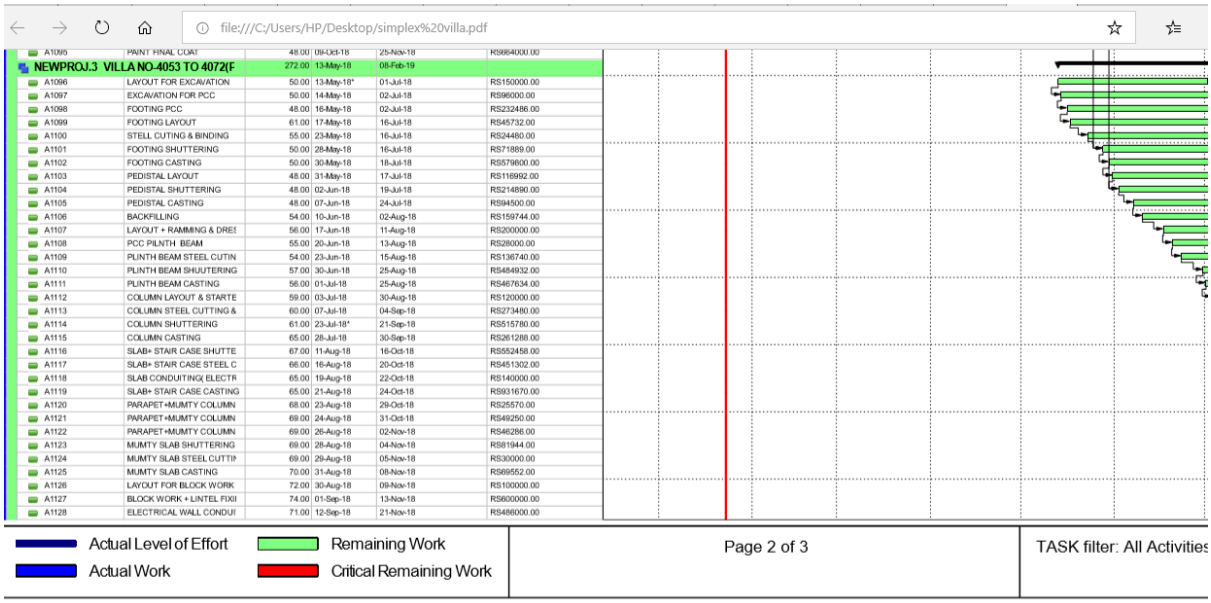


Fig9: Rescheduling done by primavera

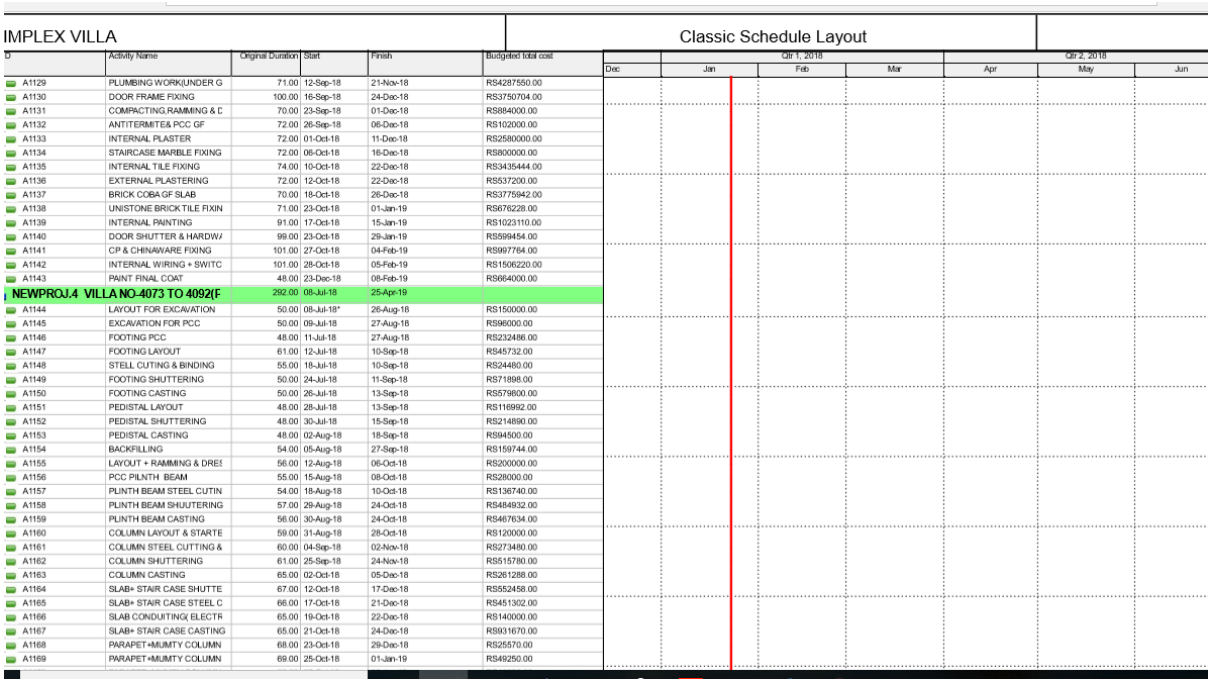


Fig10: Rescheduling done by primavera

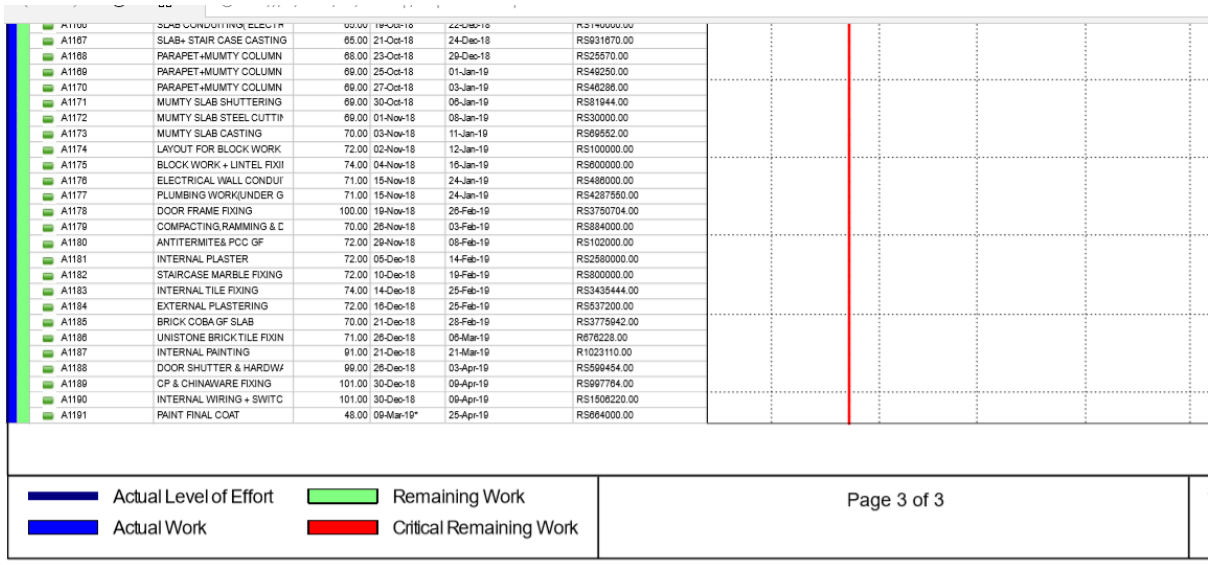


Fig11: Rescheduling done by primavera