

FACILITATING FOR BETTER CONSTRUCTION OPERATION AND MANAGEMENT FOR BUILDING USING BIM

A Thesis

Submitted in partial fulfillment of the requirements for the award of
Master of Architecture degree in Building Management

By

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**DEPARTMENT OF ARCHITECTURE
SCHOOL OF BUILDING AND ENVIRONMENT**

SATHYABAMA

**INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)**

Accredited with Grade "A" by NAAC

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This is to certify that this Report is the Bonafide work of **SHAKTHIVEL E (40840015)** who carried out the Thesis entitled "**Facilitating for better construction operation and management for building using BIM** "under our supervision from January 2022 to May 2022

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ABSTRACT

Building Information Management (BIM) models are transforming how buildings are designed and constructed, and can facilitate multidisciplinary coordination, and integrate 3D design, analysis, cost estimating, and construction scheduling. By extending the model into the post-occupancy period, BIM models can be used to support Facilities Management and Building Operations, and offer a consolidated interface for information regarding all aspects of building operational performance.

Four key challenges must be overcome to develop BIM models suitable for Operations management:

- Identification of critical information required to inform Operational decisions,
- The high level of effort to create new or modify existing BIM models for the building(s),
- The management of information transfer between real-time operations and monitoring systems and the BIM model, and
- The handling of uncertainty based on incomplete building documentation.

I have evaluated the Interactive Coordination Process in construction operation management using building information model and also to explore the Clash Detection, Constructability, Analysis, Time & Cost Estimation (4D & 5D), Integration, Element Based Model, Collaboration and Team Building Communication using BIM.

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LIST OF SYMBOLS AND ABBREVIATIONS

RFID	-	Radio-frequency identification
O&M	-	Operation and Management
AIM	-	AssetInformationModel

CHAPTER 1

INTRODUCTON

1.1 AIM

- Evaluating the Interactive Coordination Process in construction operation management using building information model

1.2 RESEARCH OBJECTIVES

- Clash Detection
- Constructability
- Analysis
- Time & Cost Estimation (4D & 5D)
- Integration
- Element Based Models
- Collaboration and Team Building
- Communication

1.3 SCOPE OF WORK

7D – FACILITY MANAGEMENT – This dimension includes 6D + INFRASTRUCTURE AND REAL ESTATE MANAGEMENT + FACILITY AND OPERATION MANAGEMENT Information

- The real beneficiary of a BIM model and its use in management throughout the completion of the infrastructure or construction.
- 7D BIM helps to monitor the management of the facility or operation right from the design stage to the demolition stage.
- The dimension is used to track important asset data such as its status, maintenance/operation manuals, warranty information, technical specifications. It may provide information about a component's manufacturer, installation date, maintenance schedule, configuration details for best performance, energy requirements and decommissioning information

BIM Dimensions

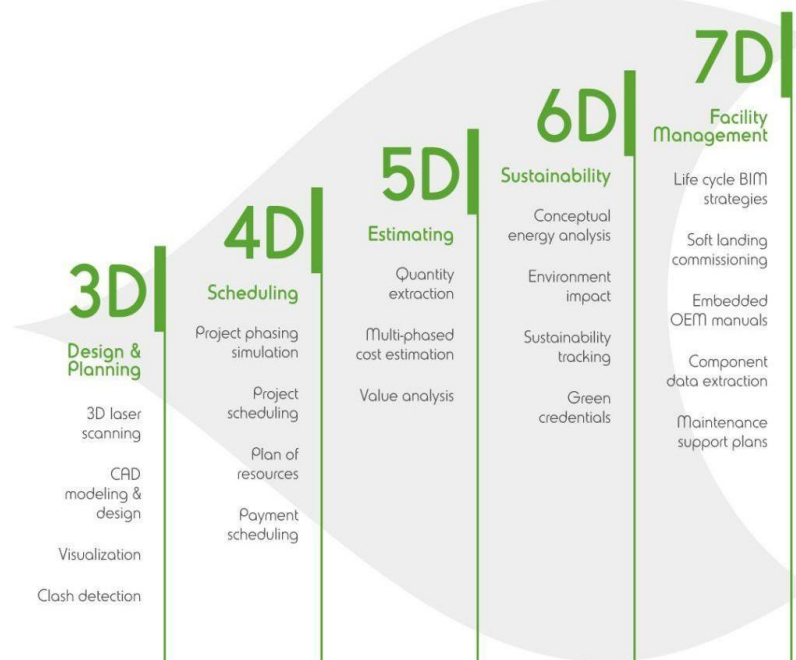


Fig 1.1 BIM dimensions

PLAN	DESIGN	CONSTRUCT	OPERATE
Existing Conditions Modeling			
Cost Estimation			
Phase Planning			
Site Analysis			
Programming			
	Design Reviews		
	Code Validation		
	LEED Evaluation		
	Other Eng. Analysis		
	Mechanical Analysis		
	Lighting Analysis		
	Structural Analysis		
	Energy Analysis		
	Design Authoring		
		3D Coordination	
		3D Control and Planning	
		Digital Fabrication	
		Construction System Design	
		Site Utilization Planning	
			Record Model
			Disaster Planning
			Space Mgmt/Tracking
			Asset Management
			Building System Analysis
			Maintenance Scheduling

Primary BIM Uses
 Secondary BIM Uses

Fig 1.2 Design classifications

1.4 RESEARCH METHODOLOGY



Fig 1.3 Research methodology

1.5 LIMITATION

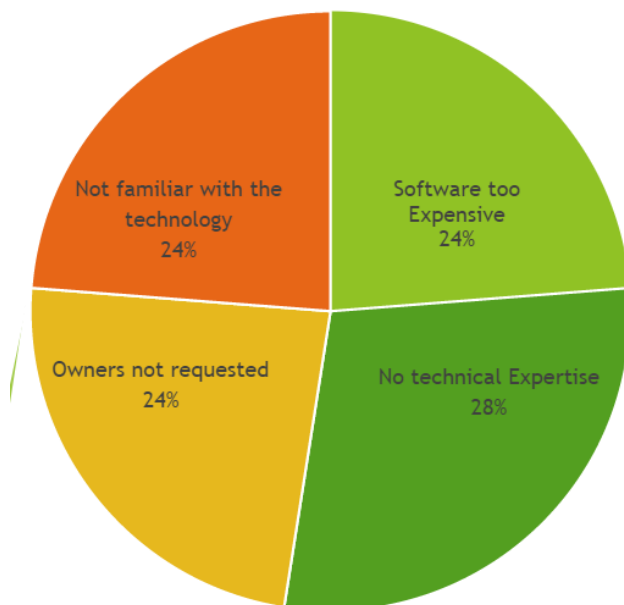


Fig 1.4 Limitation chart

- BIM is still in its infancy stage in India
- Still has not reached a stage where users can boast about the cost savings for a Project due to BIM implementation because a majority of BIM users in India have not seen a full cycle of BIM implementation for their Projects
- Organizations remain skeptical about BIM implementation and its perceived benefits

CHAPTER 2

LITERATURE REVIEW

2.1 A BUILDING INFORMATION MANAGEMENT (BIM) FRAMEWORK AND SUPPORTING CASE STUDY FOR EXISTING BUILDING OPERATIONS, MAINTENANCE AND SUSTAINABILITY

2.1.1 INTRODUCTION

Building Information Management (BIM) models are transforming how buildings are designed and constructed. BIM is not simply a 3D CAD tool, but is rather akin to a database that allows a wide range of information about the attributes of and relationships between various building elements. The use of BIM in asset management is well established, however this paper seeks to go beyond the use of construction BIM models in operations and examine the development of new BIM models for existing buildings, presenting a case study and synthesizing a framework. The term “7D” will be used to refer to these models, building upon previous definitions

2.1.2 LITERATURE REVIEW

The use of BIM in Operation management and post-occupancy phases of the Project is rapidly becoming an area of research focus. Particular technologies, such as the

- use of cloud computing ,
- passive RFID tags and
- 3D scanning

Has facilitated adoption and added value to BIM in an Operations context. In addition, there has been a substantial effort to interface between BIM models and third-party software

2.1.3 SCOPE OF WORK (CHALLENGES AND PROPOSED SOLUTIONS)

Four key challenges must be overcome to develop 7D BIM models

- (1) identifying the critical information required for sustainable operations,
- (2) managing information transfer between the BIM model ,
- (3) managing the level of effort to create the model, and
- (4) handling uncertainty where building documentation is incomplete

2.1.4 RESEARCH METHODOLOGY

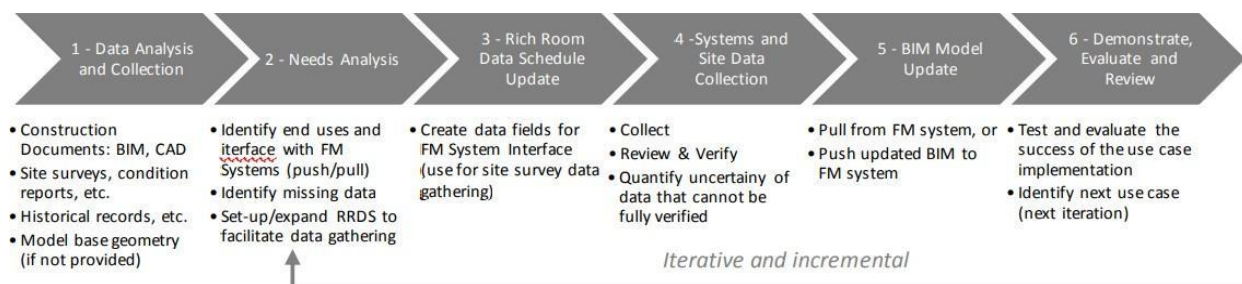


Fig 2.1 Research methodology

2.1.5 CONCLUSION

- The processes used in the model iterations completed to date have successfully addressed the challenges outlined in this paper .This will allow the tying in of preventative, reactive and deferred maintenance and building condition assessments with space reporting, hazard inventory and eventually scheduling.

2.2 DESIGN AND DEVELOPMENT OF BIM MODELS TO SUPPORT OPERATIONS AND MAINTENANCE

2.2.1 INTRODUCTION

The O&M (operation management)costs of a Project are often overlooked by Project stakeholders during the design and construction phase, despite evidence suggesting that they contribute to over half of the total lifecycle costs. This can increase to over 80% for significant infrastructure such as roads, rail and bridges. There is extensive evidence within the literature to demonstrate that BIM adoption supports the reduction of design and construction cost, increase in productivity and improved risk management processes.

2.2.2 LITERATURE REVIEW ASSET MANAGEMENT

Asset Management involves the balancing of costs, opportunities and risks against the desired performance of assets to achieve the organizational objectives. Asset management does not focus on the physical asset itself but the value that it can provide to an organization

2.2.3SCOPE OF WORK

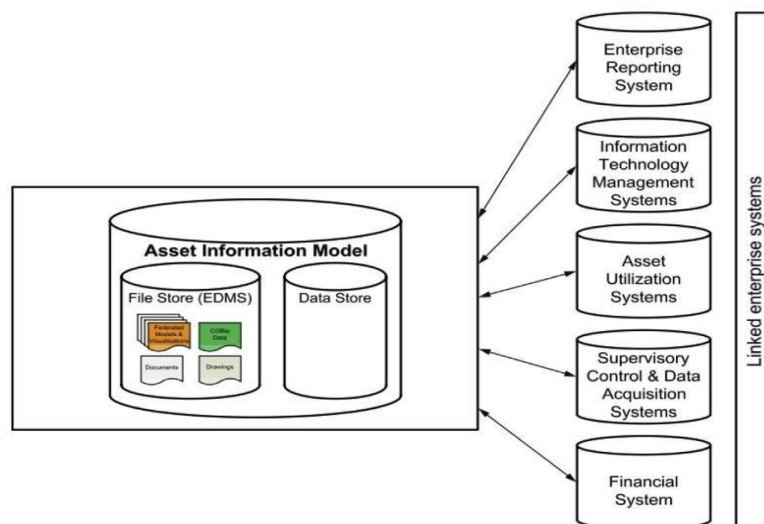


Fig 2.1 Asset management flow chart

- BIM model with architectural, structural and MEP objects

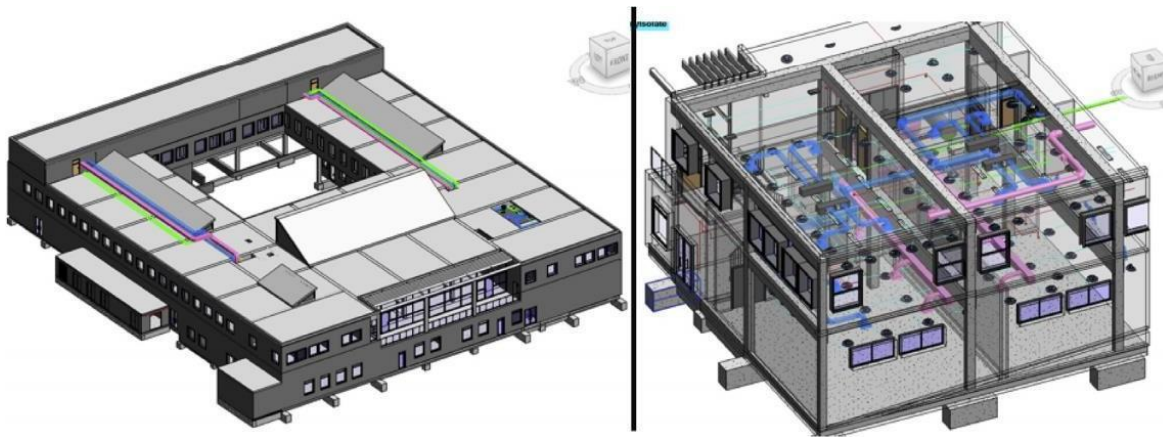


Fig 2.3 BIM model on architectural, structural and MEP

- Asset hierarchy classification within the BIM model.

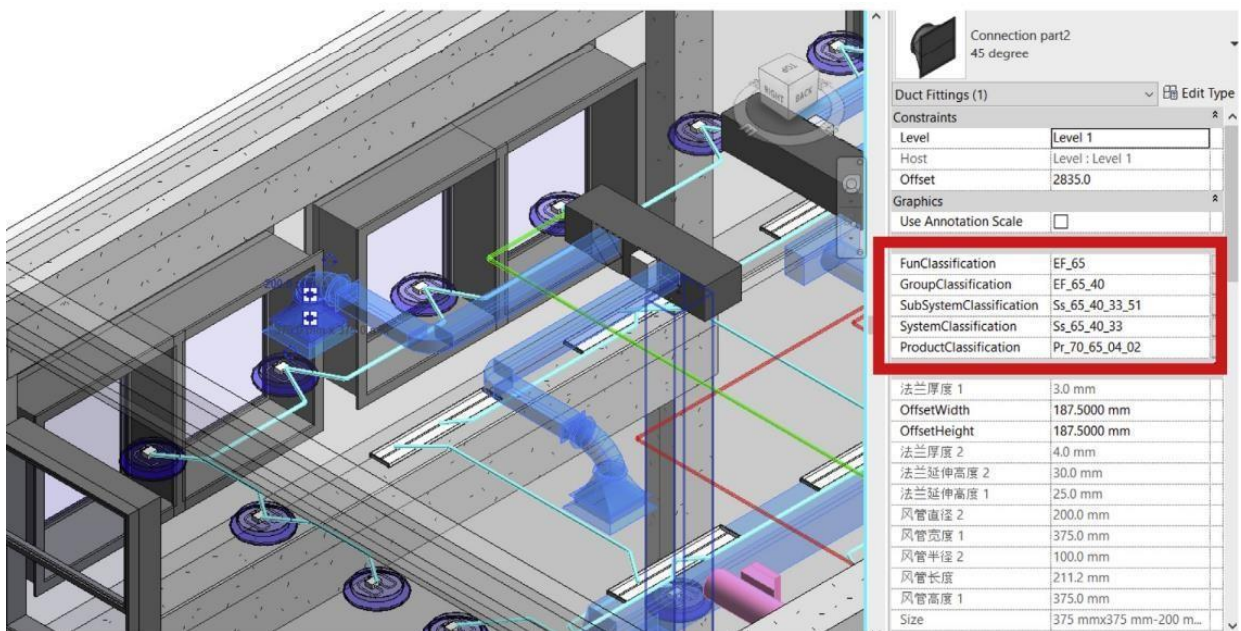


Fig 2.4 Asset hierarchy classification within the BIM model

- Overview of the BIM model extraction platform

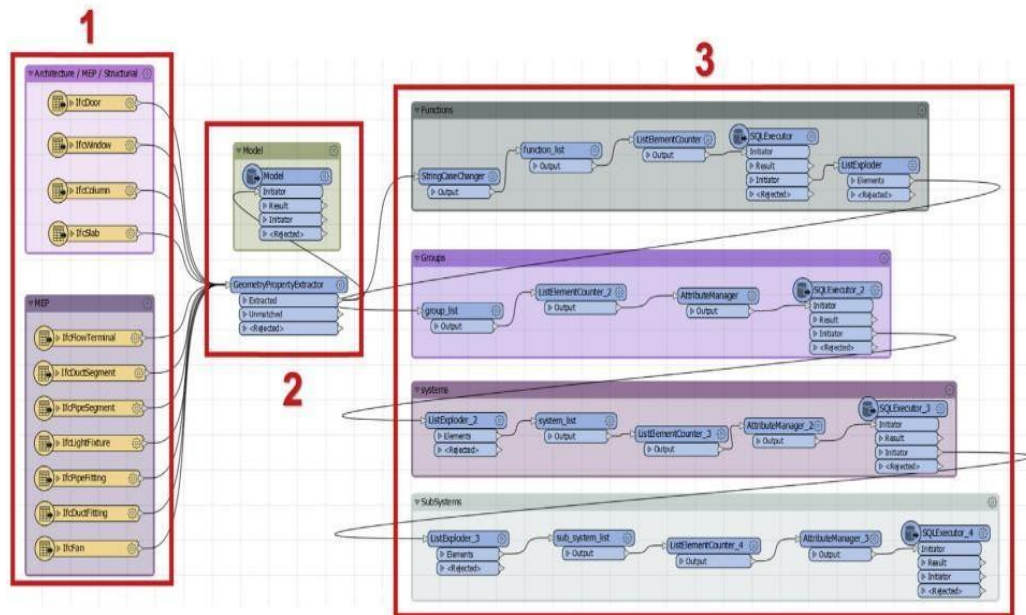
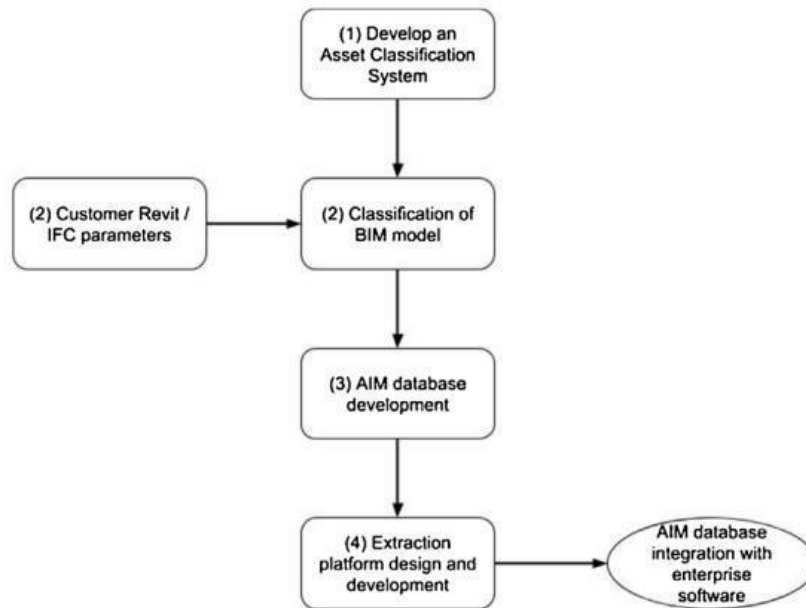


Fig 2.5 Overview of the BIM model extraction platform

2.2.4 RESEARCH METHODOLOGY



2.2.5 CONCLUSION

This paper proposes a methodology that allows for the development of an AIM. Specifically, it supports the exchange of data directly from an IFC into a relational database based on BIM object classification. This addresses one of the critical challenges of exchanging BIM-related information from the design and construction phases into the O&M phase

2.3 A NEW PARADIGM FOR VISUAL INTERACTIVE MODELING AND SIMULATION FOR CONSTRUCT

2.3.1 INTRODUCTION

Building Information Modeling (BIM) is one of the most promising developments in the Architecture, Engineering and Construction (AEC) industries. BIM simulates the construction Project in a virtual environment. With BIM technology, an accurate virtual model of a building is digitally constructed. When completed, the computer-generated model contains precise geometry and relevant data needed to support the construction, fabrication and procurement activities

2.3.2 SCOPE OF WORK

- Visualization: 3D renderings can be easily generated in-house with little additional effort.
- Fabrication/shop drawings: it is easy to generate shop drawings for various building systems, e.g, the sheet metal ductwork shop drawing can be quickly produced once the model is complete.
- Code reviews: fire departments and other officials may use these models for building Projects review.
- Forensic analysis: a building information model can easily be adapted to graphically illustrate potential failures, leaks, evacuation plans, etc.
- Facilities management: facilities management departments can use BIM for renovations, space planning, and maintenance operations.
- Cost estimating: BIM software(s) have built-in cost estimating features. Material quantities are automatically extracted and changed when any changes are made in the model
- Construction sequencing: a building information model can be effectively used to create material ordering, fabrication, and delivery schedules for all building components.
- Conflict, interference and collision detection: because BIM models are created, to scale, in 3D space, all major systems can be visually checked for interferences. This process can verify that piping does not intersect with steel beams, ducts or walls

2.3.3 RESEARCH METHODOLOGY

- Comparison between Conventional CAD and new BIM Approach

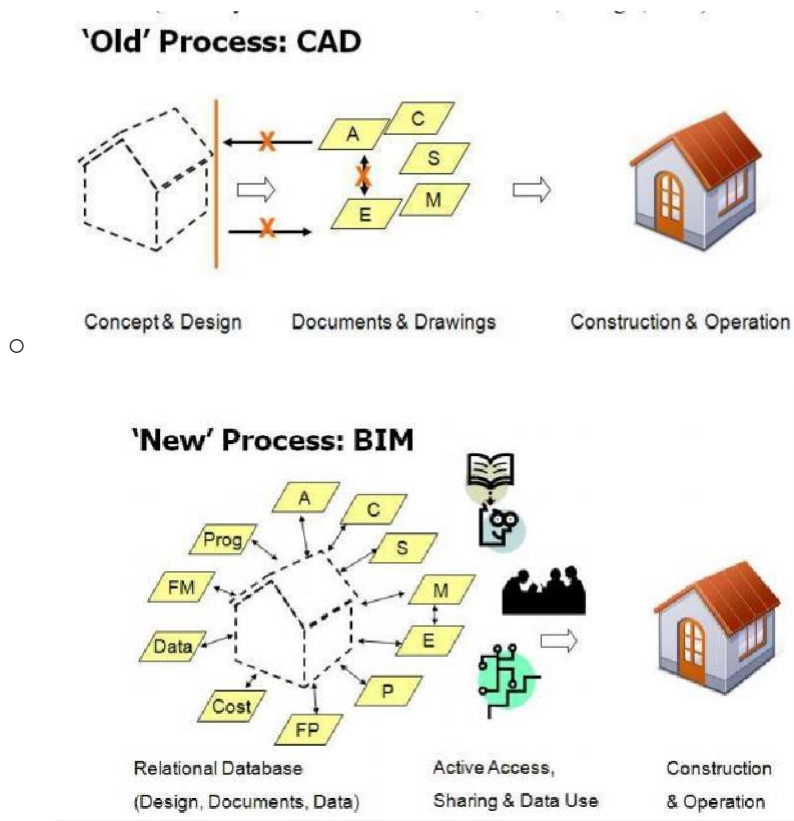


Fig 2.6 Comparison between Conventional CAD and new BIM Approach

2.3.4 CONCLUSION

- Building Information Modeling (BIM) has emerged as an innovative way to manage Projects. Many researchers and practitioners have indicated that the BIM technology is set to become as indispensable to building design and construction as the proverbial tee square or hammer and nail. As the use of BIM accelerates, collaboration within Project teams should increase, which will lead to improved profitability, reduced costs, better time management and Improved customer/client relationships.

LITERATURE CASE STUDY

2.4 HILTON AQUARIUM, ATLANTA , GEORGIA



Fig 2.7 Hilton aquarium view

- Project name: Hilton Aquarium, Atlanta, Georgia
- Project scope: \$46M, 484,000 SF hotel and parking structure
- Contract type: Guaranteed maximum price
- Design assist: GC and subcontractors on board at design definition phase
- BIM scope: Design coordination, clash detection, and work sequencing

A building information model is created consisting of the architectural, structural and MEP systems of the proposed building as shown in. The model was created during the design development phase using detail level information from subcontractors based on drawings from the designers. Using this model, the Project team achieved the following benefits.

2.4.1 SCOPE OF WORK

- Proactively identified 590 conflicts between structural and MEP components and resolved them prior to field installations
- Design coordination enhanced
- Additional cost increases avoided
- Enabled Owner scope revisions without issuing change orders
- Accommodated design changes

2.4.2 INFERENCE

- Through frequent coordination sessions, the Project team was able to quickly identify and resolve system conflicts, saving an estimated \$200,000 in extras and avoiding months of potential delays

2.5 CASE STUDY 02: ONE ISLAND EAST PROJECT, HONG KONG

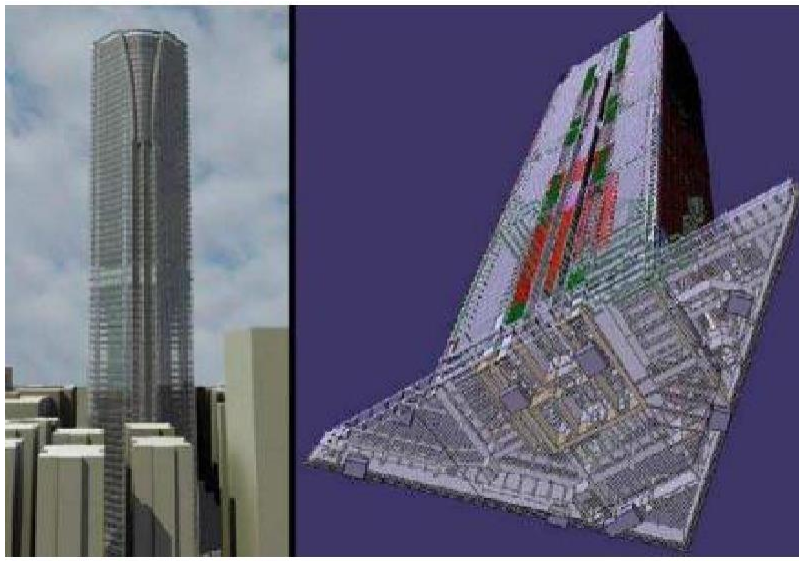


Fig 2.8 OIE Project view

This case study documents the implementation of BIM to manage the functional and financial relationships between design, construction, and facility management on a large, complex Project by an owner-developer. The owner identified the potential of BIM to manage information more efficiently and save time and cost over the Project life cycle. The brief Project data is as follows:

2.5.1 SCOPE OF WORK

- Project name: One Island East, Hong Kong, China
- Project scope: \$300M, 1,517,711 SF commercial building
- Structure: Reinforced concrete
- Exterior: Aluminum curtain wall
- Owner: Swire Properties Limited
- Contractor: Gammon Construction Limited
- BIM scope: Design coordination, clash detection, and work sequencing

2.5.2 INFERENCE

- The One Island East (OIE) is a large commercial office building with seventy floors.

Almost all coordination issues were managed using BIM. Through BIM, over 2000 clashes and errors were identified prior to bidding and construction, which means that a substantial cost savings was achieved, compared to the incomplete design information inherent in a traditional 2D process.

CHAPTER 3

METHODOLOGY

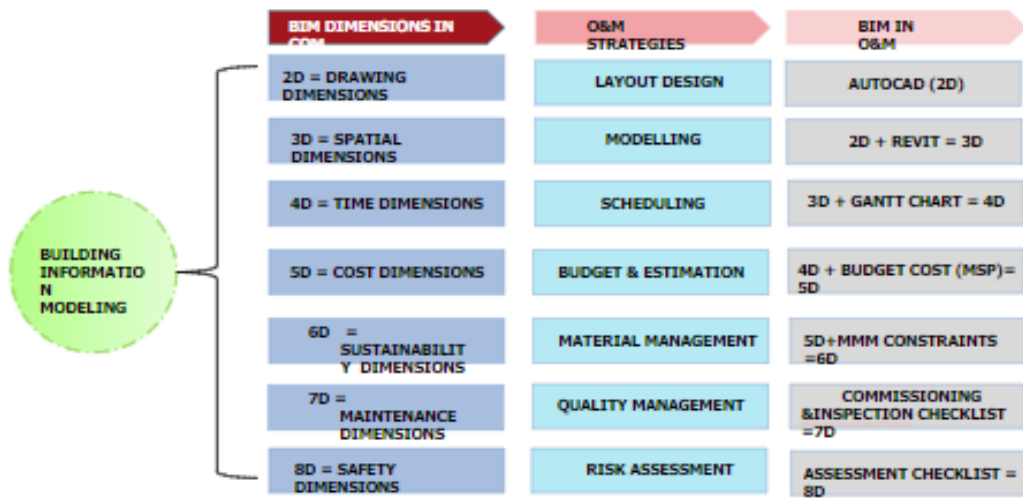


Fig 3.1 Introduction to BIM

3.1 CASE STUDY 01 - EARTH EXCAVATION



Client Name :EK Infra Pvt Ltd
 Typology : Midrise Residential Apartments
 Building Height : G+3
 ARCHITECT : RED ARCHITECTS
 Drawings were carefully studied and proceeded with following scope of work.



Fig 3.2 Project-1 view

3.1.1 2D IN BIM LAYOUT

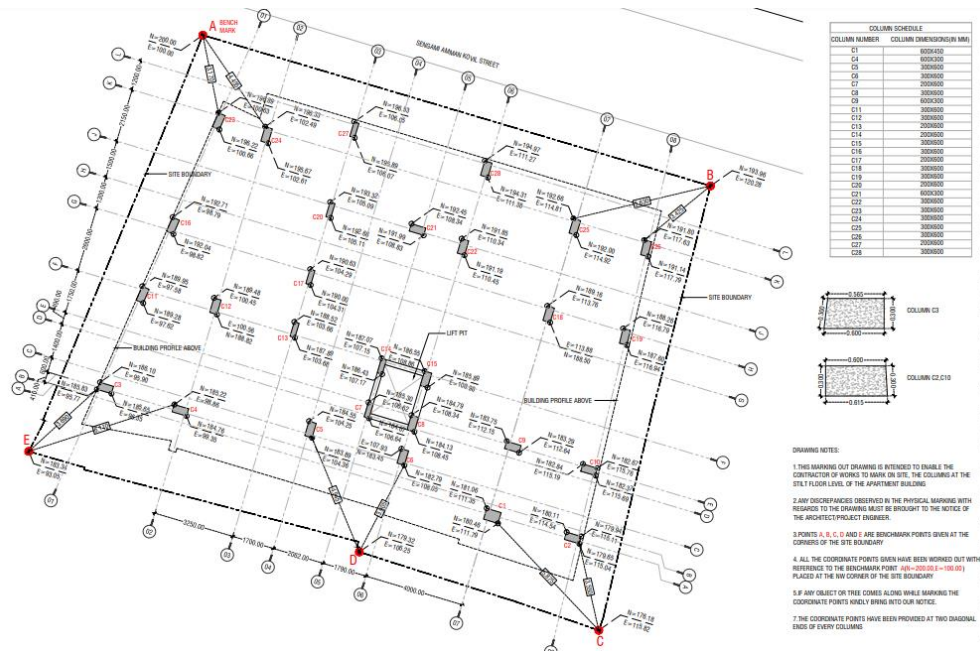


Fig 3.3 Project-1 plan

3.1.2 3D IN BIM - REVIT MODEL

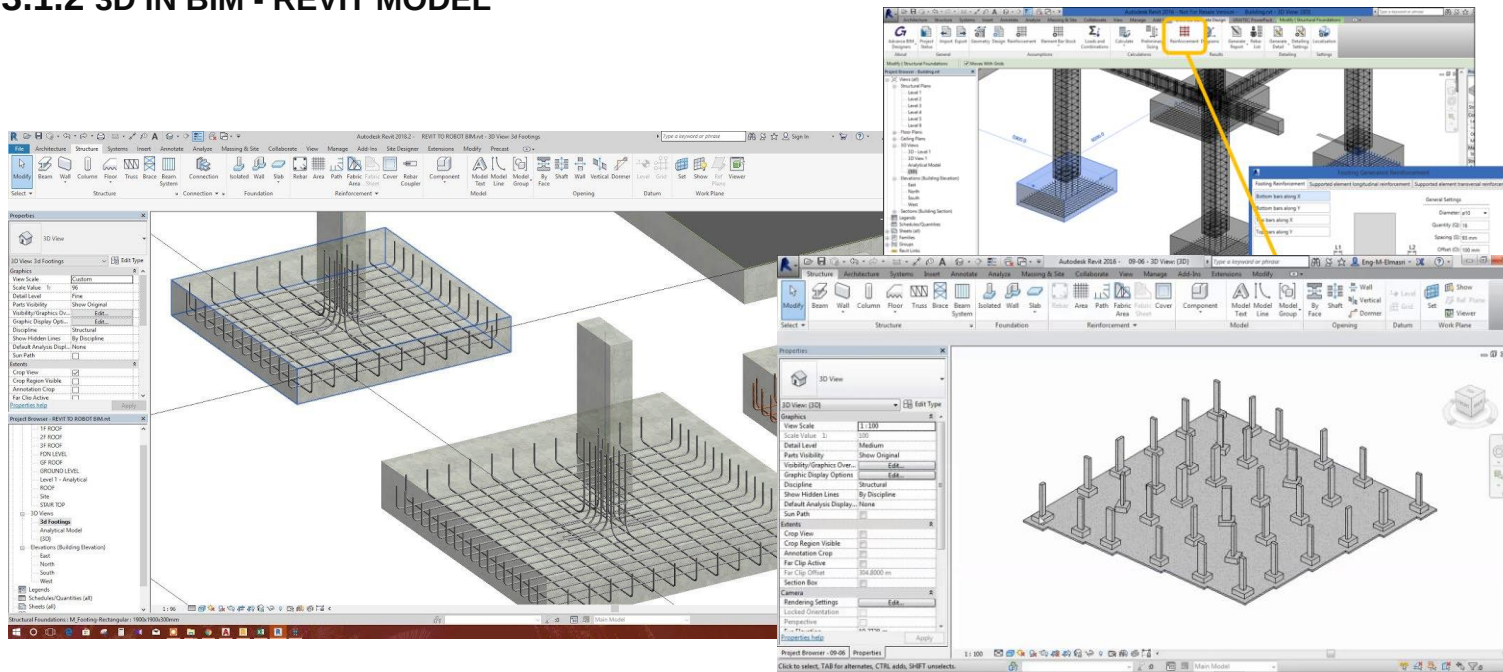


Fig 3.4 Project-3D BIM model

Family and Type	Material: Volume	Family and Type	Material: Volume	Family and Type	Material: Volume
Basic Wall: Generic - 9" Brick	341.06	Basic Wall: Generic - 9" Brick	101.55	Basic Wall: Generic - 9" Brick	206.25
Basic Wall: Generic - 9" Brick	37.9	Basic Wall: Generic - 9" Brick	178	Basic Wall: Generic - 9" Brick	22.92
Basic Wall: Generic - 9" Brick	170.5	Basic Wall: Generic - 9" Brick	19.78	Basic Wall: Generic - 9" Brick	206.25
Basic Wall: Generic - 9" Brick	18.94	Basic Wall: Generic - 9" Brick	801.12	Basic Wall: Generic - 9" Brick	22.92
Basic Wall: Generic - 9" Brick	331.94	Basic Wall: Generic - 9" Brick	89.01	Basic Wall: Generic - 9" Brick	204.88
Basic Wall: Generic - 9" Brick	36.88	Basic Wall: Generic - 9" Brick	219.31	Basic Wall: Generic - 9" Brick	22.76
Basic Wall: Generic - 9" Brick	185.56	Basic Wall: Generic - 9" Brick	24.37	Basic Wall: Generic - 9" Brick	206.25
Basic Wall: Generic - 9" Brick	20.62	Basic Wall: Generic - 9" Brick	24.75	Basic Wall: Generic - 9" Brick	22.92
Basic Wall: Generic - 9" Brick	88.56	Basic Wall: Generic - 9" Brick	2.75	Basic Wall: Generic - 9" Brick	247.5
Basic Wall: Generic - 9" Brick	9.84	Basic Wall: Generic - 9" Brick	319.5	Basic Wall: Generic - 9" Brick	27.5
Basic Wall: Generic - 9" Brick	368.72	Basic Wall: Generic - 9" Brick	35.5	Basic Wall: Generic - 9" Brick	204.88
Basic Wall: Generic - 9" Brick	40.97	Basic Wall: Generic - 9" Brick	597	Basic Wall: Generic - 9" Brick	22.76
Basic Wall: Generic - 9" Brick	125.47	Basic Wall: Generic - 9" Brick	66.33	Basic Wall: Generic - 9" Brick	204.88
Basic Wall: Generic - 9" Brick	13.94	Basic Wall: Generic - 9" Brick	213.13	Basic Wall: Generic - 9" Brick	22.76
Basic Wall: Generic - 9" Brick	53.97	Basic Wall: Generic - 9" Brick	23.68	Basic Wall: Generic - 9" Brick	163.63
Basic Wall: Generic - 9" Brick	6	Basic Wall: Generic - 9" Brick	558.56	Basic Wall: Generic - 9" Brick	18.18
Basic Wall: Generic - 9" Brick	98.91	Basic Wall: Generic - 9" Brick	62.06	Basic Wall: Generic - 9" Brick	38.16
Basic Wall: Generic - 9" Brick	10.99	Basic Wall: Generic - 9" Brick	213.13	Basic Wall: Generic - 9" Brick	4.24
Basic Wall: Generic - 9" Brick	262.88	Basic Wall: Generic - 9" Brick	23.68	Basic Wall: Generic - 9" Brick	40.56
Basic Wall: Generic - 9" Brick	29.21	Basic Wall: Generic - 9" Brick	206.25	Basic Wall: Generic - 9" Brick	4.51
Basic Wall: Generic - 9" Brick	669.81	Basic Wall: Generic - 9" Brick	22.92	Basic Wall: Generic - 9" Brick	267.06
Basic Wall: Generic - 9" Brick	74.42	Basic Wall: Generic - 9" Brick	206.25	Basic Wall: Generic - 9" Brick	29.67
Basic Wall: Generic - 9" Brick	213.13	Basic Wall: Generic - 9" Brick	22.92	Basic Wall: Generic - 9" Brick	37.47
Basic Wall: Generic - 9" Brick	23.68	Basic Wall: Generic - 9" Brick	206.25	Basic Wall: Generic - 9" Brick	4.16
Basic Wall: Generic - 9" Brick	133.63	Basic Wall: Generic - 9" Brick	22.92	Basic Wall: Generic - 9" Brick	33.69
Basic Wall: Generic - 9" Brick	14.85	Basic Wall: Generic - 9" Brick	204.88	Basic Wall: Generic - 9" Brick	3.74
Basic Wall: Generic - 9" Brick	114.94	Basic Wall: Generic - 9" Brick	22.76	Basic Wall: Generic - 9" Brick	42.09
Basic Wall: Generic - 9" Brick	12.77	Basic Wall: Generic - 9" Brick	204.88	Basic Wall: Generic - 9" Brick	4.68
Basic Wall: Generic - 9" Brick	125.81	Basic Wall: Generic - 9" Brick	22.76	Basic Wall: Generic - 9" Brick	126.84
Basic Wall: Generic - 9" Brick	13.98	Basic Wall: Generic - 9" Brick	204.88	Basic Wall: Generic - 9" Brick	14.09
Basic Wall: Generic - 9" Brick	907.31	Basic Wall: Generic - 9" Brick	22.76	Basic Wall: Generic - 9" Brick	26.44
Basic Wall: Generic - 9" Brick	100.81	Basic Wall: Generic - 9" Brick	204.88	Basic Wall: Generic - 9" Brick	2.94
Basic Wall: Generic - 9" Brick	99.94	Basic Wall: Generic - 9" Brick	22.76	Basic Wall: Generic - 9" Brick	260.56
Basic Wall: Generic - 9" Brick	11.1	Basic Wall: Generic - 9" Brick	164.31	Basic Wall: Generic - 9" Brick	28.95
Basic Wall: Generic - 9" Brick	218.25	Basic Wall: Generic - 9" Brick	18.26	Basic Wall: Generic - 9" Brick	153.28
Basic Wall: Generic - 9" Brick	24.25	Basic Wall: Generic - 9" Brick	571.56	Basic Wall: Generic - 9" Brick	17.03
Basic Wall: Generic - 9" Brick	93.06	Basic Wall: Generic - 9" Brick	63.51	Basic Wall: Generic - 9" Brick	179.5
Basic Wall: Generic - 9" Brick	10.34	Basic Wall: Generic - 9" Brick	211.75	Basic Wall: Generic - 9" Brick	19.94
Basic Wall: Generic - 9" Brick	171.19	Basic Wall: Generic - 9" Brick	23.53	Basic Wall: Generic - 9" Brick	378.12
Basic Wall: Generic - 9" Brick	19.02	Basic Wall: Generic - 9" Brick	557.19	Basic Wall: Generic - 9" Brick	42.01
Basic Wall: Generic - 9" Brick	304.19	Basic Wall: Generic - 9" Brick	61.91	Basic Wall: Generic - 9" Brick	44.34
Basic Wall: Generic - 9" Brick	33.8	Basic Wall: Generic - 9" Brick	206.25	Basic Wall: Generic - 9" Brick	4.93
Basic Wall: Generic - 9" Brick	913.94	Basic Wall: Generic - 9" Brick	22.92	Basic Wall: Generic - 9" Brick	44.34
Basic Wall: Generic - 9" Brick	4.93	Basic Wall: Generic - 9" Brick	145.38	Basic Wall: Generic - 9" Brick	57.56
Basic Wall: Generic - 9" Brick	121.69	Basic Wall: Generic - 9" Brick	117.22	Basic Wall: Generic - 9" Brick	6.4
Basic Wall: Generic - 9" Brick	13.52	Basic Wall: Generic - 9" Brick	13.02	Basic Wall: Generic - 4.5" Brick	20.69
Basic Wall: Generic - 9" Brick	367.34	Basic Wall: Generic - 9" Brick	218.63	Basic Wall: Generic - 4.5" Brick	21.38



Fig 3.5 project-1 bim report and view

3.1.3 4D & 5D IN BIM - SCHEDULING

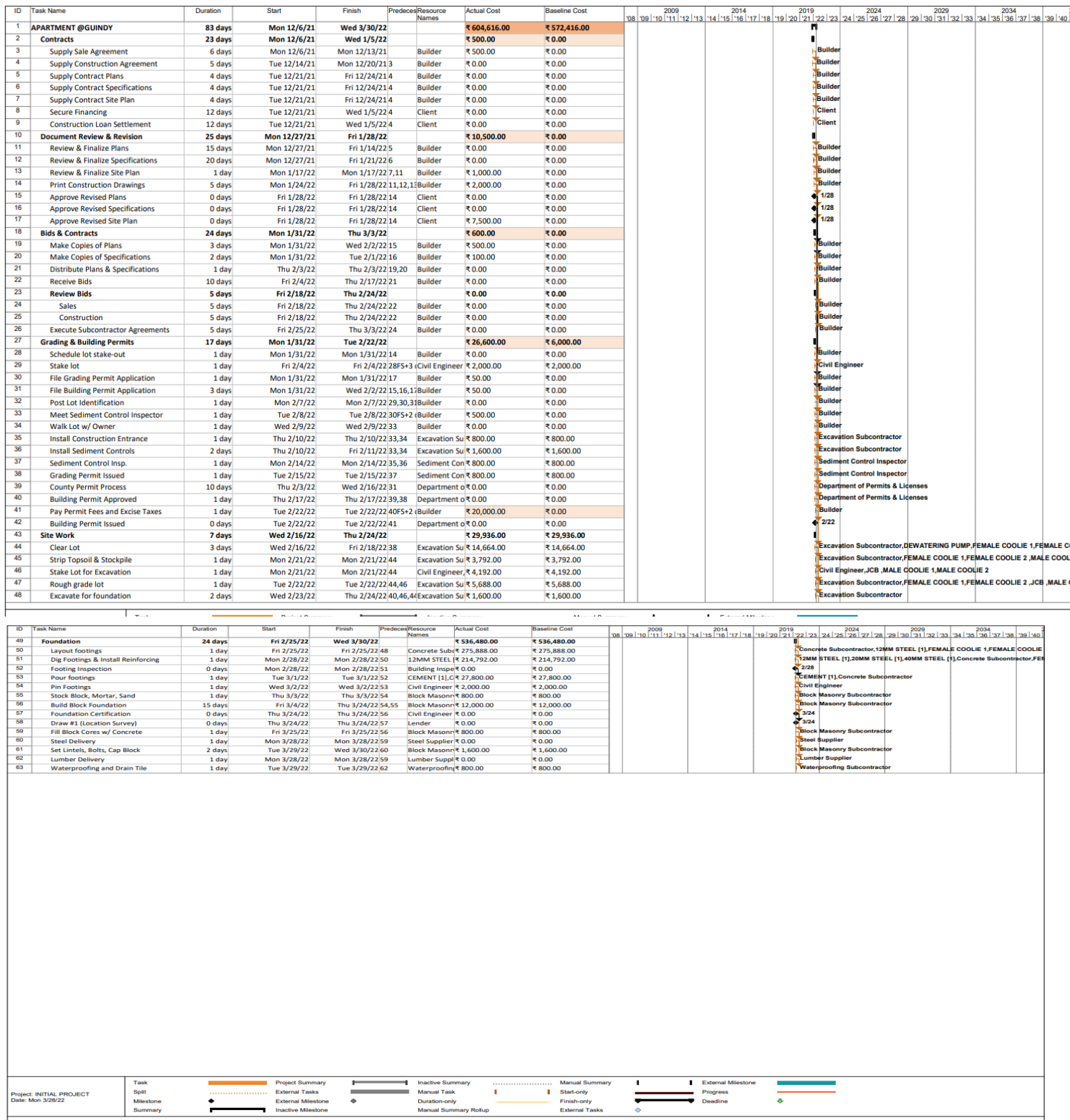


Fig 3.6 project-1 Scheduling

TIME SCHEDULING



4D BIM IN O&M

WORK PACKAGE	DURATION
MOBILISATION	06 DAYS
EXCAVATION	06 DAYS
SOIL FILLING	02 DAYS
SHUTTERING	03 DAYS
CONCRETING	02 DAYS
BACKFILLING	04 DAYS

Time Duration Calculation

Name	Remaining Work	Actual Work	Start	Finish
	0 hrs	0 hrs	NA	NA
MALE COOLIE 1	0 hrs	232 hrs	Tue 10/19/21	Mon 11/29/21
MALE COOLIE 2	0 hrs	232 hrs	Tue 10/19/21	Mon 11/29/21
MALE COOLIE 3	0 hrs	104 hrs	Wed 11/10/21	Mon 11/22/21
FEMALE COOLIE 1	0 hrs	152 hrs	Tue 10/19/21	Mon 11/22/21
FEMALE COOLIE 2	0 hrs	64 hrs	Mon 11/15/21	Mon 11/22/21
JCB	0 hrs	64 hrs	Tue 10/26/21	Mon 11/1/21
GROOVE CUTTER	0 hrs	40 hrs	Fri 11/5/21	Wed 11/10/21
VIBRATOR	0 hrs	104 hrs	Tue 11/2/21	Wed 11/24/21
PLATE COMPACTOR	0 hrs	72 hrs	Tue 11/2/21	Fri 11/26/21
POWER HAMMER AND DRILLS	0 hrs	72 hrs	Sat 11/6/21	Tue 11/16/21
DEWATERING PUMP	0 hrs	0 hrs	Tue 10/19/21	Tue 10/19/21

Fig 3.7 project-1 time scheduling

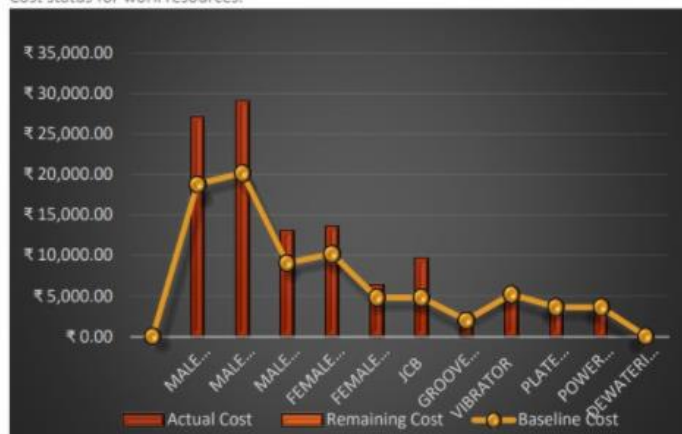
5D GANTT CHART

5D BIM = 3D + BUDGET AND COST .

COST OVERVIEW

COST STATUS

Cost status for work resources.



COST DISTRIBUTION

How costs are spread out amongst different resource types.



Fig 3.8 project-1 cost overview

5D BIM = 3D + BUDGET AND COST .

COST DETAILS

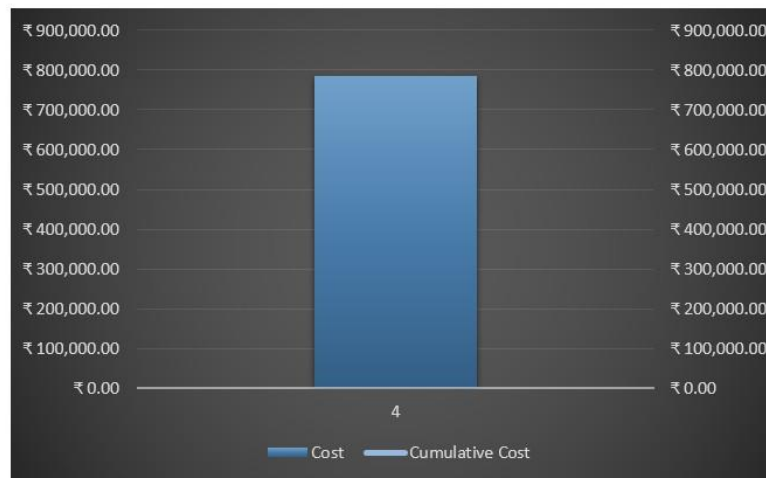
Cost details for all work resources.

Name	Actual Work	Actual Cost	Standard Rate
	0 hrs	₹ 0.00	₹ 0.00/hr
MALE COOLIE 1	232 hrs	₹ 27,000.00	₹ 125.00/hr
MALE COOLIE 2	232 hrs	₹ 29,000.00	₹ 125.00/hr
MALE COOLIE 3	104 hrs	₹ 13,000.00	₹ 125.00/hr
FEMALE COOLIE 1	152 hrs	₹ 13,600.00	₹ 100.00/hr
FEMALE COOLIE 2	64 hrs	₹ 6,400.00	₹ 100.00/hr
JCB	64 hrs	₹ 9,600.00	₹ 200.00/hr
GROOVE CUTTER	40 hrs	₹ 2,000.00	₹ 50.00/hr
VIBRATOR	104 hrs	₹ 5,200.00	₹ 50.00/hr
PLATE COMPACTOR	72 hrs	₹ 3,600.00	₹ 50.00/hr
POWER HAMMER AND DRILLS	72 hrs	₹ 3,600.00	₹ 50.00/hr
DEWATERING PUMP	0 hrs	₹ 0.00	₹ 50.00/hr

Fig 3.9 Project-1 resource allocation

CASH FLOW

Actual Cost	Baseline Cost	Cost Variance
₹ 788,025.00	₹ 757,249.00	₹ 30,776.00



Name	Remaining Cost	Actual Cost	Cost	ACWP	BCWP	BCWS
RCC Sub Structure	₹ 0.00	₹ 788,025.00	₹ 788,025.00	₹ 785,025.00	₹ 517,277.67	₹ 755,161.00

Fig 3.10 Project-1 cash flow



Fig 3.11 Project-1 EVM

3.1.4 6D IN BIM - MATERIAL MANAGEMENT

6D BIM = CONSIDERING MMM CONSTRAINTS TO REDUCE WASTE.

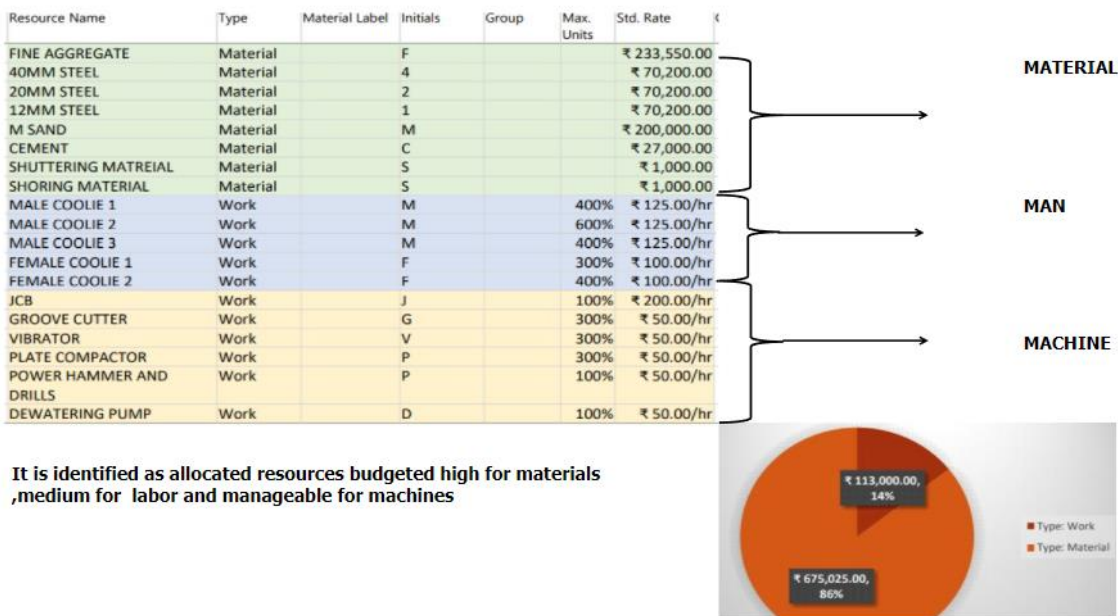


Fig 3.12 Project-1 Material management

3.1.5 7D IN BIM - CHECKLIST

Table 3.1 Project-1 quality checklist

ATTRIBUTE		YES	NO	N/A
<u>A</u>	<u>GENERAL</u>			
1.	Is area released for work?			
2.	Is equipment adequate?			
3.	Are existing structures and utilities adequately protected?			
4.	Is removed material properly dispositioned?			
5.	Dust and dirt control:			
	a) Haul routes maintained for dust control – by water or chemicals?			
	b) All paved areas kept clean?			
<u>B</u>	<u>EXCAVATION OF TRENCHING</u>			
1.	Does completed depth and configuration comply with drawings and specifications?			
2.	Required shoring and bracing in place?			
3.	Existing utilities protected?			
<u>C</u>	<u>PLACING AND COMPACTING FILL</u>			
1.	Excavation properly compacted and verified by test lab?			
	a) All sleeves, pipe cable, grounding, conduit installed and approved?			
2.	Approved fill material is used?			
3.	Is fill being placed in level lifts within thickness limits?			
4.	Is proper compaction attained and verified by test lab?			
5.	Have contaminated (and spongy) areas been cut out, filled and compacted with approved material?			
<u>D</u>	<u>BEDDING AND BACKFILL OF PIPE AND UTILITY TRENCHES</u>			
1.	Approved bedding and backfill material is used?			
	a) Is bedding fully compacted to support pipe or utility at line, grade, and slope required and verified by inspector?			
<u>E</u>	<u>GRADING</u>			
1.	Approved grading material used?			
	a) Final shaping/compacting and blade and 3-wheel rollers of 8-10 ton?			
2.	Sufficient slope for positive drainage away from structures to drainage system?			

3.1.6 8D IN BIM - RISK MANAGEMENT

Table 3.2 Project-1 risk management

S.NO	RISK DESCRIPTION	RISK IMPACT	PROBABILITY OF OCCURRENCE	RISK DESCRIPTION	PROJECT IMPACT	RISK AREA	RISK RESPONSE STRATEGY	MITIGATION	POSSIBLE % OF OCCURRENCE GENERALLY
4.	MATERIAL DELAY	High	Low	Depending single vendor	Poor communication , lack of coordination and conflicts between stakeholders	Project budget	Better communication and pre order state	Set a Minimum/Maximum. Delivery Time Setting a minimum delivery time will allow you to attend to your orders incisively	25%
5	LABOUR STRIKE	High	Low	This usually happens after contract negotiations have broken down	Delaying on project duration	Duration and cost	Good relationship between labours and pay law	Framing safe labour clause agreement	10%
6	SAFETY	Low	Low	Caused by external or internal vulnerabilities, and that may be avoided by pre-emptive action"	Keep A Detailed Record Of Your Expenses And Losses	Assess Your Injuries And Get Them Treated At The Earliest	Providing better safety measures	Clearly communicate your health and safety policy Deal with hazards quickly	10%

8D BIM = RISK ASSESSMENT

S.NO	RISK DESCRIPTION	RISK IMPACT	PROBABILITY OF OCCURRENCE	RISK DESCRIPTION	PROJECT IMPACT	RISK AREA	RISK RESPONSE STRATEGY	MITIGATION	POSSIBLE % OF OCCURRENCE GENERALLY
1.	MATERIAL ESCALATION	High	Low	Supply chain variations such as differing shipping costs, paid tariffs or a wide range of distribution channels	Cost escalation occurs when actual costs exceed previously estimated values.	Project budget	Monitor and prepare	Before you even reach the point of cost escalation, insert a clause in your vendor contracts to protect you against it. Shop local and save	25%
2	INCOMPLETE DRAWINGS AND POORLY DEFINED SCOPE	Low	High	Labour suffers to understand the idea of execution and scope	Project duration may occur due to less conveyable drawings and design scope	Design output	Designer visit to the site often	Coordination between labours , engineers , designers and owner	10%
3	DAMAGE OR THEFT TO EQUIPMENT AND TOOLS	Low	Low	Unwanted site disturbance and discussions occur	Loss of reputation between contractor and labour	Repurchase	Better supervision	Making an agreement which includes the clause of damage or theft to equipment and tools by subcontractor	20%

3.2 CASE STUDY 02 - SLAB REINFORCEMENT

3.2.1 2D IN BIM LAYOUT

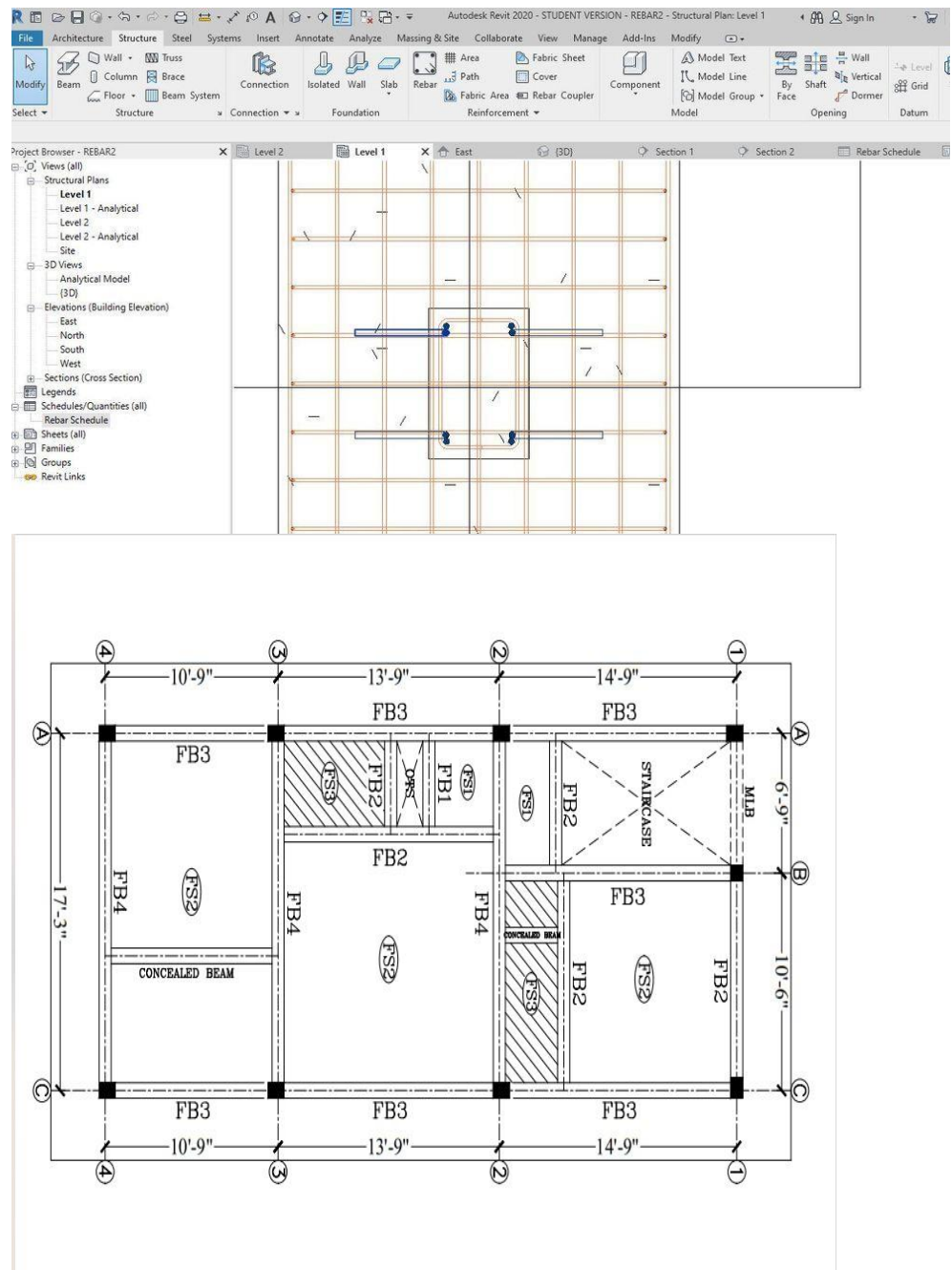


Fig 3.13 Project-2 layout design

3.2.3 3D IN BIM-REVIT MODULE

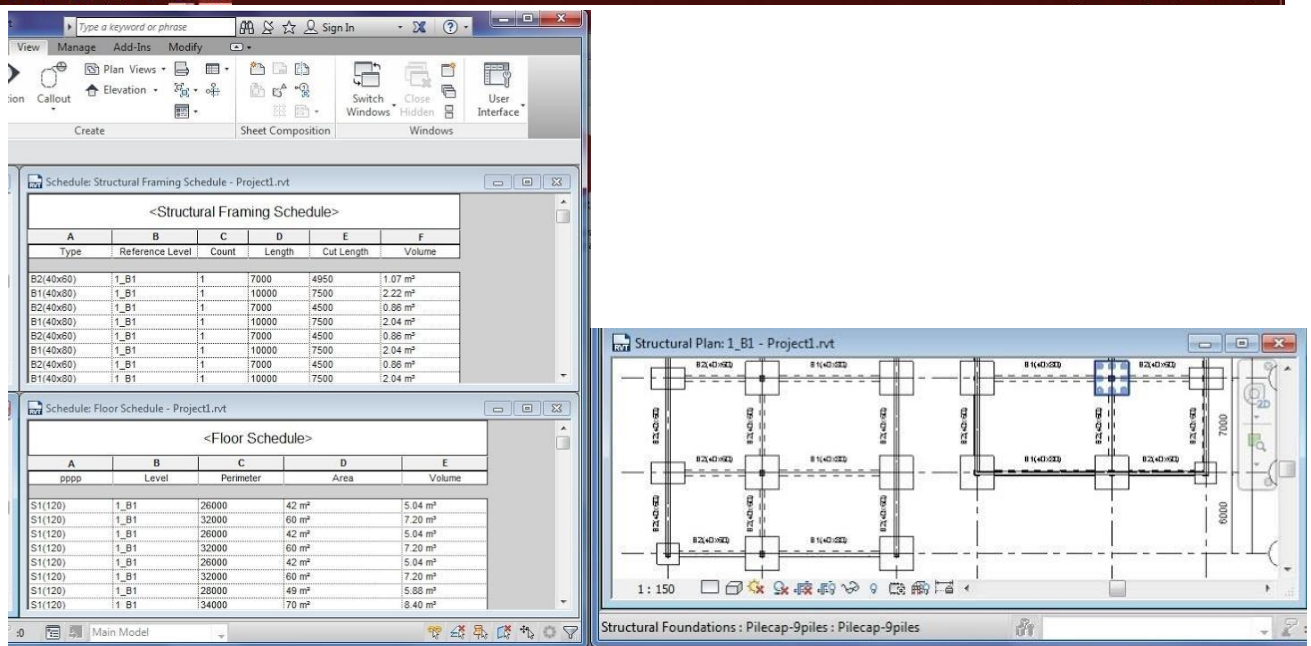
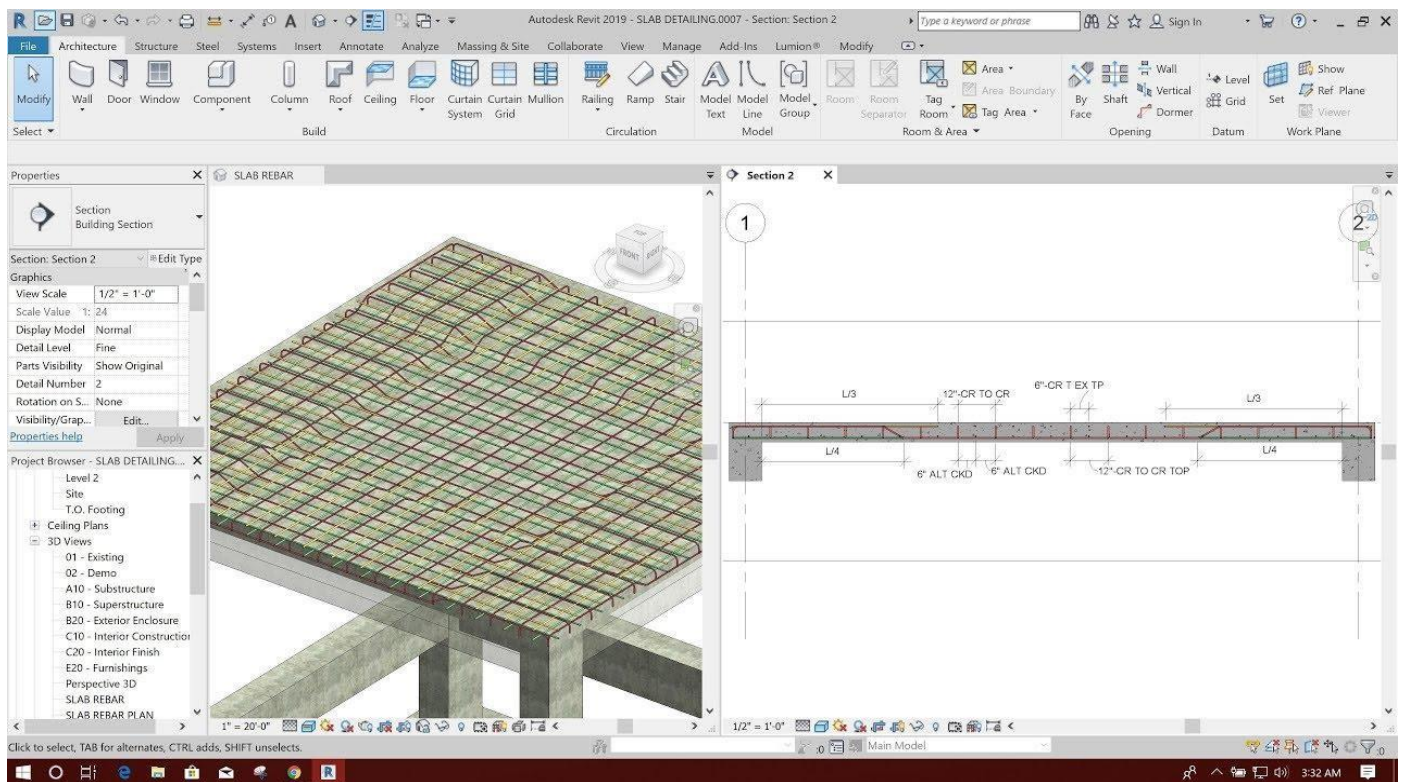


Fig 3.14 Project2 3d BIM model

3.2.3 4&5D IN BIM - SCHEDULING

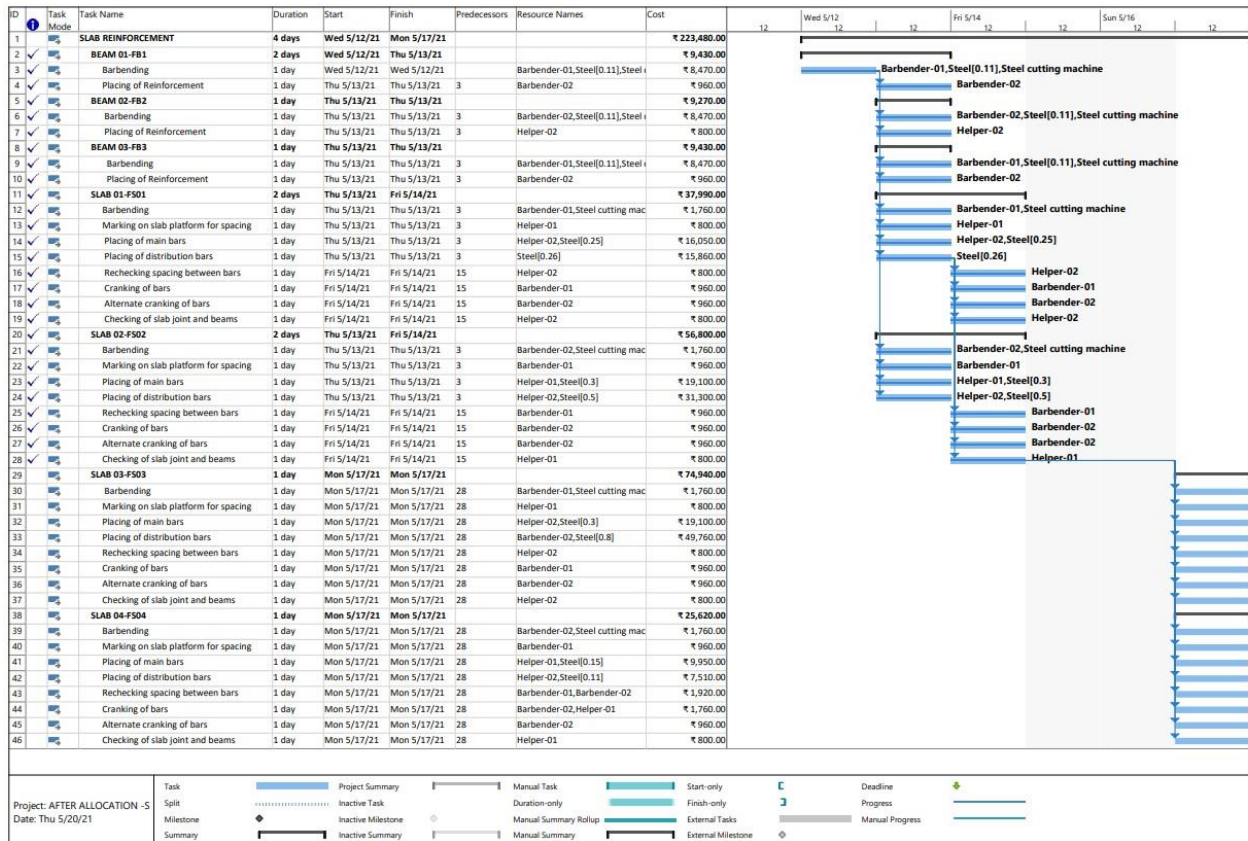


Fig 3.15 Project-2 scheduling

5D BIM = 3D + BUDGET AND COST .

RESOURCE COST ALLOCATION.



Fig 3.16 Project-2 resource cost allocation

$$5D\ BIM = 3D + \text{BUDGET AND COST}.$$

TASK COST ALLOCATION.

TASK COST VARIANCE

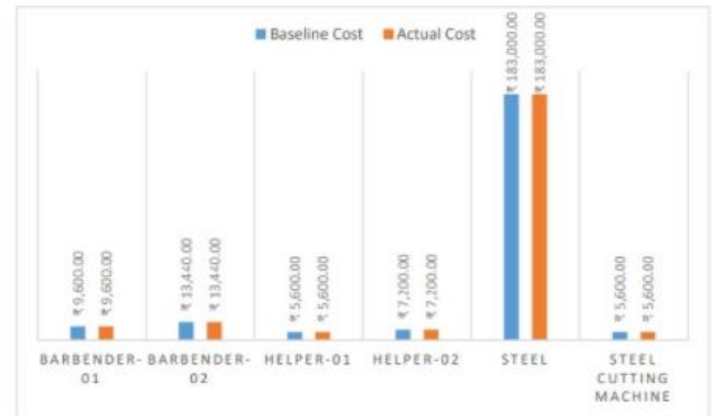
Cost variance for all top-level tasks in the project.



Name	% Complete	Cost Variance	Actual Duration	Duration
SLAB REINFORCEMENT	100%	₹ 0.00	4 days	4 days

RESOURCE COST VARIANCE

Cost variance for all the work resources.



Name	Baseline Cost	Cost Variance	Actual Cost
Barbender-01	₹ 9,600.00	₹ 0.00	₹ 9,600.00
Barbender-02	₹ 13,440.00	₹ 0.00	₹ 13,440.00
Helper-01	₹ 5,600.00	₹ 0.00	₹ 5,600.00
Helper-02	₹ 7,200.00	₹ 0.00	₹ 7,200.00
Steel cutting machine	₹ 5,600.00	₹ 0.00	₹ 5,600.00

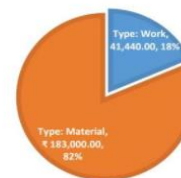
Fig 3.17 Project-2 task cost allocation

3.2.4 6D - MATERIAL MANAGEMENT

6D BIM = CONSIDERING MMM CONSTRAINTS TO REDUCE WASTE.

Barbender-01	Work	B	500%	₹ 120.00/hr	₹ 240.00/hr
Barbender-02	Work	B	700%	₹ 120.00/hr	₹ 240.00/hr
Helper-01	Work	H	400%	₹ 100.00/hr	₹ 200.00/hr
Helper-02	Work	H	400%	₹ 100.00/hr	₹ 200.00/hr
Steel	Material	S			₹ 61,000.00
Steel cutting machine	Work	S	500%	₹ 100.00/hr	₹ 200.00/hr

■ Type: Work ■ Type: Material



It is identified as allocated resources budgeted high for materials, medium for labor and manageable for machines

Fig 3.18 Project-2 material management

3.2.5 7D-QUALITY MANAGEMENT

Table 3.3 Project-2 pre commissioning checklist for casting slab

PRE COMMISSIONING CHECKLIST FOR CASTING SLAB

S.NO	PARTICULARS	CHECK	REMARKS
1.	Slab centring checked with architectural drawing	YES / NO	
	A. For elevation	YES / NO	YES
	B. For room dimensions	YES / NO	YES
	C. For electrical points	YES / NO	YES
2.	Slab centring checked completely	YES / NO	
	A. For required beam depths / slab thickness	YES / NO	YES
	B. For required head rooms	YES / NO	YES
	C. For other points	YES / NO	YES
3.	Slab centring checked completely	YES / NO	
	A. Level checked / lines checked	YES / NO	YES
	B. Oiling to beams / slabs shuttering	YES / NO	YES
4.	Centring for staircase checked	YES / NO	
5.	Reinforcement checked for beams & slabs as per RCC drawings	YES / NO	YES
6.	Proper cover bottoms / slide checked for beams	YES / NO	YES
7.	Proper cover bottoms / top checked for slab / fan hook checked	YES / NO	YES
8.	Hidden beams / inverted beams / cantilever beams checked	YES / NO	
9.	Reduction of columns as per drawing done for above slab	YES / NO	YES
10.	Proper number of chairs provide for slab	YES / NO	YES

JR ENGINEER

SENIOR ENGINEER

PROJECT ENGINEER

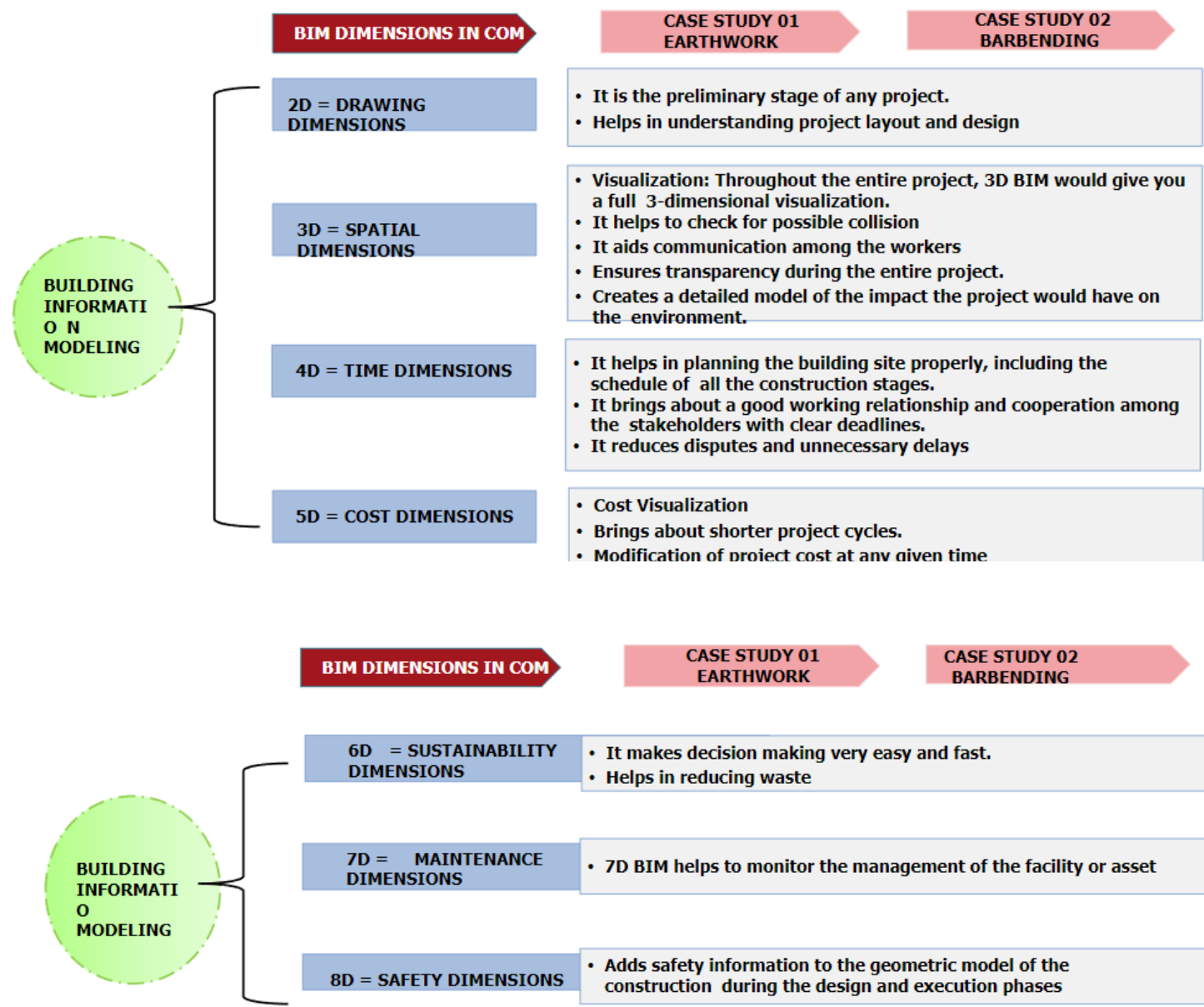
PROJECT CONSULTANT

RESIDENT ARCHITECT

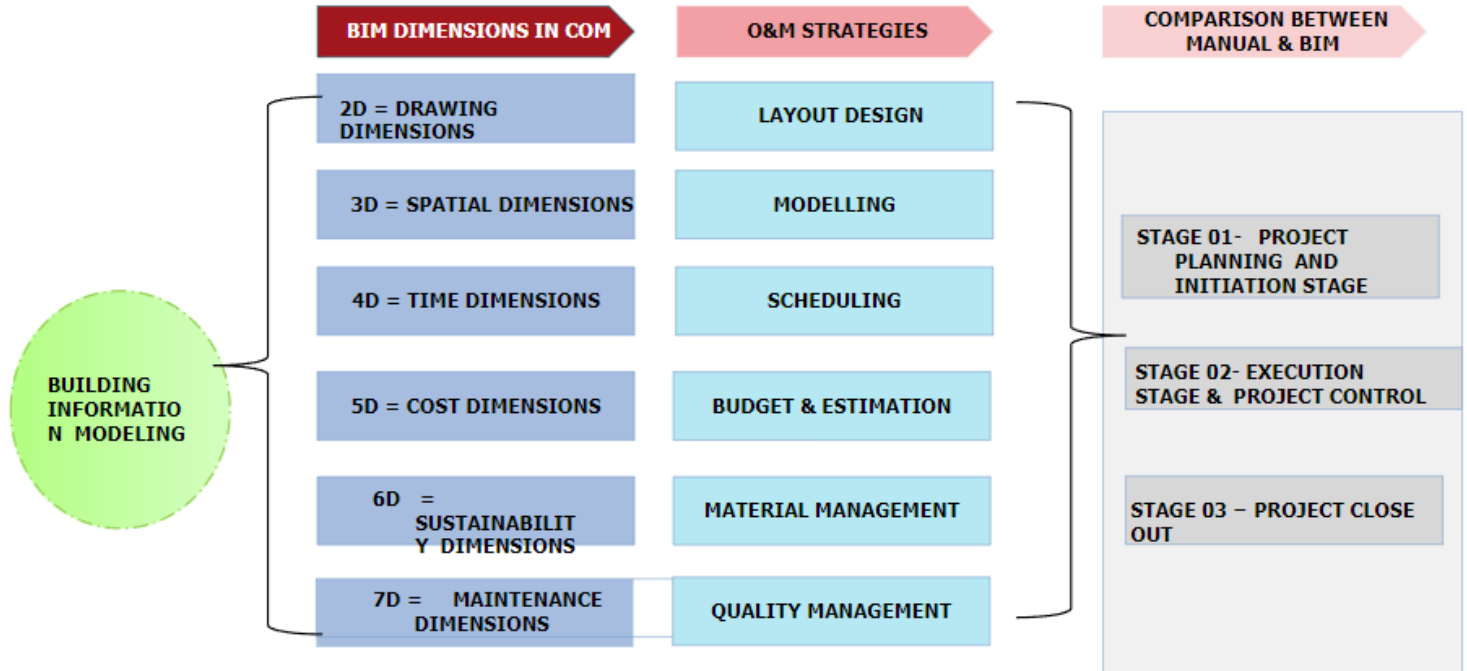
CHIEF ENGINEER

RCC CONSULTANT

3.3 INFERENCE ON BOTH CASE STUDY



CHAPTER - 04 ANALYSIS AND RESULTS



4.1 STAGE -01 - PROJECT PLANNING AND INITIATION

4.1.1 2D IN BIM LAYOUT

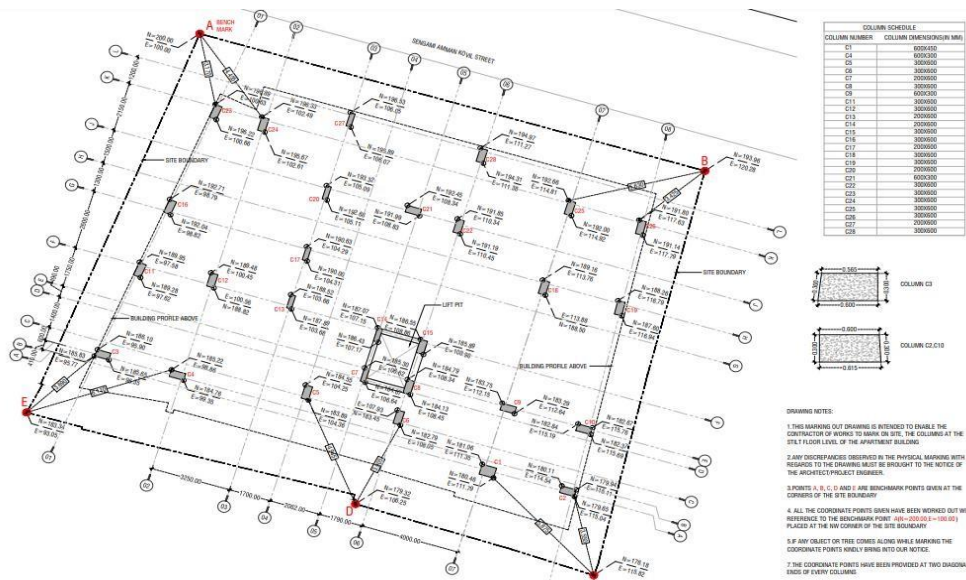


Fig 4.1 Project-1 layout design

4.1.2 3D IN BIM-REVIT MODULE

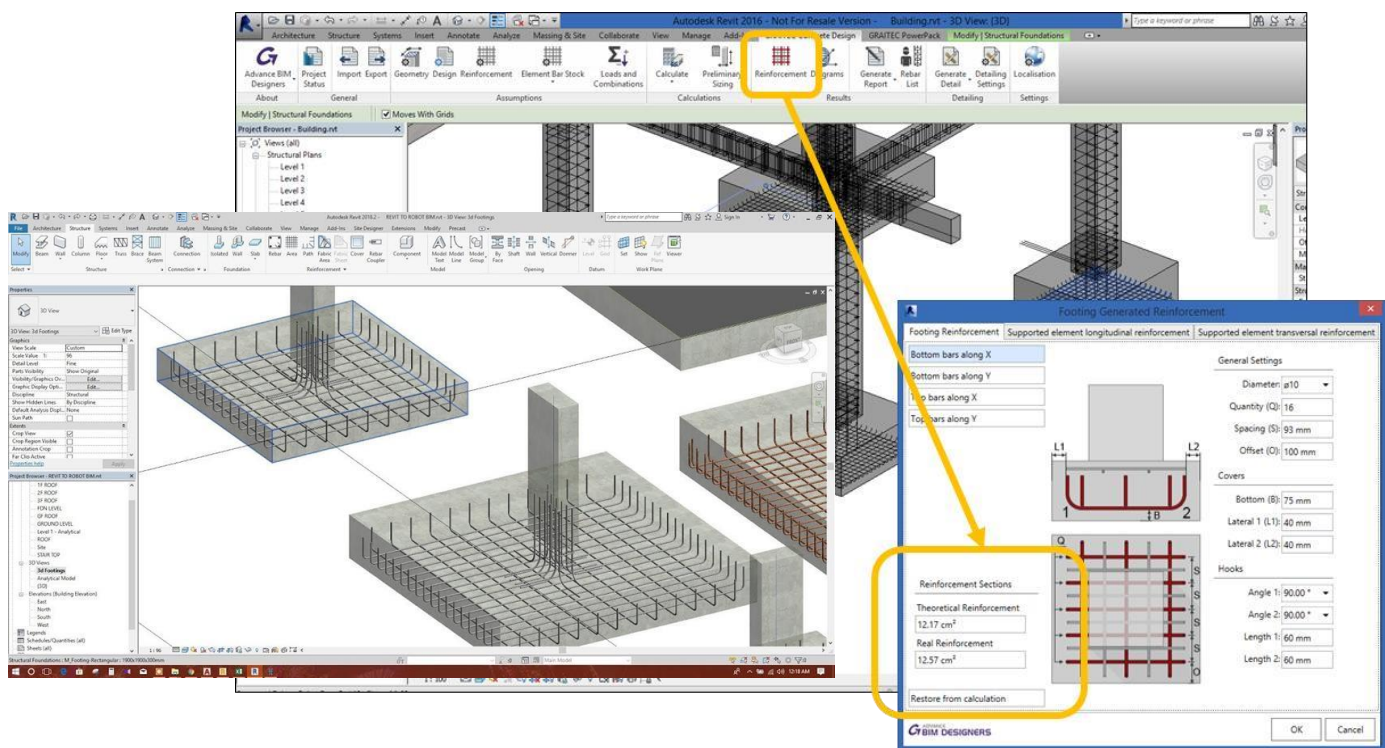


Fig 4.2 Project-1 3D BIM model

4.1.3 4&5D IN BIM - SCHEDULING

ID	Task Name	Duration	Start	Finish	Predecessor/Resource	Actual Cost	Baseline Cost	2009				2014				2019				2024				2029				2034										
1	APARTMENT @GUNDY	83 days	Mon 12/6/21	Wed 1/30/22		¥ 604,616.00	¥ 572,416.00																															
2	Contracts	23 days	Mon 12/6/21	Wed 1/5/22		¥ 500.00	¥ 0.00																															
3	Supply Site Agreement	6 days	Mon 12/6/21	Mon 12/13/21	Builder	¥ 500.00	¥ 0.00																															
4	Supply Construction Agreement	5 days	Tue 12/14/21	Mon 12/20/21	Builder	¥ 0.00	¥ 0.00																															
5	Supply Contract Plans	4 days	Tue 12/21/21	Fri 12/24/21	Builder	¥ 0.00	¥ 0.00																															
6	Supply Contract Specifications	4 days	Tue 12/21/21	Fri 12/24/21	Builder	¥ 0.00	¥ 0.00																															
7	Supply Contract Site Plan	4 days	Tue 12/21/21	Fri 12/24/21	Builder	¥ 0.00	¥ 0.00																															
8	Secure Financing	12 days	Tue 12/21/21	Wed 1/5/22	Client	¥ 0.00	¥ 0.00																															
9	Construction Loan Settlement	12 days	Tue 12/21/21	Wed 1/5/22	Client	¥ 0.00	¥ 0.00																															
10	Document Review & Revision	25 days	Mon 12/27/21	Fri 1/28/22		¥ 10,500.00	¥ 0.00																															
11	Review & Finalize Plans	15 days	Mon 12/27/21	Fri 1/14/22	Builder	¥ 0.00	¥ 0.00																															
12	Review & Finalize Specifications	20 days	Mon 12/27/21	Fri 1/21/22	Builder	¥ 0.00	¥ 0.00																															
13	Review & Finalize Site Plan	1 day	Mon 1/3/22	Mon 1/3/22	Builder	¥ 1,000.00	¥ 0.00																															
14	Print Construction Drawings	5 days	Mon 1/24/22	Fri 1/28/22	Builder	¥ 2,000.00	¥ 0.00																															
15	Approve Revised Plans	0 days	Fri 1/28/22	Fri 1/28/22	Client	¥ 0.00	¥ 0.00																															
16	Approve Revised Specifications	0 days	Fri 1/28/22	Fri 1/28/22	Client	¥ 0.00	¥ 0.00																															
17	Approve Revised Site Plan	0 days	Fri 1/28/22	Fri 1/28/22	Client	¥ 1,500.00	¥ 0.00																															
18	Bids & Contracts	24 days	Mon 1/31/22	Thu 3/3/22		¥ 600.00	¥ 0.00																															
19	Make Copies of Plans	3 days	Mon 1/31/22	Wed 2/2/22	Builder	¥ 500.00	¥ 0.00																															
20	Make Copies of Specifications	2 days	Mon 1/31/22	Tue 2/2/22	Builder	¥ 100.00	¥ 0.00																															
21	Distribute Plans & Specifications	1 day	Thu 2/3/22	Thu 2/3/22	Builder	¥ 0.00	¥ 0.00																															
22	Receive Bids	10 days	Fri 2/4/22	Thu 2/17/22	Builder	¥ 0.00	¥ 0.00																															
23	Review Bids	5 days	Fri 2/18/22	Thu 2/24/22	Builder	¥ 0.00	¥ 0.00																															
24	Sales	5 days	Fri 2/18/22	Thu 2/24/22	Builder	¥ 0.00	¥ 0.00																															
25	Construction	5 days	Fri 2/18/22	Thu 2/24/22	Builder	¥ 0.00	¥ 0.00																															
26	Execute Subcontractor Agreements	5 days	Fri 2/25/22	Thu 3/2/22	Builder	¥ 0.00	¥ 0.00																															
27	Grading & Building Permits	17 days	Mon 1/31/22	Tue 2/22/22		¥ 26,000.00	¥ 6,000.00																															
28	Schedule lot stake-out	1 day	Mon 1/31/22	Mon 1/31/22	Builder	¥ 0.00	¥ 0.00																															
29	Stake lot	1 day	Fri 2/4/22	Fri 2/4/22	Civil Engineer	¥ 2,000.00	¥ 2,000.00																															
30	File Grading Permit Application	1 day	Mon 1/31/22	Mon 1/31/22	Builder	¥ 50.00	¥ 0.00																															
31	File Building Permit Application	3 days	Mon 1/31/22	Wed 2/2/22	Builder	¥ 50.00	¥ 0.00																															
32	Post Lot Identification	1 day	Mon 2/7/22	Mon 2/7/22	Builder	¥ 0.00	¥ 0.00																															
33	Meet Sediment Control Inspector	1 day	Tue 2/8/22	Tue 2/8/22	Builder	¥ 500.00	¥ 0.00																															
34	Walk Lot w/ Owner	1 day	Wed 2/9/22	Wed 2/9/22	Builder	¥ 0.00	¥ 0.00																															
35	Install Construction Entrance	1 day	Thu 2/10/22	Thu 2/10/22	Excavation Subcontractor	¥ 800.00	¥ 800.00																															
36	Install Sediment Controls	2 days	Fri 2/11/22	Fri 2/11/22	Excavation Subcontractor	¥ 1,600.00	¥ 1,600.00																															
37	Sediment Control Insp.	1 day	Mon 2/14/22	Mon 2/14/22	Sediment Control Inspector	¥ 800.00	¥ 800.00																															
38	Grading Permit Issued	1 day	Tue 2/15/22	Tue 2/15/22	Sediment Control Inspector	¥ 800.00	¥ 800.00																															
39	County Permit Process	10 days	Thu 2/23/22	Wed 2/16/22	Department of Permits & Licenses	¥ 0.00	¥ 0.00																															
40	Building Permit Approved	1 day	Thu 2/17/22	Thu 2/17/22	Department of Permits & Licenses	¥ 0.00	¥ 0.00																															
41	Pay Permit Fees and Excise Taxes	1 day	Tue 2/22/22	Tue 2/22/22	Builder	¥ 20,000.00	¥ 0.00																															
42	Building Permit Issued	0 days	Tue 2/22/22	Tue 2/22/22	Department of Permits & Licenses	¥ 0.00	¥ 0.00																															
43	Site Work	7 days	Wed 2/23/22	Thu 2/24/22		¥ 29,936.00	¥ 29,936.00																															
44	Clear Lot	3 days	Wed 2/16/22	Fri 1/28/22	Excavation Subcontractor	¥ 14,664.00	¥ 14,664.00																															
45	Strip Topsoil & Stockpile	1 day	Mon 2/21/22	Mon 2/21/22	Excavation Subcontractor	¥ 3,792.00	¥ 3,792.00																															
46	Stake Lot for Excavation	1 day	Mon 2/21/22	Mon 2/21/22	Civil Engineer	¥ 4,192.00	¥ 4,192.00																															
47	Rough grade lot	1 day	Tue 2/22/22	Tue 2/22/22	Excavation Subcontractor	¥ 5,688.00	¥ 5,688.00																															
48	Excavate for foundation	2 days	Wed 2/23/22	Thu 2/24/22	Excavation Subcontractor	¥ 1,600.00	¥ 1,600.00																															

Task

Project Summary

Inactive Summary

Manual Summary

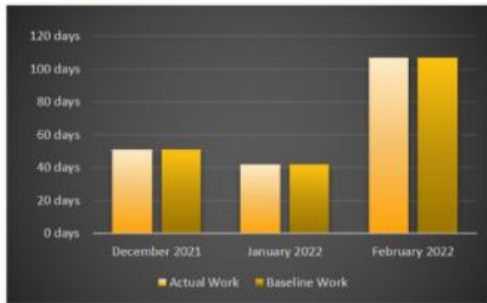
External Milestone

Fig 4.3 Project-1 scheduling

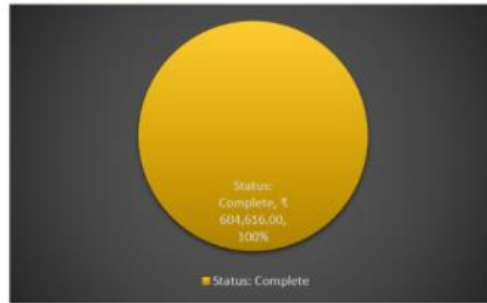
4D BIM = 3D + TIME

TASK DURATION OVERVIEW

ACTIVITY COMPARISON



ACTIVITY STATUS ON 28.03.2022



ACTIVITY DETAILS

Name	Actual Work	Baseline Work
APARTMENT @GUINDY	227 days	227 days

MANUAL CALCULATION OF DURATION

WORK PACKAGE	DURATION
Contracts	16 DAYS
Document Review & Revision	06 DAYS
Review Bids	02 DAYS
Site Work	05 DAYS
Foundation	22 DAYS

Fig 4.4 Project-1 task duration overview

5D GANTT CHART

ID	Task Name	Total Cost	Baseline	Actual Cost	Variance	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
1	APARTMENT @GUINDY	₹ 604,616.00	₹ 572,416.00	₹ 604,616.00	₹ 32,200.00																
2	Contracts	₹ 500.00	₹ 0.00	₹ 500.00	₹ 500.00																
3	Supply Site Agreement	₹ 150.00	₹ 0.00	₹ 150.00	₹ 150.00																
4	Supply Construction Agreement	₹ 0.00	₹ 0.00	₹ 0.00	₹ 0.00																
5	Supply Contract Plans	₹ 0.00	₹ 0.00	₹ 0.00	₹ 0.00																
6	Supply Contract Specifications	₹ 0.00	₹ 0.00	₹ 0.00	₹ 0.00																
7	Supply Contract Site Plan	₹ 0.00	₹ 0.00	₹ 0.00	₹ 0.00																
8	Secure Financing	₹ 0.00	₹ 0.00	₹ 0.00	₹ 0.00																
9	Construction Loan Settlement	₹ 0.00	₹ 0.00	₹ 0.00	₹ 0.00																
10	Document Review & Revision	₹ 10,000.00	₹ 0.00	₹ 10,000.00	₹ 10,000.00																
11	Review & Finalize Plans	₹ 0.00	₹ 0.00	₹ 0.00	₹ 0.00																
12	Review & Finalize Specifications	₹ 0.00	₹ 0.00	₹ 0.00	₹ 0.00																
13	Review & Finalize Site Plan	₹ 1,000.00	₹ 0.00	₹ 1,000.00	₹ 1,000.00																
14	Print Construction Drawings	₹ 2,000.00	₹ 0.00	₹ 2,000.00	₹ 2,000.00																
15	Approve Revised Plans	₹ 0.00	₹ 0.00	₹ 0.00	₹ 0.00																
16	Approve Revised Specifications	₹ 0.00	₹ 0.00	₹ 0.00	₹ 0.00																
17	Approve Revised Site Plan	₹ 7,500.00	₹ 0.00	₹ 7,500.00	₹ 7,500.00																
18	Bids & Contracts	₹ 600.00	₹ 0.00	₹ 600.00	₹ 600.00																
19	Make Copies of Plans	₹ 500.00	₹ 0.00	₹ 500.00	₹ 500.00																
20	Make Copies of Specifications	₹ 100.00	₹ 0.00	₹ 100.00	₹ 100.00																
21	Distribute Plans & Specifications	₹ 0.00	₹ 0.00	₹ 0.00	₹ 0.00																
22	Receive Bids	₹ 0.00	₹ 0.00	₹ 0.00	₹ 0.00																
23	Review Bids	₹ 0.00	₹ 0.00	₹ 0.00	₹ 0.00																
24	Sales	₹ 0.00	₹ 0.00	₹ 0.00	₹ 0.00																
25	Construction	₹ 0.00	₹ 0.00	₹ 0.00	₹ 0.00																
26	Excavate Subcontractor Agreements	₹ 0.00	₹ 0.00	₹ 0.00	₹ 0.00																
27	Grading & Building Permits	₹ 26,600.00	₹ 6,000.00	₹ 26,600.00	₹ 20,600.00																
28	Schedule lot stake-out	₹ 0.00	₹ 0.00	₹ 0.00	₹ 0.00																
29	Stake lot	₹ 2,000.00	₹ 2,000.00	₹ 2,000.00	₹ 0.00																
30	File Grading Permit Application	₹ 50.00	₹ 0.00	₹ 50.00	₹ 50.00																
31	File Building Permit Application	₹ 50.00	₹ 0.00	₹ 50.00	₹ 50.00																
32	Post lot identification	₹ 0.00	₹ 0.00	₹ 0.00	₹ 0.00																
33	Meet Sediment Control Inspector	₹ 500.00	₹ 0.00	₹ 500.00	₹ 500.00																
34	Stake lot w/ Owner	₹ 0.00	₹ 0.00	₹ 0.00	₹ 0.00																
35	Install Construction Entrance	₹ 800.00	₹ 800.00	₹ 800.00	₹ 0.00																
36	Install Sediment Controls	₹ 1,600.00	₹ 1,600.00	₹ 1,600.00	₹ 0.00																
37	Sediment Control Insp.	₹ 800.00	₹ 800.00	₹ 800.00	₹ 0.00																
38	Grading Permit Issued	₹ 800.00	₹ 800.00	₹ 800.00	₹ 0.00																
39	County Permit Process	₹ 0.00	₹ 0.00	₹ 0.00	₹ 0.00																
40	Building Permit Approved	₹ 0.00	₹ 0.00	₹ 0.00	₹ 0.00																
41	Pay Permit Fees and Excise Taxes	₹ 20,000.00	₹ 0.00	₹ 20,000.00	₹ 20,000.00																
42	Building Permit Issued	₹ 0.00	₹ 0.00	₹ 0.00	₹ 0.00																
43	Site Work	₹ 29,936.00	₹ 29,936.00	₹ 29,936.00	₹ 0.00																
44	Clear Lot	₹ 14,664.00	₹ 14,664.00	₹ 14,664.00	₹ 0.00																
45	Strip Topsoil & Stockpile	₹ 3,792.00	₹ 3,792.00	₹ 3,792.00	₹ 0.00																
46	Stake Lot for Excavation	₹ 4,192.00	₹ 4,192.00	₹ 4,192.00	₹ 0.00																
47	Rough grade lot	₹ 5,688.00	₹ 5,688.00	₹ 5,688.00	₹ 0.00																
48	Excavate for foundation	₹ 1,600.00	₹ 1,600.00	₹ 1,600.00	₹ 0.00																

5D GANTT CHART

GUINDY PROJECT DIRECT CONSTRUCTION BUDGET		
Sl.No.	DESCRIPTION	Budget Cost INR
1	CIVIL , STRUCTURAL & FINISHES WORKS	
1a	CIVIL & STRUCTURES All Structures including Blockworks,brickworks	11,700,000.00
1b	FINISHES WORKS	
	PLASTERING WORK	1,820,000.00
	FLOORING WORK	1,600,000.00
	PAINTING WORK	1,050,000.00
	WOOD AND ALUMINIUM WORK	2,000,000.00
	METAL WORK	1,470,000.00
	WATER PROOFING WORKS	700,000.00
2	MEP WORKS	
	Plumbing	1,500,000.00
	Internal Electrical	1,260,000.00
	False Ceiling	75,000.00
	EB connections	252,000.00
	DG Sets	624,000.00
	Lifts	1,000,000.00
	Security systems	120,000.00
	External lighting	120,000.00
	STP excluding civil works	-
	Electrical feeding cable	120,000.00
	Construction of storm water sewer pipe connection	120,000.00
3	SPECIALISED FINISHES	
	Architectural Elevation works	1,000,000.00
	Car park and other signages	
	Ward robes/Cupboards	

MANUAL CALCULATION OF BUDGET

4	EXTERNAL DEVELOPMENT Landscape (Hard and Soft scape)	100,000.00
	MISCELANIOUS WORKS Sample Flat, Scaffolding, Site Cleaning,,Labour camp,site office,Borewell, Rainwater harvesting etc.,	1,000,000.00
6	CONSULTANCY Architectural Charges Structural consultant MEP consultant	1,000,000.00
7	OVER HEADS Staff salaries Administrative expenses Security service	800,000.00 800,000.00 200,000.00
8	SPECIAL UTILITIES GYM Recreation Hall Indoor play Area Children Play Area	
	TOTAL	30,131,000.00
	Total Area	12,000.00
	COST PER SFT	2,510.92
8	TAXES Gst @ 18% Amout	5,423,580.00
	GRAND TOTAL	35,554,580.00
	COST PER SFT	2,962.88

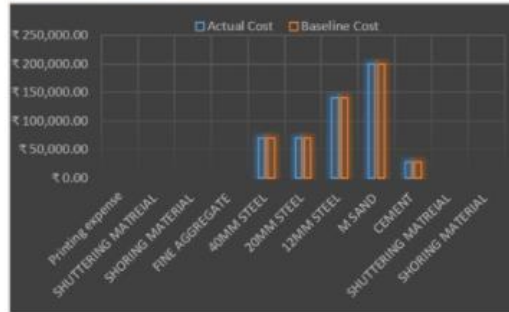
Fig 4.5 Project-1 cost estimation and manual calculation



Fig 4.6 Project-1 cash flow

RESOURCE COST OVERVIEW- MATERIALS

COST STATUS FOR MATERIALS

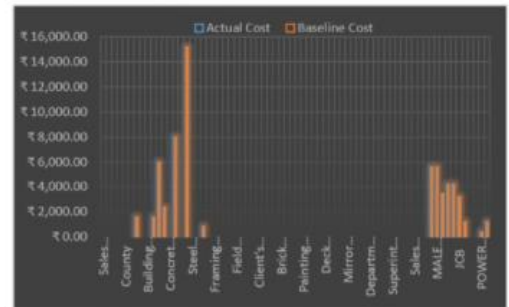


COST DISTRIBUTION FOR ALL RESOURCES



RESOURCE COST OVERVIEW- WORK

COST STATUS FOR WORK



COST DISTRIBUTION FOR ALL RESOURCES



Fig 4.7 Project-1 resource cost overview material and work

ACWP	BCWP	Cost Variance
₹ 604,616.00	₹ 572,416.00	₹ 32,200.00

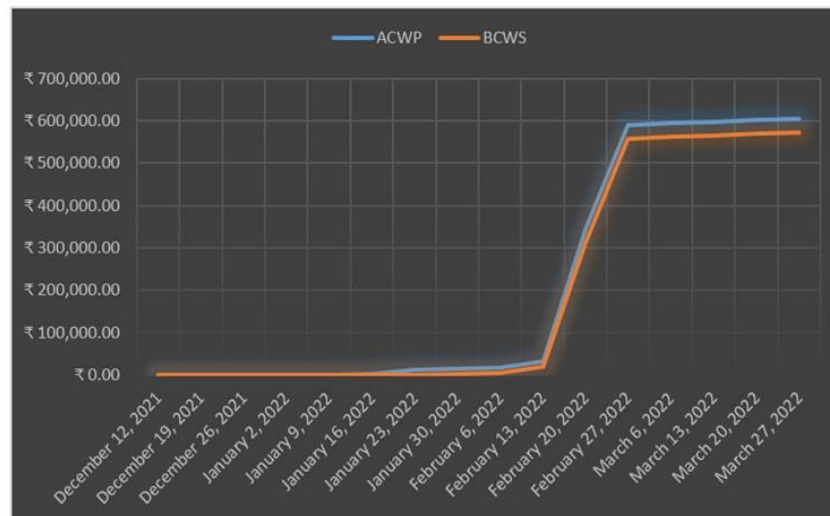
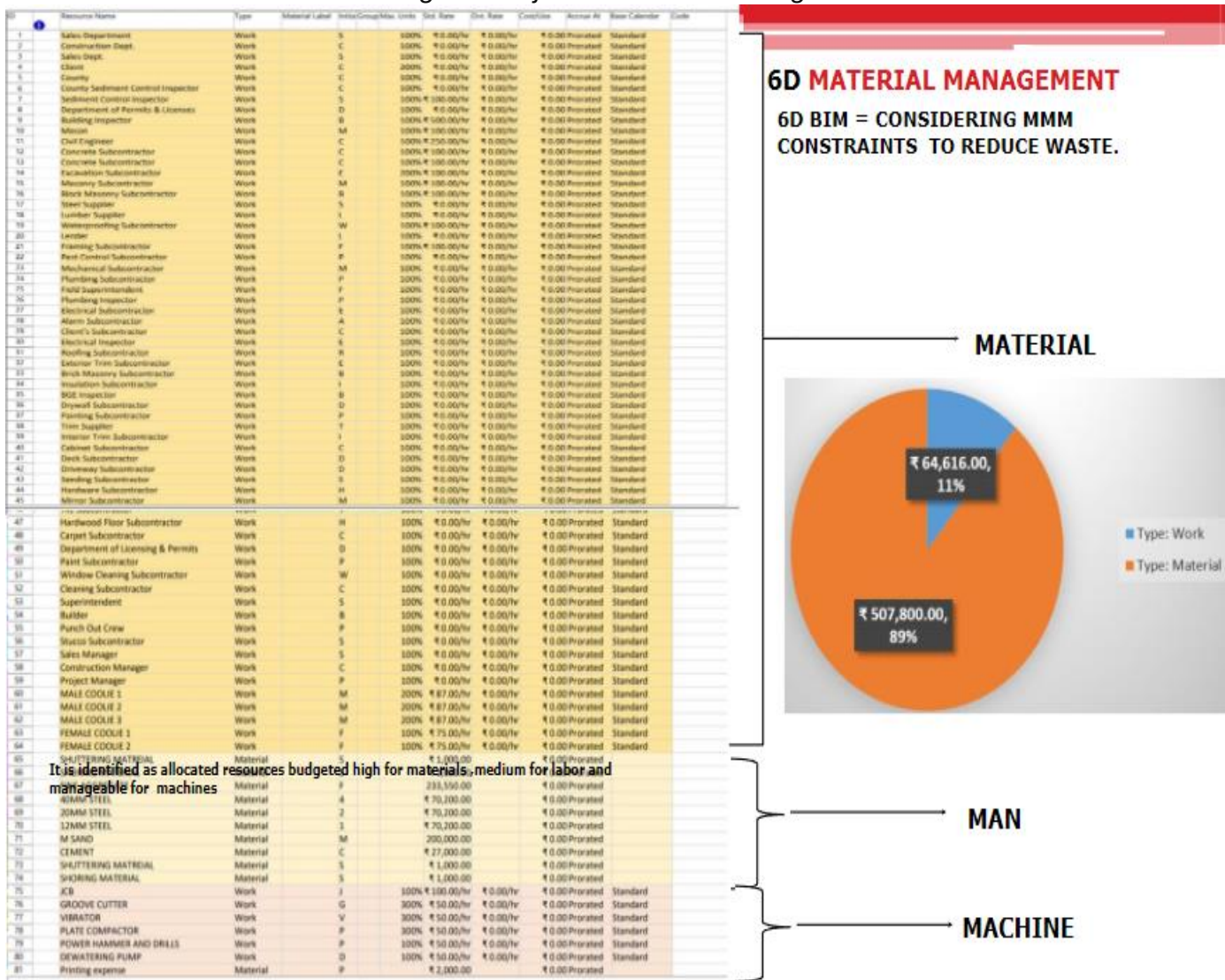


Fig 4.8 Project-1 EVM

4.1.4 6D - MATERIAL MANAGEMENT

Fig 4.9 Project-1 material manageme



4.1.5 7D-QUALITY MANAGEMENT

RESIDENTIAL APARTMENTS GUINDY PRE COMMISSIONING CHECKLIST		
SITE LOCATION DATE:		INCHARGE PERSON:
SI NO	DESCRIPTION	REMARKS (YES/NO/NA)
1	GENERAL INSPECTION ON SITE	YES
	Excavations, adjacent areas, and protective systems inspected by a competent person daily before the start of work.	YES
	Competent person has the authority to remove employees from the excavation immediately.	NO
	Surface encumbrances removed or supported.	YES
	Employees protected from loose rock or soil that could pose a hazard by falling or rolling into the excavation.	YES
	Hard hats worn by all employees.	NO
	Spoils, materials, and equipment set back at least two feet from the edge of the excavation.	YES
	Barriers provided at all remotely located excavations, wells, pits, shafts, etc.	NO
	Walkways and bridges over excavations four feet or more in depth are equipped with standard guardrails and toeboards.	NO
	Warning vests or other highly visible clothing provided and worn by all employees exposed to public vehicular traffic	YES
	Employees required to stand away from vehicles being loaded or unloaded	NO
	Warning system established and utilized when mobile equipment is operating near the edge of the excavation	NO
	Employees prohibited from going under suspended loads.	NO
	Employees prohibited from working on the faces of slopes or benched excavations above other employees.	NO

7D QUALITY MANAGEMENT

7D BIM = QUALITY MANAGEMENT IN O&M .

PRE COMMISSIONING CHECKLIST

Fig 4.10 Project-1 pre commissioning check list

4.2 STAGE-02-EXECUTION STAGE & PROJECT CONTROL



Project name : apartment at manivakkam
Client : shreem foundation Typology : residence Building height : stilt + 5

Fig 4.11 Project 2 - view

4.2.1 2D IN BIM LAYOUT

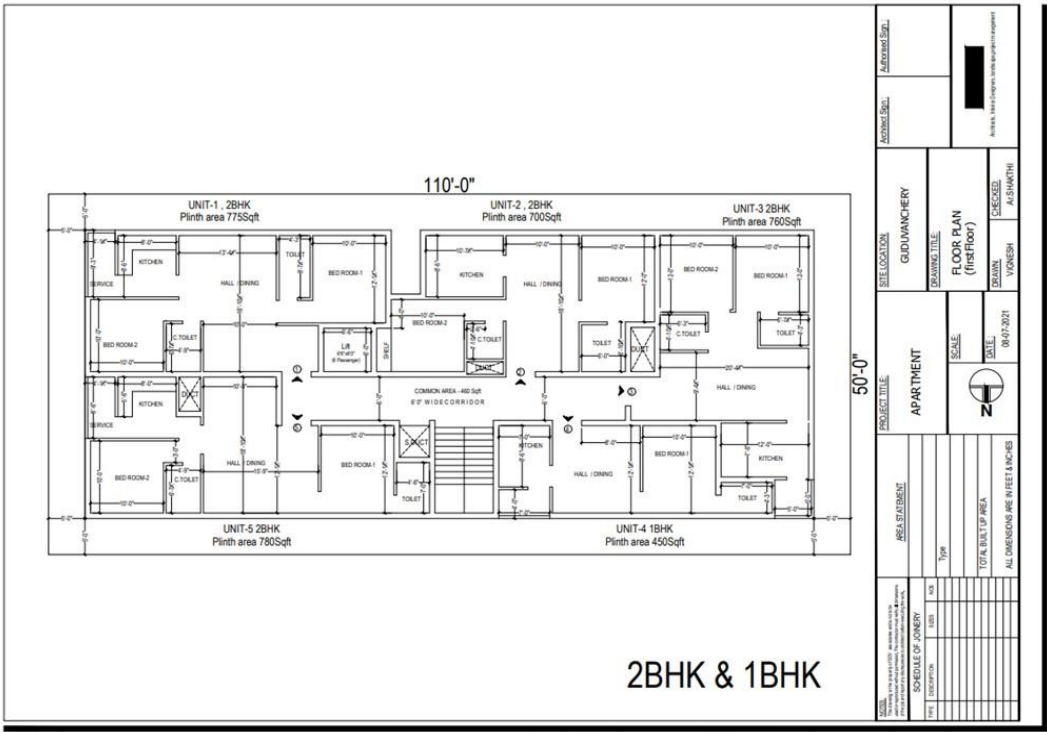


Fig 4.12 Project 2 - layout design

4.2.2 3D IN BIM-REVIT MODULE

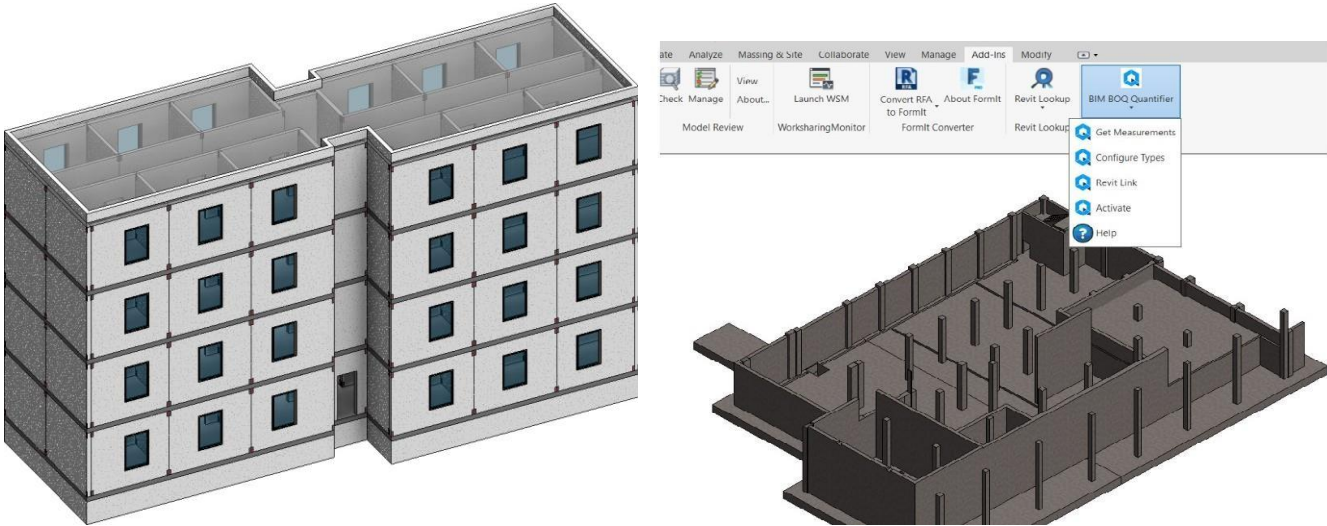


Fig 4.13 Project 2 - 3D BIM model

4.2.3 4&5D IN BIM - SCHEDULING

ID	Task Name	Duration	Start	Finish	Resource Names	Predecessors	Baseline Cost	Actual Cost	
0	MID PROJECT	168 days	Fri 10/1/21	Mon 4/25/22			₹ 2,624,697.00	₹ 3,884,610.00	
1	1 RCC Sub Structure	55 days	Fri 10/1/21	Tue 12/7/21			₹ 790,433.00	₹ 2,001,825.00	
2	1.1 Mobilization ,Borewell and Grid Marking	6 days	Tue 10/19/21	Mon 10/25/21	FEMALE COOLIE 1,MALE CO		₹ 19,136.00	₹ 19,136.00	
3	1.2 Earth Work excavation	6 days	Tue 10/26/21	Mon 11/1/21	FEMALE COOLIE 2 ,MALE CC2		₹ 22,336.00	₹ 22,336.00	
4	1.3 Soil filling &compaction	2 days	Mon 11/1/21	Wed 11/3/21	FEMALE COOLIE 1,MALE CO3		₹ 2,600.00	₹ 1,000.00	
5	1.4 Anti Termite Treatment & PCC for footings	1 day	Fri 11/5/21	Fri 11/5/21	MALE COOLIE 1	4	₹ 1,096.00	₹ 696.00	
6	1.5 Footing column Reinforcement C1 - C13	4 days	Wed 11/3/21	Mon 11/8/21	20MM STEEL [0.5],12MM S 3FS+1 day		₹ 181,900.00	₹ 175,500.00	
7	1.6 Footing column Reinforcement C14 - C 27	5 days	Tue 11/9/21	Sat 11/13/21	12MM STEEL [0.5],40MM S 6		₹ 82,160.00	₹ 78,160.00	
8	1.7 Shuttering for Footings	3 days	Mon 11/8/21	Thu 11/11/21	MALE COOLIE 3 ,SHORING H6		₹ 3,088.00	₹ 3,088.00	
9	1.8 Concreting for footing	2 days	Fri 11/12/21	Sat 11/13/21	CEMENT [1],FINE AGGREGATE		₹ 148,759.00	₹ 148,759.00	
10	1.9 Pedestal shoe marking and concreting	1 day	Tue 11/16/21	Tue 11/16/21	FEMALE COOLIE 2 ,FINE AGGREGATE	1 day	₹ 119,767.00	₹ 119,767.00	
11	1.10 Shuttering for columns upto plinth	2 days	Wed 11/17/21	Thu 11/18/21	FEMALE COOLIE 1,FEMALE [10		₹ 7,576.00	₹ 7,576.00	
12	1.11 concreting of columns upto plinth	1 day	Fri 11/19/21	Fri 11/19/21	FEMALE COOLIE 1,FEMALE [11		₹ 119,671.00	₹ 119,671.00	
13	1.12 Back filling for footing	2 days	Sat 11/20/21	Tue 11/23/21	FEMALE COOLIE 1,FEMALE [12		₹ 8,376.00	₹ 7,576.00	
14	1.13 consolidation in footing	1 day	Tue 11/23/21	Wed 11/24/21	MALE COOLIE 1,MALE COOI13		₹ 2,392.00	₹ 2,392.00	
15	1.14 Compaction with earth rammer	3 days	Wed 11/24/21	Fri 11/26/21	MALE COOLIE 1,MALE COOI14		₹ 1,792.00	₹ 592.00	
16	1.15 M Sand filling for Plinth beam	2 days	Sat 11/27/21	Mon 11/29/21	MALE COOLIE 1,MALE COOI15		₹ 42,784.00	₹ 42,784.00	
17	1.16 PCC for Plinthbeam	2 days	Tue 11/30/21	Wed 12/1/21	MALE COOLIE 2,12MM STEI16		₹ 577,000.00	₹ 868,792.00	
18	1.17 Reinforcement for plinth beam	4 days	Tue 11/30/21	Fri 12/3/21	CEMENT [2],SHUTTERING M 17FS-2 days		₹ 200,500.00	₹ 355,000.00	
19	1.18 Shuttering for plinth beam	4 days	Fri 10/1/21	Tue 10/5/21	SHORING MATERIAL [1]	18FS-2 days	₹ 0.00	₹ 2,000.00	
20	1.19 concreting for plinth beam	1 day	Tue 12/7/21	Tue 12/7/21	CEMENT [3]	19	₹ 27,000.00	₹ 27,000.00	
21	2 RCC Super structure	113 days	Wed 12/8/21	Mon 4/25/22			₹ 1,384,264.00	₹ 1,425,960.00	
22	2.1 Slit floor roof slab	32 days	Wed 12/8/21	Tue 1/18/22			₹ 487,568.00	₹ 521,564.00	
23	2.1.1 Column Reinforcement upto FF	3 days	Wed 12/8/21	Fri 12/10/21	40MM STEEL [1]	20	₹ 70,200.00	₹ 70,200.00	
24	2.1.2 Column Marking	1 day	Mon 12/13/21	Mon 12/13/21	MALE COOLIE 1,MALE COOI20		₹ 700.00	₹ 900.00	
25	2.1.3 starter fixing and concreting above plinth	1 day	Tue 12/14/21	Tue 12/14/21	CEMENT [1],FEMALE	24	₹ 996.00	₹ 28,296.00	
26	2.1.4 shuttering for colms	3 days	Wed 12/15/21	Fri 12/17/21	SHUTTERING MATRIEAL [1]	25	₹ 1,000.00	₹ 1,000.00	
27	2.1.5 Concreting for columns	1 day	Sat 12/18/21	Sat 12/18/21	CEMENT [1]	26	₹ 27,000.00	₹ 27,000.00	
28	2.1.6 Brickwork for basement	4 days	Mon 12/20/21	Thu 12/23/21	BRICK small[1],FEMALE COO27		₹ 35,568.00	₹ 38,768.00	
29	2.1.7 Filling and Consolidation	2 days	Fri 12/24/21	Mon 12/27/21	M SAND [1]	28	₹ 201,600.00	₹ 200,000.00	
30	2.1.8 Compaction with eart rammer	1 day	Tue 12/28/21	Tue 12/28/21	FEMALE COOLIE 1	29	₹ 450.00	₹ 700.00	
31	2.1.9 Pest control for basement floor area	1 day	Wed 12/29/21	Wed 12/29/21	CEMENT [1]	30	₹ 27,000.00	₹ 27,000.00	
32	2.1.10 PCC in floor area	2 days	Thu 12/30/21	Fri 12/31/21	CEMENT [1]	31	₹ 27,000.00	₹ 27,000.00	
33	2.1.11 Shuttering for GF roof slab	5 days	Mon 1/3/22	Fri 1/7/22	SHUTTERING MATRIEAL [1]	32	₹ 1,000.00	₹ 1,000.00	
34	2.1.12 Reinforcement for GF roof slab	4 days	Sat 1/8/22	Wed 1/12/22	20MM STEEL [1]	33	₹ 70,200.00	₹ 70,200.00	
35	2.1.13 MEP works	2 days	Thu 1/13/22	Mon 1/17/22	ELECTRICIAN 1 ,PLUMBER 134		₹ 2,500.00	₹ 2,500.00	
36	2.1.14 slab concreting	1 day	Tue 1/18/22	Tue 1/18/22	CEMENT [1]	35	₹ 27,000.00	₹ 27,000.00	
37	2.2 First floor roof slab	20 days	Sat 1/22/22	Tue 2/15/22			₹ 226,496.00	₹ 226,496.00	
38	2.2.1 column Reinforcement upto SF	2 days	Sat 1/22/22	Mon 1/24/22	12MM STEEL [1]	36FS+3 days	₹ 70,200.00	₹ 70,200.00	
39	2.2.2 Column marking	1 day	Tue 1/25/22	Tue 1/25/22	MALE COOLIE 2	38	₹ 696.00	₹ 696.00	
40	2.2.3 starter fixing and concreting	1 day	Thu 1/27/22	Thu 1/27/22	CEMENT [1]	39	₹ 27,000.00	₹ 27,000.00	
41	2.2.4 shuttering for columns	2 days	Fri 1/28/22	Sat 1/29/22	SHUTTERING MATRIEAL [1]	40	₹ 1,000.00	₹ 1,000.00	
42	2.2.5 concreting for columns	1 day	Mon 1/31/22	Mon 1/31/22	CEMENT [1]	41	₹ 27,000.00	₹ 27,000.00	
43	2.2.6 shuttering for first floor roof slab	5 days	Tue 2/1/22	Sat 2/5/22	SHUTTERING MATRIEAL [1]	42	₹ 1,000.00	₹ 1,000.00	
44	2.2.7 Reinforcement for FF roof slab	4 days	Mon 2/7/22	Thu 2/10/22	20MM STEEL [1]	43	₹ 70,200.00	₹ 70,200.00	
45	2.2.8 MEP Works	1 day	Fri 2/11/22	Fri 2/11/22	ELECTRICIAN 2,PLUMBER 2	44	₹ 2,400.00	₹ 2,400.00	

Project: MID PROJECT
Date: Mon 3/28/22

Task Split

Milestone Summary

Project Summary

Inactive Task

Inactive Milestone

Inactive Summary

Manual Task

Manual Summary Rollup

Manual Summary

Start-only

Finish-only

External Tasks

Deadline Late

Critical

Critical Split

Progress

Manual Progress

Slack

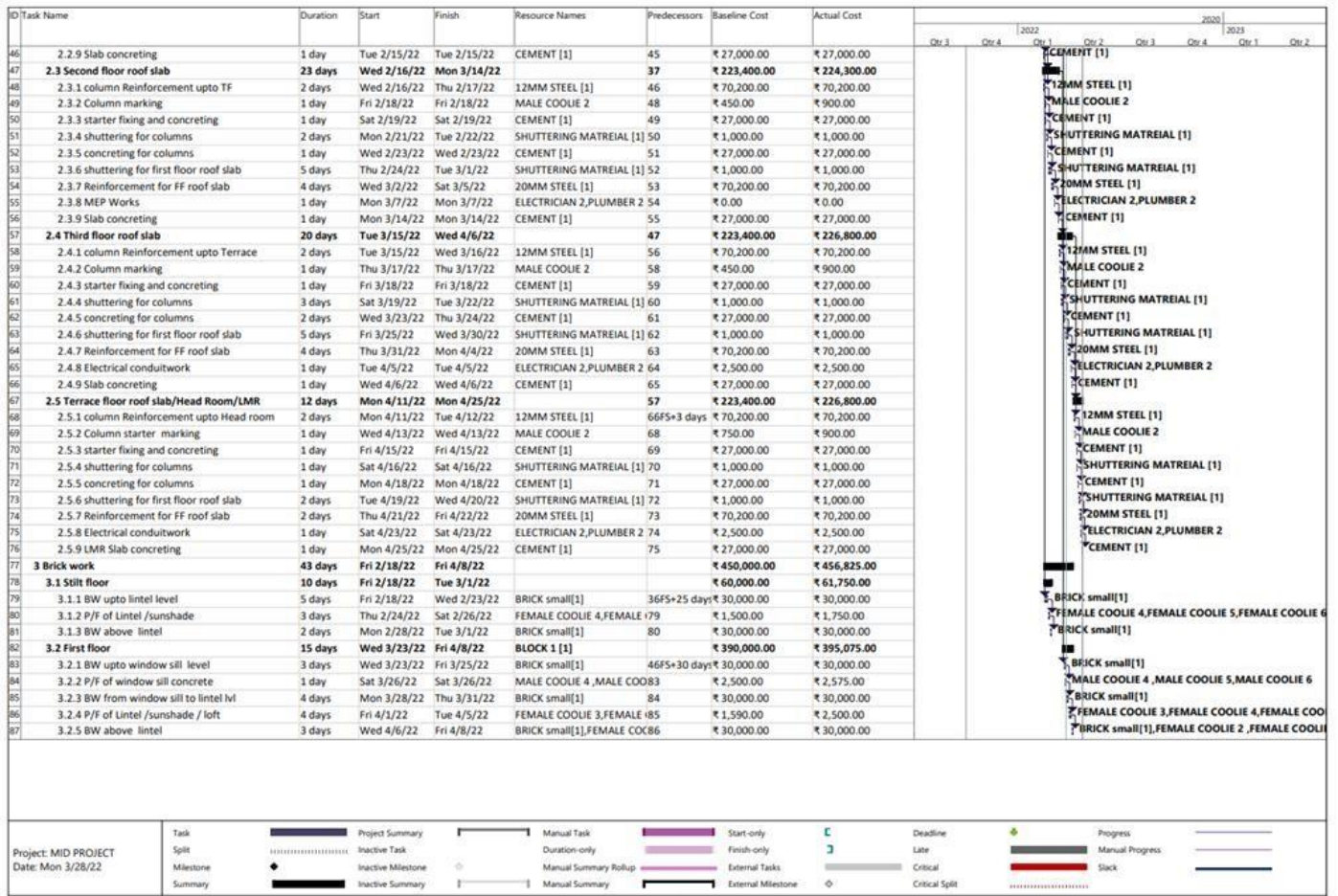
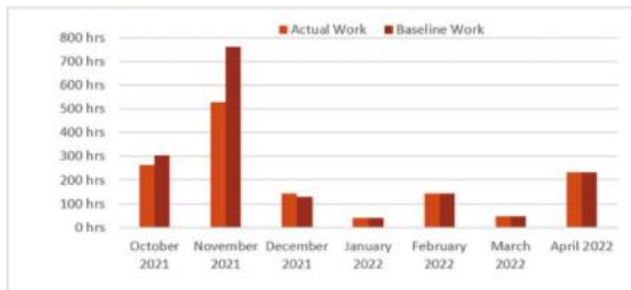


Fig 4.14 Project 2 - scheduling

4D BIM = 3D + TIME
SCHEDULE.

TASK DURATION OVERVIEW

ACTIVITY STATUS



DURATION DETAILS

Name	Actual Work	Baseline Work
RCC Sub Structure	800 hrs	1,136 hrs
RCC Super structure	264 hrs	256 hrs
Brick work	336 hrs	336 hrs

MANUAL CALCULATION OF DURATION

WORK PACKAGE	DURATION
Rcc substructure	90 DAYS
Rcc superstructure 150	150 DAYS
Block work	70 DAYS

Fig 4.15 Project 2 - task duration overview

5D GANTT CHART

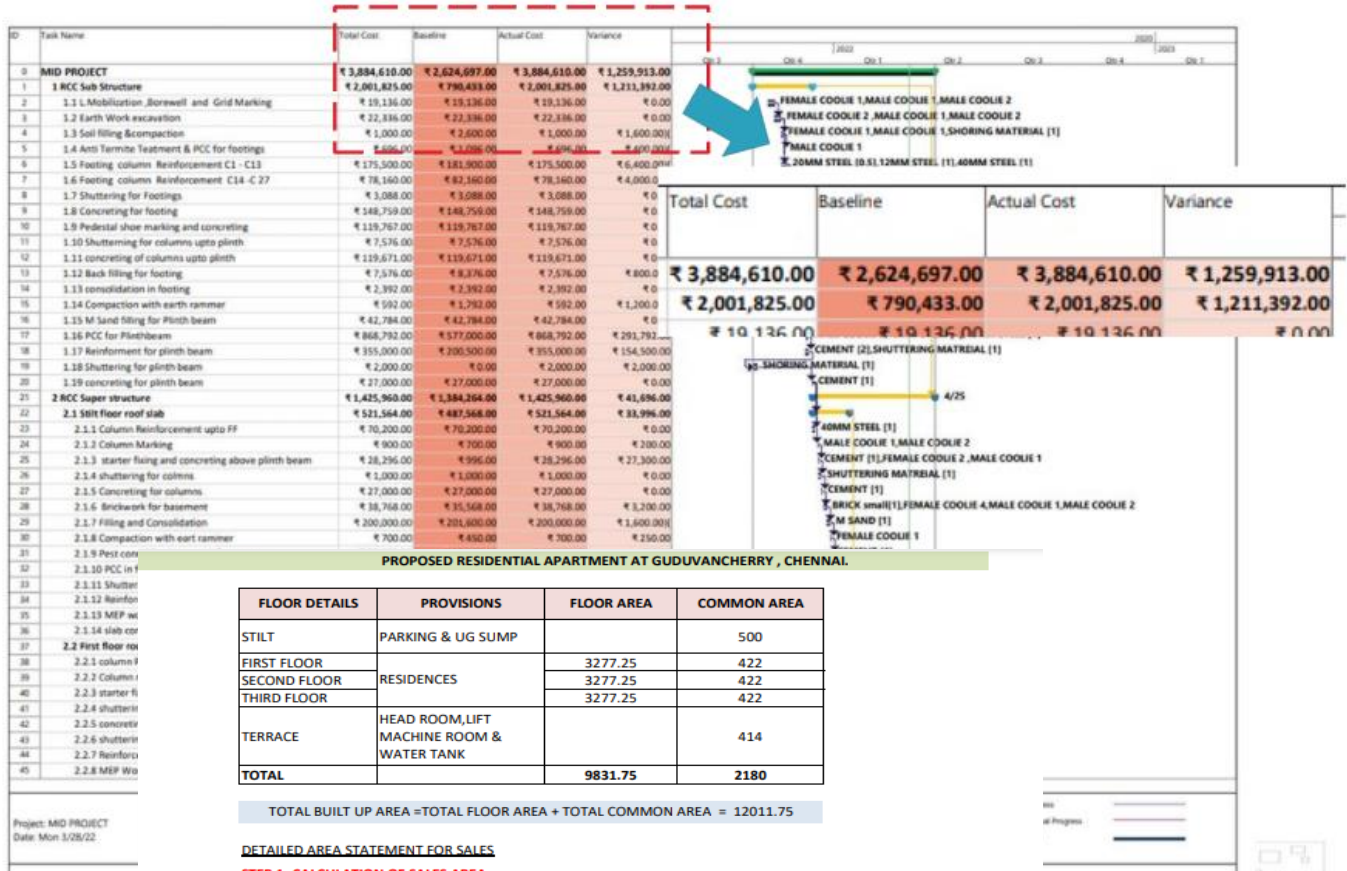
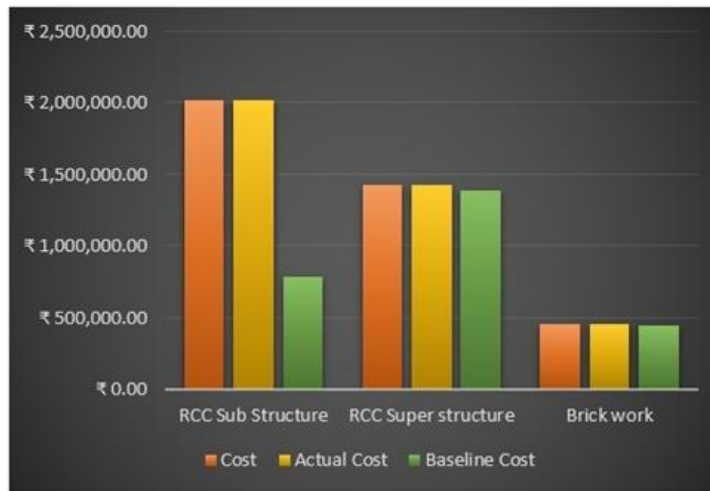


Fig 4.16 Project 2 - cost estimation and manual calculation

CASH FLOW

Actual Cost	Baseline Cost	Remaining Cost	Cost Variance
₹ 3,902,210.00	₹ 2,624,697.00	₹ 0.00	₹ 1,277,513.00

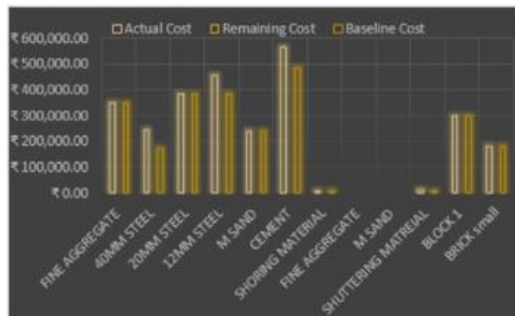


Name	Remaining Cost	Actual Cost	Cost
RCC Sub Structure	₹ 0.00	₹ 2,017,825.00	₹ 2,017,825.00
RCC Super structure	₹ 0.00	₹ 1,427,560.00	₹ 1,427,560.00
Brick work	₹ 0.00	₹ 456,825.00	₹ 456,825.00

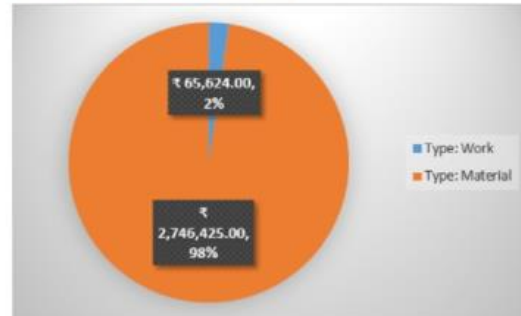
Fig 4.17 Project 2 - cash flow

RESOURCE COST OVERVIEW- MATERIAL

COST STATUS FOR MATERIAL

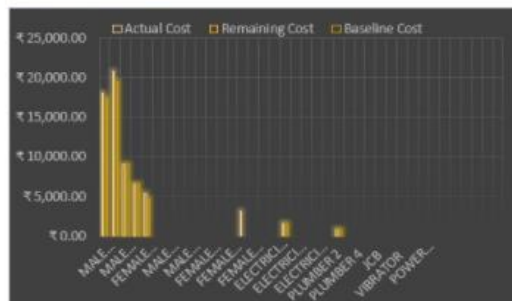


COST DISTRIBUTION FOR ALL RESOURCES

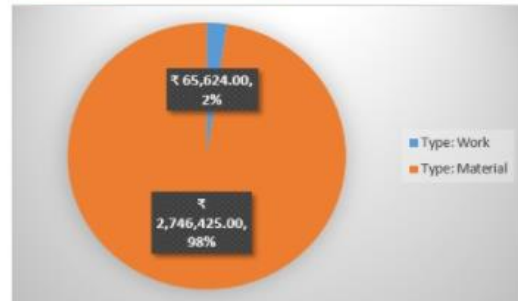


RESOURCE COST OVERVIEW- MAN

COST STATUS FOR MAN



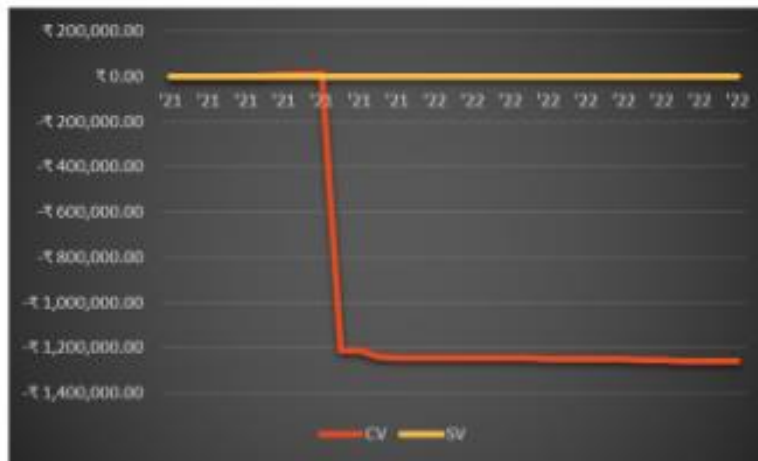
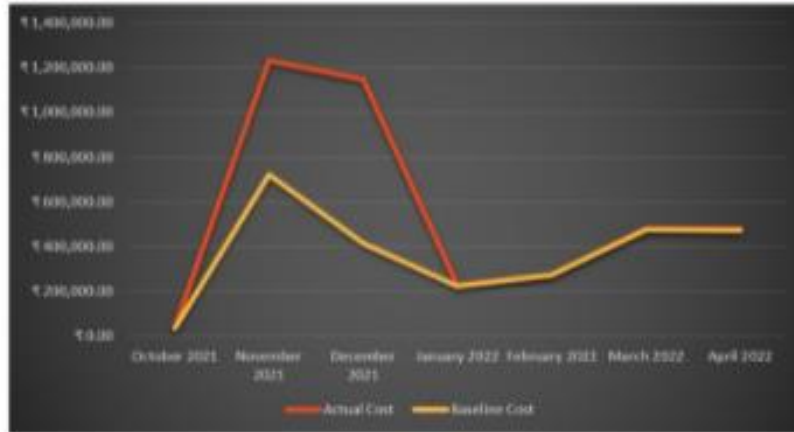
COST DISTRIBUTION FOR ALL MATERIALS



5D BIM = 3D + BUDGET AND COST .

EAC	ACWP	BCWP
₹ 3,887,095.26	₹ 3,882,522.00	₹ 2,621,609.00

EARNED VALUE MANAGEMENT



VARIANCE OVER TIME

Cost and schedule variances for the project based on status date. If CV is negative then, the project is over budget. If SV is positive then the project is behind schedule.

Fig 4.19 Project 2 -EVM

4.2.4 6D - MATERIAL MANAGEMENT

ID	Resource Name	Type	Material Label	Initials	Group	Max. Units	Std. Rate	Ovt. Rate	Cost/Use	Accrue At	Code
1	FINE AGGREGATE	Material		F			₹ 233,550.00		₹ 0.00	Prorated	
2	40MM STEEL	Material		4			₹ 70,200.00		₹ 0.00	Prorated	
3	20MM STEEL	Material		2			₹ 70,200.00		₹ 0.00	Prorated	
4	12MM STEEL	Material		1			₹ 70,200.00		₹ 0.00	Prorated	
5	M SAND	Material		M			₹ 200,000.00		₹ 0.00	Prorated	
6	CEMENT	Material		C			₹ 27,000.00		₹ 0.00	Prorated	
7	SHORING MATERIAL	Material		S			₹ 1,000.00		₹ 0.00	Prorated	
8	FINE AGGREGATE	Material		F			₹ 233,550.00		₹ 0.00	Prorated	
9	M SAND	Material		M			₹ 200,000.00		₹ 0.00	Prorated	
10	SHUTTERING MATREIAL	Material		S			₹ 1,000.00		₹ 0.00	Prorated	
11	MALE COOLIE 1	Work		M		200%	₹ 87.00/hr	₹ 0.00/hr	₹ 0.00	Prorated	
12	MALE COOLIE 2	Work		M		200%	₹ 87.00/hr	₹ 0.00/hr	₹ 0.00	Prorated	
13	MALE COOLIE 3	Work		M		200%	₹ 87.00/hr	₹ 0.00/hr	₹ 0.00	Prorated	
14	FEMALE COOLIE 1	Work		F		100%	₹ 75.00/hr	₹ 0.00/hr	₹ 0.00	Prorated	
15	FEMALE COOLIE 2	Work		F		100%	₹ 75.00/hr	₹ 0.00/hr	₹ 0.00	Prorated	
16	MALE COOLIE 4	Work		M		200%	₹ 87.00/hr	₹ 0.00/hr	₹ 0.00	Prorated	
17	MALE COOLIE 5	Work		M		200%	₹ 0.00/hr	₹ 0.00/hr	₹ 0.00	Prorated	
18	MALE COOLIE 6	Work		M		400%	₹ 100.00/hr	₹ 0.00/hr	₹ 0.00	Prorated	
19	MALE COOLIE 7	Work		M		400%	₹ 100.00/hr	₹ 0.00/hr	₹ 0.00	Prorated	
20	MALE COOLIE 8	Work		M		500%	₹ 100.00/hr	₹ 0.00/hr	₹ 0.00	Prorated	
21	FEMALE COOLIE 1	Work		F		800%	₹ 75.00/hr	₹ 0.00/hr	₹ 0.00	Prorated	
22	FEMALE COOLIE 2	Work		F		700%	₹ 75.00/hr	₹ 0.00/hr	₹ 0.00	Prorated	
23	FEMALE COOLIE 3	Work		F		300%	₹ 100.00/hr	₹ 0.00/hr	₹ 0.00	Prorated	
24	FEMALE COOLIE 4	Work		F		100%	₹ 100.00/hr	₹ 0.00/hr	₹ 0.00	Prorated	
25	FEMALE COOLIE 5	Work		F		300%	₹ 100.00/hr	₹ 0.00/hr	₹ 0.00	Prorated	
26	FEMALE COOLIE 6	Work		F		100%	₹ 0.00/hr	₹ 0.00/hr	₹ 0.00	Prorated	
27	ELECTRICIAN 1	Work		E		400%	₹ 200.00/hr	₹ 0.00/hr	₹ 0.00	Prorated	
28	ELECTRICIAN 2	Work		E		400%	₹ 200.00/hr	₹ 0.00/hr	₹ 0.00	Prorated	
29	ELECTRICIAN 3	Work		E		100%	₹ 200.00/hr	₹ 0.00/hr	₹ 0.00	Prorated	
30	ELECTRICIAN 4	Work		E		100%	₹ 200.00/hr	₹ 0.00/hr	₹ 0.00	Prorated	
31	ELECTRICIAN 5	Work		E		100%	₹ 200.00/hr	₹ 0.00/hr	₹ 0.00	Prorated	
32	PLUMBER 1	Work		P		400%	₹ 200.00/hr	₹ 0.00/hr	₹ 0.00	Prorated	
33	PLUMBER 2	Work		P		400%	₹ 100.00/hr	₹ 0.00/hr	₹ 0.00	Prorated	
34	PLUMBER 3	Work		P		400%	₹ 100.00/hr	₹ 0.00/hr	₹ 0.00	Prorated	
35	PLUMBER 4	Work		P		450%	₹ 100.00/hr	₹ 0.00/hr	₹ 0.00	Prorated	
36	PLUMBER 5	Work		P		400%	₹ 100.00/hr	₹ 0.00/hr	₹ 0.00	Prorated	
37	BLOCK 1	Material		B			₹ 300,000.00		₹ 0.00	Prorated	
38	BRICK small	Material		B			₹ 30,000.00		₹ 0.00	Prorated	
39	JCB	Work		J		100%	₹ 100.00/hr	₹ 0.00/hr	₹ 0.00	Prorated	
40	GROOVE CUTTER	Work		G		300%	₹ 50.00/hr	₹ 0.00/hr	₹ 0.00	Prorated	
41	VIBRATOR	Work		V		300%	₹ 50.00/hr	₹ 0.00/hr	₹ 0.00	Prorated	
42	PLATE COMPACTOR	Work		P		300%	₹ 50.00/hr	₹ 0.00/hr	₹ 0.00	Prorated	
43	POWER HAMMER AND DRILLS	Work		P		100%	₹ 50.00/hr	₹ 0.00/hr	₹ 0.00	Prorated	
44	DEWATERING PUMP	Work		D		100%	₹ 50.00/hr	₹ 0.00/hr	₹ 0.00	Prorated	

Fig 4.20 Project 2 -material management

4.2.5 7D-QUALITY MANAGEMENT

RESIDENTIAL APARTMENTS GUINDY PRE COMMISSIONING CHECKLIST		
SITE LOCATION		
DATE		INCHARGE PERSON:
SI NO	DESCRIPTION	REMARKS (YES/NO/NA)
1	GENERAL INSPECTION ON SITE	YES
	Excavations, adjacent areas, and protective systems inspected by a competent person daily before the start of work.	YES
	Competent person has the authority to remove employees from the excavation immediately.	NO
	Surface encumbrances removed or supported.	YES
	Employees protected from loose rock or soil that could pose a hazard by falling or rolling into the excavation.	YES
	Hard hats worn by all employees.	NO
	Spoils, materials, and equipment set back at least two feet from the edge of the excavation.	YES
	Barriers provided at all remotely located excavations, wells, pits, shafts, etc.	NO
	Walkways and bridges over excavations four feet or more in depth are equipped with standard guardrails and toeboards.	NO
	Warning vests or other highly visible clothing provided and worn by all employees exposed to public vehicular traffic	YES
	Employees required to stand away from vehicles being loaded or unloaded	NO
	Warning system established and utilized when mobile equipment is operating near the edge of the excavation	NO
	Employees prohibited from going under suspended loads.	NO
	Employees prohibited from working on the faces of slopes or benched excavations above other employees.	NO

7D QUALITY MANAGEMENT

7D BIM = QUALITY MANAGEMENT IN O&M .

PRE COMMISSIONING CHECKLIST

Fig 4.21 Project 2 -pre-commissioning checklist

4.3 STAGE-03-PROJECT CLOSE OUT



ABOUT THE PROJECT
Client name - EK INFRA
Team/ Group - EK INFRA GROUP
Site location - MEDAVAKKAM
Project Status - 90 % COMPLETED
Built up area - 80,000 Sqft

Fig 4.22 Project 3-view

4.3.1 2D IN BIM LAYOUT



Fig 4.23 Project 3-layout design

4.3.2 3D IN BIM-REVIT MODULE

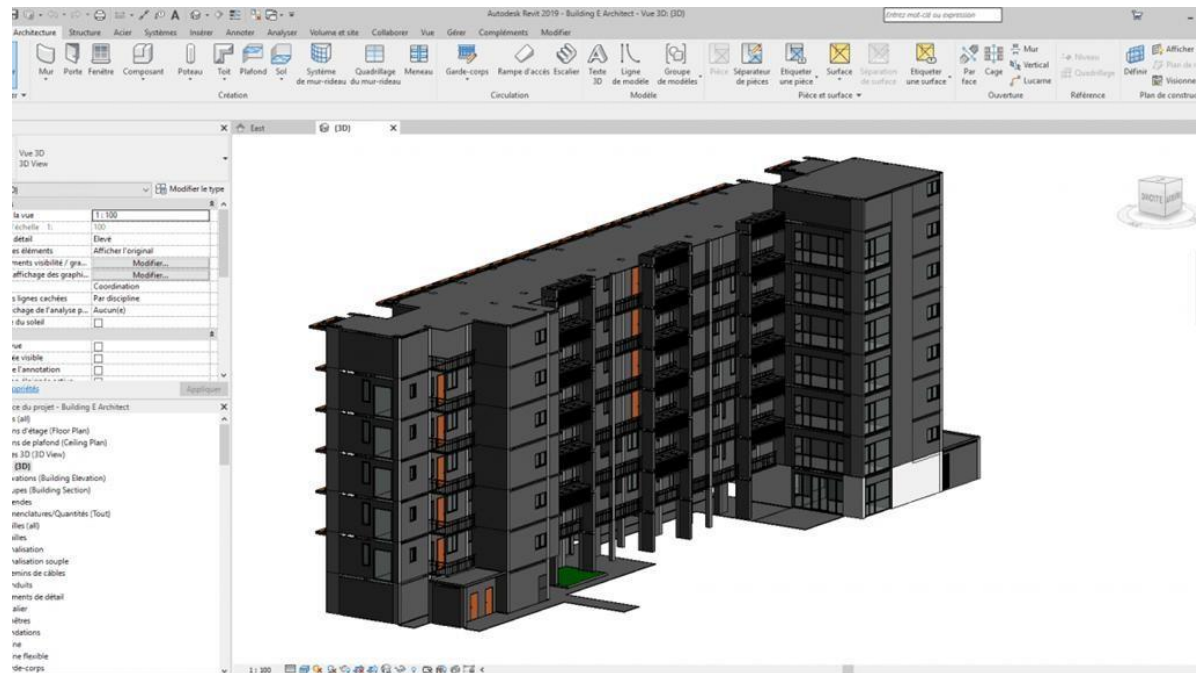


Fig 4.24 Project 3-3D BIM model

4.3.3 4&5D IN BIM - SCHEDULING

ID	Task Name	Duration	Start	Finish	Predecessors	Resource Names	Baseline Cost	Actual Cost	2020	2021	2022	2023	2024
1	APARTMENT @ MEDAVAKKAM	298 days	Mon 4/13/20	Wed 6/2/21			₹ 28,854,793.00	₹ 28,840,801.00					
2	PRE CONSTRUCTION	12 days	Mon 4/13/20	Tue 4/28/20			₹ 0.00	₹ 0.00					
3	Prepare contract drawings	3 days	Mon 4/13/20	Wed 4/15/20			₹ 0.00	₹ 0.00					
4	Permit (foundation)	3 days	Thu 4/16/20	Mon 4/20/20	3		₹ 0.00	₹ 0.00					
5	Permit (full building)	4 days	Tue 4/21/20	Fri 4/24/20	4		₹ 0.00	₹ 0.00					
6	Site utility relocation	2 days	Mon 4/27/20	Tue 4/28/20	5		₹ 0.00	₹ 0.00					
7	PROJECT PROCUREMENT	16 days	Thu 4/16/20	Thu 5/7/20			₹ 0.00	₹ 0.00					
8	Subcontractors bid & interview period	8 days	Thu 4/16/20	Mon 4/27/20	3		₹ 0.00	₹ 0.00					
9	Recommendation and approval of subcontracts	4 days	Tue 4/21/20	Fri 4/24/20	4		₹ 0.00	₹ 0.00					
10	Sheeting and Shoring procurement	8 days	Mon 4/27/20	Wed 5/6/20	5		₹ 0.00	₹ 0.00					
11	other material procurement	7 days	Wed 4/29/20	Thu 5/7/20	6		₹ 0.00	₹ 0.00					
12	RCC Sub Structure	66 days	Fri 5/8/20	Fri 8/7/20			₹ 3,277,937.00	₹ 3,277,937.00					
13	L.Mobilization ,Borewell and Grid Marking	8 days	Fri 5/8/20	Tue 5/19/20	11	FEMALE COOLIE 1 ,	₹ 19,136.00	₹ 19,136.00					
14	Earth Work excavation	8 days	Wed 5/20/20	Fri 5/29/20	13	FEMALE COOLIE 2 ,	₹ 22,336.00	₹ 22,336.00					
15	Soil filling &compaction	6 days	Mon 6/1/20	Mon 6/8/20	14	FEMALE COOLIE 1 ,	₹ 18,376.00	₹ 18,376.00					
16	Anti Termite Treatment & PCC for footings	2 days	Tue 6/9/20	Wed 6/10/20	15	MALE COOLIE 1,GROOVE CUTTER	₹ 2,192.00	₹ 2,192.00					
17	Footing column Reinforcement	5 days	Tue 6/11/20	Wed 6/17/20	16	20MM STEEL 6[0.5],12MM STEEL 6[1],40MM STEEL 1[1],GROOVE CUTTER	₹ 1,186,000.00	₹ 1,186,000.00					
18	Footing column Reinforcement	4 days	Thu 6/18/20	Tue 6/23/20	17	12MM STEEL 6[0.5],40MM STEEL [0.5],MALE COOLIE 2,M SAND [0.2]	₹ 521,484.00	₹ 521,484.00					
19	Shuttering for Footings	5 days	Wed 6/24/20	Tue 6/30/20	18	MALE COOLIE 3,SHUTTERING MATERIAL [1],CEMENT [1],FINE AGGREGATE [0.5],MALE COOLIE 2,M SAND [0.2]	₹ 2,000.00	₹ 2,000.00					
20	Concreting for footing	3 days	Wed 7/1/20	Fri 7/3/20	19	CEMENT [1],FINE AGGREGATE [0.5],MALE COOLIE 2,M SAND [0.2]	₹ 150,751.00	₹ 150,751.00					
21	Pedestal shoe marking and concreting	2 days	Mon 7/6/20	Tue 7/7/20	20	FEMALE COOLIE 2 ,FINE AGGREGATE [0.5],MALE COOLIE 2,M SAND [0.2]	₹ 120,367.00	₹ 120,367.00					
22	Shuttering for columns upto plinth	1 day	Wed 7/8/20	Wed 7/8/20	21	FEMALE COOLIE 1 ,FINE AGGREGATE [0.5],MALE COOLIE 2,M SAND [0.2]	₹ 3,592.00	₹ 3,592.00					
23	concreting of columns upto plinth	2 days	Thu 7/9/20	Fri 7/10/20	22	FEMALE COOLIE 1 ,FINE AGGREGATE [0.5],MALE COOLIE 2,M SAND [0.2]	₹ 121,567.00	₹ 121,567.00					
24	Back filling for footing	1 day	Mon 7/13/20	Mon 7/13/20	23	VIBRATOR ,FEMALE COOLIE 1 ,FINE AGGREGATE [0.5],MALE COOLIE 2,M SAND [0.2]	₹ 3,992.00	₹ 3,992.00					
25	consolidation in footing	3 days	Tue 7/14/20	Thu 7/16/20	24	MALE COOLIE 1,M ,FINE AGGREGATE [0.5],MALE COOLIE 2,M SAND [0.2]	₹ 5,176.00	₹ 5,176.00					
26	Compaction with earth rammer	1 day	Fri 7/17/20	Fri 7/17/20	25	PLATE COMPACTOR ,MALE COOLIE 1 ,FINE AGGREGATE [0.5],MALE COOLIE 2,M SAND [0.2]	₹ 1,792.00	₹ 1,792.00					
27	M Sand filling for Plinth beam	3 days	Mon 7/20/20	Wed 7/22/20	26	MALE COOLIE 1,M ,FINE AGGREGATE [0.5],MALE COOLIE 2,M SAND [0.2]	₹ 44,176.00	₹ 44,176.00					
28	PCC for Plinthbeam	2 days	Thu 7/23/20	Fri 7/24/20	27	40MM STEEL 5[1],20MM STEEL 6[1]	₹ 727,000.00	₹ 727,000.00					
29	Reinforcement for plinth beam	2 days	Mon 7/27/20	Tue 7/28/20	28	20MM STEEL 6[1],SHUTTERING MATERIAL [1]	₹ 300,000.00	₹ 300,000.00					
30	Shuttering for plinth beam	4 days	Wed 7/29/20	Mon 8/3/20	29	SHUTTERING MATERIAL [1],CEMENT [1]	₹ 1,000.00	₹ 1,000.00					
31	concreting for plinth beam	4 days	Tue 8/4/20	Fri 8/7/20	30	CEMENT [1]	₹ 27,000.00	₹ 27,000.00					
32	RCC Super structure	99 days	Mon 8/10/20	Thu 12/24/20			₹ 11,170,920.00	₹ 11,170,920.00					
33	Still floor roof slab	31 days	Mon 8/10/20	Mon 9/21/20			₹ 5,683,184.00	₹ 5,683,184.00					
34	Column Reinforcement upto FF	3 days	Mon 8/10/20	Wed 8/12/20	31	12MM STEEL 4[1],12MM STEEL 5[1],12MM STEEL 6[1],FEMALE COOLIE 4,FEMALE COOLIE 5	₹ 3,200,000.00	₹ 3,200,000.00					
35	Column Marking	1 day	Thu 8/13/20	Thu 8/13/20	34	FEMALE COOLIE 4 ,FEMALE COOLIE 5	₹ 0.00	₹ 0.00					
36	starter fixing and concreting above plinth beam	1 day	Fri 8/14/20	Fri 8/14/20	35	20MM STEEL 1[1]	₹ 400,000.00	₹ 400,000.00					
37	shuttering for colmns	3 days	Mon 8/17/20	Wed 8/19/20	36	SHUTTERING MATERIAL [1]	₹ 1,000.00	₹ 1,000.00					
38	Concreting for columns	1 day	Thu 8/20/20	Thu 8/20/20	37	M SAND [1]	₹ 200,000.00	₹ 200,000.00					
Project: PROJECT CLOSE OUT Date: Mon 3/28/22 Task Split Milestone Summary Project Summary Inactive Task Inactive Milestone Inactive Summary Manual Task Duration-only Manual Summary Rollup Manual Summary Start-only Finish-only External Tasks External Milestone Deadline Progress Manual Progress													

Page 1

ID	Task Name	Duration	Start	Finish	Predecessor	Resource Names	Baseline Cost	Actual Cost	2020	2021	2022	2023	2024
39	Brickwork for basement	4 days	Fri 8/21/20	Wed 8/26/20	38	BLOCK 4 [1]	₹ 1,525,000.00	₹ 1,525,000.00	H2	H1	H2	H1	H2
40	Filling and Consolidation	2 days	Thu 8/27/20	Fri 8/28/20	39	MALE COOLIE 1,M,₹ 2,784.00	₹ 2,784.00						
41	Compaction with eart rammer	1 day	Mon 8/31/20	Mon 8/31/20	40	VIBRATOR	₹ 400.00	₹ 400.00					
42	Pest control for basement floor area	1 day	Tue 9/1/20	Tue 9/1/20	41		₹ 0.00	₹ 0.00					
43	PCC in floor area	2 days	Wed 9/2/20	Thu 9/3/20	42	CEMENT [1]	₹ 27,000.00	₹ 27,000.00					
44	Shuttering for GF roof slab	5 days	Fri 9/4/20	Thu 9/10/20	43		₹ 0.00	₹ 0.00					
45	Reinforcement for GF roof slab	4 days	Fri 9/11/20	Wed 9/16/20	44	12MM STEEL 3[1]	₹ 300,000.00	₹ 300,000.00					
46	MEP works	2 days	Thu 9/17/20	Fri 9/18/20	45		₹ 0.00	₹ 0.00					
47	slab concreting	1 day	Mon 9/21/20	Mon 9/21/20	46	CEMENT [1]	₹ 27,000.00	₹ 27,000.00					
48	First floor roof slab	18 days	Tue 9/22/20	Thu 10/15/20	47	₹ 3,285,568.00	₹ 3,285,568.00						
49	column Reinforcement upto SF	2 days	Tue 9/22/20	Wed 9/23/20	47	40MM STEEL 2[1],	₹ 1,127,000.00	₹ 1,127,000.00					
50	Column marking	1 day	Thu 9/24/20	Thu 9/24/20	49	FEMALE COOLIE 4,	₹ 0.00	₹ 0.00					
51	starter fixing and concreting	1 day	Fri 9/25/20	Fri 9/25/20	50	20MM STEEL 1[1]	₹ 400,000.00	₹ 400,000.00					
52	shuttering for columns	2 days	Mon 9/28/20	Tue 9/29/20	51	SHUTTERING MATI	₹ 1,000.00	₹ 1,000.00					
53	concreting for columns	1 day	Wed 9/30/20	Wed 9/30/20	52	M SAND [1]	₹ 200,000.00	₹ 200,000.00					
54	shuttering for first floor roof slab	5 days	Thu 10/1/20	Wed 10/7/20	53	BLOCK 4 [1]	₹ 1,525,000.00	₹ 1,525,000.00					
55	Reinforcement for FF roof slab	4 days	Thu 10/8/20	Tue 10/13/20	54	MALE COOLIE 1,M,₹ 5,568.00	₹ 5,568.00						
56	MEP Works	1 day	Wed 10/14/20	Wed 10/14/20	55		₹ 0.00	₹ 0.00					
57	Slab concreting	1 day	Thu 10/15/20	Thu 10/15/20	56	CEMENT [1]	₹ 27,000.00	₹ 27,000.00					
58	Second floor roof slab	18 days	Fri 10/16/20	Tue 11/10/20	57	₹ 757,392.00	₹ 757,392.00						
59	column Reinforcement upto TF	2 days	Fri 10/16/20	Mon 10/19/20	57	20MM STEEL 5[1]	₹ 400,000.00	₹ 400,000.00					
60	Column marking	1 day	Tue 10/20/20	Tue 10/20/20	59	MALE COOLIE 1,M,₹ 1,392.00	₹ 1,392.00						
61	starter fixing and concreting	1 day	Wed 10/21/20	Wed 10/21/20	60		₹ 0.00	₹ 0.00					
62	shuttering for columns	2 days	Thu 10/22/20	Fri 10/23/20	61	SHUTTERING MATI	₹ 1,000.00	₹ 1,000.00					
63	concreting for columns	1 day	Mon 10/26/20	Mon 10/26/20	62	CEMENT [1]	₹ 27,000.00	₹ 27,000.00					
64	shuttering for first floor roof slab	5 days	Mon 10/27/20	Mon 11/2/20	63	SHUTTERING MATI	₹ 1,000.00	₹ 1,000.00					
65	Reinforcement for FF roof slab	4 days	Tue 11/3/20	Fri 11/6/20	64	12MM STEEL 3[1]	₹ 300,000.00	₹ 300,000.00					
66	MEP Works	1 day	Mon 11/9/20	Mon 11/9/20	65		₹ 0.00	₹ 0.00					
67	Slab concreting	1 day	Tue 11/10/20	Tue 11/10/20	66	CEMENT [1]	₹ 27,000.00	₹ 27,000.00					
68	Third floor roof slab	20 days	Tue 11/11/20	Tue 12/8/20	67	₹ 657,392.00	₹ 657,392.00						
69	column Reinforcement upto Terrace	2 days	Wed 11/11/20	Thu 11/12/20	67	12MM STEEL 1[1]	₹ 300,000.00	₹ 300,000.00					
70	Column marking	1 day	Fri 11/13/20	Fri 11/13/20	69	MALE COOLIE 1,M,₹ 1,392.00	₹ 1,392.00						
71	starter fixing and concreting	1 day	Mon 11/16/20	Mon 11/16/20	70		₹ 0.00	₹ 0.00					
72	shuttering for columns	3 days	Tue 11/17/20	Thu 11/19/20	71	SHUTTERING MATI	₹ 1,000.00	₹ 1,000.00					
73	concreting for columns	2 days	Fri 11/20/20	Mon 11/23/20	72	CEMENT [1]	₹ 27,000.00	₹ 27,000.00					
74	shuttering for first floor roof slab	5 days	Tue 11/24/20	Mon 11/30/20	73	SHUTTERING MATI	₹ 1,000.00	₹ 1,000.00					
75	Reinforcement for FF roof slab	4 days	Tue 12/1/20	Fri 12/4/20	74	12MM STEEL 3[1]	₹ 300,000.00	₹ 300,000.00					
76	Electrical conduitwork	1 day	Mon 12/7/20	Mon 12/7/20	75		₹ 0.00	₹ 0.00					

Project: PROJECT CLOSE OUT Date: Mon 3/28/22	Task	Project Summary	Manual Task	Start-only	Deadline
Split	Inactive Task	Duration-only	Finish-only	Progress	
Milestone	Inactive Milestone	Manual Summary Rollup	External Tasks	Manual Progress	
Summary	Inactive Summary	Manual Summary	External Milestone		

ID	Task Name	Duration	Start	Finish	Predecessor	Resource Names	Baseline Cost	Actual Cost	2020	2021	2022	2023	2024
77	Slab concreting	1 day	Tue 12/8/20	Tue 12/8/20	76	CEMENT [1]	₹ 27,000.00	₹ 27,000.00					
78	Terrace floor roof slab/Head Room/LMR	12 days	Wed 12/9/20	Thu 12/24/20	77	₹ 787,384.00	₹ 787,384.00						
79	column Reinforcement upto Head room	2 days	Wed 12/9/20	Thu 12/10/20	77	20MM STEEL 5[1]	₹ 400,000.00	₹ 400,000.00					
80	Column starter marking	1 day	Fri 12/11/20	Fri 12/11/20	79	MALE COOLIE 1,M,₹ 1,392.00	₹ 1,392.00						
81	starter fixing and concreting	1 day	Mon 12/14/20	Mon 12/14/20	80	CEMENT [1],MALE	₹ 28,392.00	₹ 28,392.00					
82	shuttering for columns	1 day	Tue 12/15/20	Tue 12/15/20	81	SHUTTERING MATI	₹ 1,000.00	₹ 1,000.00					
83	concreting for columns	1 day	Wed 12/16/20	Wed 12/16/20	82	CEMENT [1]	₹ 27,000.00	₹ 27,000.00					
84	shuttering for first floor roof slab	2 days	Thu 12/17/20	Fri 12/18/20	83	SHUTTERING MATI	₹ 1,000.00	₹ 1,000.00					
85	Reinforcement for FF roof slab	2 days	Mon 12/21/20	Tue 12/22/20	84	12MM STEEL 4[1]	₹ 300,000.00	₹ 300,000.00					
86	Electrical conduitwork	1 day	Wed 12/23/20	Wed 12/23/20	85	ELECTRICIAN 3	₹ 1,600.00	₹ 1,600.00					
87	LMR Slab concreting	1 day	Thu 12/24/20	Thu 12/24/20	86	CEMENT [1]	₹ 27,000.00	₹ 27,000.00					
88	Brick work	63 days	Mon 8/17/20	Wed 11/11/20	84	₹ 12,273,762.00	₹ 12,273,762.00						
89	Stillt floor	48 days	Mon 8/17/20	Wed 10/14/20	35	BLOCK 1 [1]	₹ 12,271,760.00	₹ 12,271,760.00					
90	BW upto lintel level	5 days	Mon 8/17/20	Fri 8/21/20	36	MALE COOLIE 1,M,₹ 6,960.00	₹ 6,960.00						
91	P/F of Lintel /sunshade	3 days	Mon 8/20/20	Mon 8/24/20	37	MALE COOLIE 3,M,₹ 2,088.00	₹ 2,088.00						
92	BW above lintel	2 days	Fri 8/21/20	Mon 8/24/20	38	FEMALE COOLIE 1,	₹ 2,592.00	₹ 2,592.00					
93	First floor	12 days	Mon 8/31/20	Tue 9/15/20	39	BLOCK 2 [1]	₹ 1,545,040.00	₹ 1,545,040.00					
94	BW upto window sill level	3 days	Mon 8/31/20	Wed 9/2/20	40	FEMALE COOLIE 1,	₹ 7,776.00	₹ 7,776.00					
95	P/F of window sill concrete	1 day	Tue 9/1/20	Tue 9/1/20	41	FEMALE COOLIE 1,	₹ 1,896.00	₹ 1,896.00					
96	BW from window sill to lintel lvl	4 days	Wed 9/2/20	Mon 9/7/20	42	FEMALE COOLIE 1,	₹ 10,368.00	₹ 10,368.00					
97	P/F of Lintel /sunshade / loft	4 days	Fri 9/4/20	Wed 9/9/20	43	FEMALE COOLIE 4,	₹ 0.00	₹ 0.00					
98	BW above lintel	3 days	Fri 9/11/20	Tue 9/15/20	44	MALE COOLIE 5,M,₹ 0.00	₹ 0.00						
99	Second floor	23 days	Mon 9/21/20	Wed 10/21/20	45	BLOCK 3 [1]	₹ 1,545,040.00	₹ 1,545,040.00					
100	BW upto window sill level	3 days	Mon 9/21/20	Wed 9/23/20	46	FEMALE COOLIE 2,	₹ 7,776.00	₹ 7,776.00					
101	P/F of window sill concrete	1 day	Tue 9/22/20	Tue 9/22/20	47	FEMALE COOLIE 1,	₹ 1,896.00	₹ 1,896.00					
102	BW from window sill to lintel lvl	4 days	Fri 10/16/20	Wed 10/21/20	48	FEMALE COOLIE 1,	₹ 10,368.00	₹ 10,368.00					
103	P/F of Lintel /sunshade / loft	4 days	Fri 9/24/20	Tue 9/29/20	49	FEMALE COOLIE 4,	₹ 0.00	₹ 0.00					
104	BW above lintel	4 days	Fri 9/25/20	Wed 9/30/20	50	MALE COOLIE 5,M,₹ 0.00	₹ 0.00						
105	Third floor	14 days	Wed 9/30/20	Mon 10/19/20	51	BLOCK 4 [1]	₹ 1,545,040.00	₹ 1,545,040.00					
106	BW upto window sill level	3 days	Wed 9/30/20	Fri 10/2/20	52	FEMALE COOLIE 1,	₹ 7,776.00	₹ 7,776.00					
107	P/F of window sill concrete	1 day	Thu 10/1/20	Thu 10/1/20	53	FEMALE COOLIE 1,	₹ 1,896.00	₹ 1,896.00					
108	BW from window sill to lintel lvl	4 days	Thu 10/8/20	Tue 10/13/20	54	FEMALE COOLIE 1,	₹ 10,368.00	₹ 10,368.00					
109	P/F of Lintel /sunshade / loft	4 days	Wed 10/14/20	Mon 10/19/20	55	FEMALE COOLIE 4,	₹ 0.00	₹ 0.00					
110	BW above lintel	3 days	Thu 10/15/20	Mon 10/19/20	56	MALE COOLIE 5,M,₹ 0.00	₹ 0.00						
111	Terrace Floor	17 days	Tue 10/20/20	Wed 11/11/20	57	₹ 1,992.00	₹ 1,992.00						
112	BW for LMR and Parapet wall	1 day	Wed 11/11/20	Wed 11/11/20	58	MALE COOLIE 1,M,₹ 1,392.00	₹ 1,392.00						
113	P/F of Lintel /sunshade / loft	1 day	Tue 10/20/20	Tue 10/20/20	59	FEMALE COOLIE 2,	₹ 600.00	₹ 600.00					
114	BW above lintel	1 day	Wed 10/21/20	Wed 10/21/20	60	FEMALE COOLIE 3,	₹ 0.00	₹ 0.00					

Project: PROJECT CLOSE OUT Date: Mon 3/28/22	Task	Project Summary	Manual Task	Start-only	Deadline
Split	Inactive Task	Duration-only	Finish-only	Progress	
Milestone	Inactive Milestone	Manual Summary Rollup	External Tasks	Manual Progress	
Summary	Inactive Summary	Manual Summary	External Milestone		

ID	Task Name	Duration	Start	Finish	Predecessor	Resource Names	Baseline Cost	Actual Cost	2020	2021	2022	2023	2024
115	Electrical Works	22 days	Thu 11/12/20	Fri 12/11/20	88		₹ 1,004,800.00	₹ 1,004,800.00					
116	Concealed works	10 days	Thu 11/12/20	Wed 11/25/20	88		₹ 112,000.00	₹ 112,000.00					
117	Stilt Floor	5 days	Thu 11/12/20	Wed 11/18/20	89	ELECTRICIAN 1 ,ELE	₹ 16,000.00	₹ 16,000.00					
118	First floor	10 days	Thu 11/12/20	Wed 11/25/20	93	ELECTRICIAN 1 ,ELE	₹ 32,000.00	₹ 32,000.00					
119	second floor	10 days	Thu 11/12/20	Wed 11/25/20	99	ELECTRICIAN 1 ,ELE	₹ 32,000.00	₹ 32,000.00					
120	Third floor	10 days	Thu 11/12/20	Wed 11/25/20	105	ELECTRICIAN 2 ,ELE	₹ 32,000.00	₹ 32,000.00					
121	Wirreing works	9 days	Thu 11/26/20	Tue 12/8/20			₹ 460,800.00	₹ 460,800.00					
122	Stilt Floor	5 days	Thu 11/26/20	Wed 12/2/20	118	ELECTRICIAN 2 ,ELE	₹ 416,000.00	₹ 416,000.00					
123	First floor	5 days	Thu 11/26/20	Wed 12/2/20	119	ELECTRICIAN 2 ,ELE	₹ 16,000.00	₹ 16,000.00					
124	second floor	5 days	Thu 11/26/20	Wed 12/2/20	120	ELECTRICIAN 1 ,ELE	₹ 16,000.00	₹ 16,000.00					
125	Third floor	4 days	Thu 12/3/20	Tue 12/8/20	122	ELECTRICIAN 1 ,ELE	₹ 12,800.00	₹ 12,800.00					
126	Final Fixtures	7 days	Thu 12/3/20	Fri 12/11/20			₹ 432,000.00	₹ 432,000.00					
127	Stilt Floor	3 days	Wed 12/9/20	Fri 12/11/20	121	ELECTRICIAN 2 ,ELE	₹ 409,600.00	₹ 409,600.00					
128	First floor	3 days	Thu 12/3/20	Mon 12/7/20	122	ELECTRICIAN 2 ,ELE	₹ 9,600.00	₹ 9,600.00					
129	second floor	3 days	Thu 12/3/20	Mon 12/7/20	123	ELECTRICIAN 1 ,ELE	₹ 9,600.00	₹ 9,600.00					
130	Third floor	1 day	Thu 12/3/20	Thu 12/3/20	124	ELECTRICIAN 1 ,ELE	₹ 3,200.00	₹ 3,200.00					
131	Plumbing	50 days	Thu 11/12/20	Wed 1/20/21	88		₹ 518,400.00	₹ 518,400.00					
132	Plumbing Concealed works	48 days	Thu 11/12/20	Mon 1/18/21			₹ 288,000.00	₹ 288,000.00					
133	First floor	48 days	Thu 11/12/20	Mon 1/18/21	88	PLUMBER 1,PLUMI	₹ 230,400.00	₹ 230,400.00					
134	second floor	6 days	Thu 11/12/20	Thu 11/19/20	99	PLUMBER 1,PLUMI	₹ 28,800.00	₹ 28,800.00					
135	Third floor	6 days	Thu 11/12/20	Thu 11/19/20	105	PLUMBER 1,PLUMI	₹ 28,800.00	₹ 28,800.00					
136	Plumbing Final Fixtures	43 days	Fri 11/20/20	Tue 1/19/21			₹ 220,800.00	₹ 220,800.00					
137	First floor	1 day	Tue 1/19/21	Tue 1/19/21	133	PLUMBER 1,PLUMI	₹ 4,800.00	₹ 4,800.00					
138	second floor	1 day	Fri 11/20/20	Fri 11/20/20	134	PLUMBER 1,PLUMI	₹ 4,800.00	₹ 4,800.00					
139	Third floor	1 day	Fri 11/20/20	Fri 11/20/20	135	PLUMBER 1,PLUMI	₹ 4,800.00	₹ 4,800.00					
140	Roof water tanks works	1 day	Wed 1/20/21	Wed 1/20/21	136	PLUMBER 1,PLUMI	₹ 4,800.00	₹ 4,800.00					
141	External works	1 day	Wed 1/20/21	Wed 1/20/21	137	PLUMBER 1,PLUMI	₹ 4,800.00	₹ 4,800.00					
142	Plastering Work	93 days	Thu 1/21/21	Mon 5/31/21	131		₹ 391,464.00	₹ 391,464.00					
143	Internal plastering	93 days	Thu 1/21/21	Mon 5/31/21			₹ 303,264.00	₹ 303,264.00					
144	First Floor	93 days	Thu 1/21/21	Mon 5/31/21	90	FEMALE COOLIE 1 ,	₹ 241,056.00	₹ 241,056.00					
145	second Floor	12 days	Thu 1/21/21	Fri 2/5/21	93	FEMALE COOLIE 3 ,	₹ 0.00	₹ 0.00					
146	Third Floor	12 days	Thu 1/21/21	Fri 2/5/21	105	FEMALE COOLIE 1 ,	₹ 31,104.00	₹ 31,104.00					
147	Ground Floor	12 days	Thu 1/21/21	Fri 2/5/21	111	FEMALE COOLIE 1 ,	₹ 31,104.00	₹ 31,104.00					
148	External Plastering	15 days	Thu 1/21/21	Wed 2/10/21			₹ 88,200.00	₹ 88,200.00					
149	North side	15 days	Thu 1/21/21	Wed 2/10/21	132	FEMALE COOLIE 1 ,	₹ 38,880.00	₹ 38,880.00					
150	South side	15 days	Thu 1/21/21	Wed 2/10/21	134	FEMALE COOLIE 3 ,	₹ 0.00	₹ 0.00					
151	East side	15 days	Thu 1/21/21	Wed 2/10/21	135	FEMALE COOLIE 1 ,	₹ 38,880.00	₹ 38,880.00					
152	West side	15 days	Thu 1/21/21	Wed 2/10/21	133	MALE COOLIE 4 ,M	₹ 10,440.00	₹ 10,440.00					

ID	Task Name	Duration	Start	Finish	Predecessor	Resource Names	Baseline Cost	Actual Cost	2020	2021	2022	2023	2024
191	second floor	1 day	Mon 2/8/21	Mon 2/8/21	145		₹ 0.00	₹ 0.00					
192	Third floor	1 day	Mon 2/8/21	Mon 2/8/21	146		₹ 0.00	₹ 0.00					
193	snag	82 days	Tue 2/9/21	Wed 6/2/21			₹ 11,200.00	₹ 11,200.00					
194	First floor	1 day	Wed 2/10/21	Wed 2/10/21	179	PAINTING 1 ,PAINT	₹ 4,000.00	₹ 4,000.00					
195	second floor	1 day	Tue 2/9/21	Tue 2/9/21	180	PAINTING 2 ,PAINT	₹ 3,200.00	₹ 3,200.00					
196	Third floor	1 day	Wed 6/2/21	Wed 6/2/21	181	PAINTING 1 ,PAINT	₹ 4,000.00	₹ 4,000.00					
197	Windows	1 day	Tue 6/1/21	Tue 6/1/21			₹ 5,392.00	₹ 5,392.00					
198	UPVC / Aluminium / wooden windows	1 day	Tue 6/1/21	Tue 6/1/21	144		₹ 3,792.00	₹ 3,792.00					
199	First Floor	1 day	Tue 6/1/21	Tue 6/1/21	144	MALE COOLIE 1,PA	₹ 1,496.00	₹ 1,496.00					
200	second floor	1 day	Tue 6/1/21	Tue 6/1/21	145	MALE COOLIE 2,PA	₹ 1,496.00	₹ 1,496.00					
201	Third floor	1 day	Tue 6/1/21	Tue 6/1/21	146	MALE COOLIE 7,PA	₹ 800.00	₹ 800.00					
202	Ground Floor / common areas / others	1 day	Tue 6/1/21	Tue 6/1/21			₹ 0.00	₹ 0.00					
203	Safety grills	1 day	Tue 6/1/21	Tue 6/1/21	144		₹ 1,600.00	₹ 1,600.00					
204	First Floor	1 day	Tue 6/1/21	Tue 6/1/21	144	PAINTING 8	₹ 800.00	₹ 800.00					
205	second floor	1 day	Tue 6/1/21	Tue 6/1/21	145	MALE COOLIE 8	₹ 0.00	₹ 0.00					
206	Third floor	1 day	Tue 6/1/21	Tue 6/1/21	146	PAINTING 9	₹ 800.00	₹ 800.00					
207	Ground Floor / common areas / others	1 day	Tue 6/1/21	Tue 6/1/21			₹ 0.00	₹ 0.00					
208	Painting work	110 days	Thu 12/31/20	Wed 6/2/21			₹ 84,000.00	₹ 84,000.00					
209	Internal Painting --First Floor	1 day	Tue 6/1/21	Tue 6/1/21	144		₹ 18,400.00	₹ 18,400.00					
210	Putty - First coat	1 day	Tue 6/1/21	Tue 6/1/21	145	PAINTING 1 ,PAINT	₹ 4,000.00	₹ 4,000.00					
211	Putty - Second Coat	1 day	Tue 6/1/21	Tue 6/1/21	146	PAINTING 2 ,PAINT	₹ 3,200.00	₹ 3,200.00					
212	sanding and primer works	1 day	Tue 6/1/21	Tue 6/1/21	147	PAINTING 1 ,PAINT	₹ 4,000.00	₹ 4,000.00					
213	Wall paint first coat	1 day	Tue 6/1/21	Tue 6/1/21	148	PAINTING 2 ,PAINT	₹ 3,200.00	₹ 3,200.00					
214	wall paint second coat	1 day	Tue 6/1/21	Tue 6/1/21	149	PAINTING 1 ,PAINT	₹ 4,000.00	₹ 4,000.00					
215	Internal Painting -- Second floor	1 day	Tue 6/1/21	Tue 6/1/21	144		₹ 18,400.00	₹ 18,400.00					
216	Putty - First coat	1 day	Tue 6/1/21	Tue 6/1/21	145	PAINTING 1 ,PAINT	₹ 4,000.00	₹ 4,000.00					
217	Putty - Second Coat	1 day	Tue 6/1/21	Tue 6/1/21	146	PAINTING 2 ,PAINT	₹ 3,200.00	₹ 3,200.00					
218	sanding and primer works	1 day	Tue 6/1/21	Tue 6/1/21	147	PAINTING 1 ,PAINT	₹ 4,000.00	₹ 4,000.00					
219	Wall paint first coat	1 day	Tue 6/1/21	Tue 6/1/21	148	PAINTING 2 ,PAINT	₹ 3,200.00	₹ 3,200.00					
220	wall paint second coat	1 day	Tue 6/1/21	Tue 6/1/21	149	PAINTING 1 ,PAINT	₹ 4,000.00	₹ 4,000.00					
221	Internal Painting -- Third floor	1 day	Thu 2/11/21	Thu 2/11/21	150		₹ 18,400.00	₹ 18,400.00					
222	Putty - First coat	1 day	Thu 2/11/21	Thu 2/11/21	151	PAINTING 1 ,PAINT	₹ 4,000.00	₹ 4,000.00					
223	Putty - Second Coat	1 day	Thu 2/11/21	Thu 2/11/21	152	PAINTING 2 ,PAINT	₹ 3,200.00	₹ 3,200.00					
224	sanding and primer works	1 day	Thu 2/11/21	Thu 2/11/21	153	PAINTING 1 ,PAINT	₹ 4,000.00	₹ 4,000.00					
225	Wall paint first coat	1 day	Thu 2/11/21	Thu 2/11/21	154	PAINTING 2 ,PAINT	₹ 3,200.00	₹ 3,200.00					
226	wall paint second coat	1 day	Thu 2/11/21	Thu 2/11/21	155	PAINTING 1 ,PAINT	₹ 4,000.00	₹ 4,000.00					
227	External Painting	110 days	Thu 12/31/20	Wed 6/2/21	156		₹ 10,400.00	₹ 10,400.00					
228	Primer	1 day	Thu 12/31/20	Thu 12/31/20	157	PAINTING 2 ,PAINT	₹ 3,200.00	₹ 3,200.00					

ID	Task Name	Duration	Start	Finish	Predecessor	Resource Names	Baseline Cost	Actual Cost	2020	2021	2022	2023	2024
229	First Coat	1 day	Wed 6/2/21	Wed 6/2/21	158	PAINTING 1 ,PAINT	₹ 4,000.00	₹ 4,000.00					
230	second Coat	1 day	Wed 6/2/21	Wed 6/2/21	159	PAINTING 2 ,PAINT	₹ 3,200.00	₹ 3,200.00					
231	Ground Floor Painting works	1 day	Wed 6/2/21	Wed 6/2/21	160		₹ 18,400.00	₹ 18,400.00					
232	Putty - First coat	1 day	Wed 6/2/21	Wed 6/2/21	161	PAINTING 1 ,PAINT	₹ 4,000.00	₹ 4,000.00					
233	Putty - Second Coat	1 day	Wed 6/2/21	Wed 6/2/21	162	PAINTING 2 ,PAINT	₹ 3,200.00	₹ 3,200.00					
234	sanding and primer works	1 day	Wed 6/2/21	Wed 6/2/21	163	PAINTING 1 ,PAINT	₹ 4,000.00	₹ 4,000.00					
235	Wall paint first coat	1 day	Wed 6/2/21	Wed 6/2/21	164	PAINTING 2 ,PAINT	₹ 3,200.00	₹ 3,200.00					
236	wall paint second coat	1 day	Wed 6/2/21	Wed 6/2/21	165	PAINTING 1 ,PAINT	₹ 4,000.00	₹ 4,000.00					
237	INSPECTION @ CLOSE - OUT	1 day	Wed 6/2/21	Wed 6/2/21	166		₹ 13,992.00	₹ 0.00					
238	Weather day allowance	1 day	Wed 6/2/21	Wed 6/2/21	167		₹ 0.00	₹ 0.00					
239	Final clean	1 day	Wed 6/2/21	Wed 6/2/21	168	FEMALE COOLIE 2 ,	₹ 1,992.00	₹ 0.00					

ID	Task Name	Duration	Start	Finish	Predecessor	Resource Names	Baseline Cost	Actual Cost	2020	2021	2022	2023	2024
153	waterproofing work	72 days	Tue 9/22/20	Wed 12/30/20			₹ 33,888.00	₹ 33,888.00	H2	H1	H2	H1	H2
154	waterproofing for sunken @ first floor	6 days	Tue 9/22/20	Tue 9/29/20	33	FEMALE COOLIE 1, ₹ 15,552.00	₹ 15,552.00						
155	waterproofing for sunken @ second floor	6 days	Fri 10/16/20	Fri 10/23/20	48	FEMALE COOLIE 3, ₹ 0.00	₹ 0.00						
156	Water proofing for sunken @ Third floor	6 days	Wed 12/9/20	Wed 12/16/20	68	FEMALE COOLIE 1, ₹ 15,552.00	₹ 15,552.00						
157	Terrace waterproofing	4 days	Fri 12/25/20	Wed 12/30/20	78	MALE COOLIE 4, ₹ 2,784.00	₹ 2,784.00						
158	Floor Finishing works	297 days	Mon 4/13/20	Tue 6/1/21			₹ 16,248.00	₹ 16,248.00					
159	Dry Areas	297 days	Mon 4/13/20	Tue 6/1/21			₹ 5,880.00	₹ 5,880.00					
160	Floor Tile -- First Floor (Including Skirting)	1 day	Tue 6/1/21	Tue 6/1/21	144	FEMALE COOLIE 1, ₹ 2,592.00	₹ 2,592.00						
161	Floor Tile -- Second Floor (Including Skirting)	1 day	Mon 2/8/21	Mon 2/8/21	145	FEMALE COOLIE 3, ₹ 0.00	₹ 0.00						
162	Floor Tile -- Third Floor (Including Skirting)	1 day	Mon 2/8/21	Mon 2/8/21	146	FEMALE COOLIE 1, ₹ 2,592.00	₹ 2,592.00						
163	Ground floor (Common areas+ car park +	1 day	Mon 4/13/20	Mon 4/13/20		MALE COOLIE 4, ₹ 696.00	₹ 696.00						
164	wet areas	82 days	Mon 2/8/21	Tue 6/1/21			₹ 10,368.00	₹ 10,368.00					
165	wall tile	82 days	Mon 2/8/21	Tue 6/1/21			₹ 5,184.00	₹ 5,184.00					
166	wall tile -- First Floor	1 day	Tue 6/1/21	Tue 6/1/21	144	FEMALE COOLIE 1, ₹ 2,592.00	₹ 2,592.00						
167	wall tile -- Second Floor	1 day	Mon 2/8/21	Mon 2/8/21	145	FEMALE COOLIE 3, ₹ 0.00	₹ 0.00						
168	wall tile -- Third Floor	1 day	Mon 2/8/21	Mon 2/8/21	146	FEMALE COOLIE 1, ₹ 2,592.00	₹ 2,592.00						
169	Floor Tile	82 days	Mon 2/8/21	Tue 6/1/21			₹ 5,184.00	₹ 5,184.00					
170	First Floor	1 day	Tue 6/1/21	Tue 6/1/21	144	FEMALE COOLIE 1, ₹ 2,592.00	₹ 2,592.00						
171	second floor	1 day	Mon 2/8/21	Mon 2/8/21	145	FEMALE COOLIE 3, ₹ 0.00	₹ 0.00						
172	Third floor	1 day	Mon 2/8/21	Mon 2/8/21	146	FEMALE COOLIE 1, ₹ 2,592.00	₹ 2,592.00						
173	Roof works	1 day	Thu 2/11/21	Thu 2/11/21			₹ 0.00	₹ 0.00					
174	weather proof tiles	1 day	Thu 2/11/21	Thu 2/11/21	149	FEMALE COOLIE 3, ₹ 0.00	₹ 0.00						
175	Joinery work	83 days	Mon 2/8/21	Wed 6/2/21			₹ 64,000.00	₹ 64,000.00					
176	Doors	83 days	Mon 2/8/21	Wed 6/2/21			₹ 64,000.00	₹ 64,000.00					
177	Frames	83 days	Mon 2/8/21	Wed 6/2/21			₹ 24,000.00	₹ 24,000.00					
178	First floor	2 days	Tue 6/1/21	Wed 6/2/21	144	CARPENTER ,CARP ₹ 9,600.00	₹ 9,600.00						
179	second floor	2 days	Mon 2/8/21	Tue 2/9/21	145	CARPENTER ,CARP ₹ 9,600.00	₹ 9,600.00						
180	Third floor	1 day	Mon 2/8/21	Mon 2/8/21	146	CARPENTER ,CARP ₹ 4,800.00	₹ 4,800.00						
181	shutters	82 days	Mon 2/8/21	Tue 6/1/21			₹ 14,400.00	₹ 14,400.00					
182	First floor	1 day	Tue 6/1/21	Tue 6/1/21	144	CARPENTER ,CARP ₹ 4,800.00	₹ 4,800.00						
183	second floor	1 day	Mon 2/8/21	Mon 2/8/21	145	CARPENTER ,CARP ₹ 4,800.00	₹ 4,800.00						
184	Third floor	1 day	Mon 2/8/21	Mon 2/8/21	146	CARPENTER ,CARP ₹ 4,800.00	₹ 4,800.00						
185	Ironmongery	82 days	Mon 2/8/21	Tue 6/1/21			₹ 14,400.00	₹ 14,400.00					
186	First floor	1 day	Tue 6/1/21	Tue 6/1/21	144	CARPENTER ,CARP ₹ 4,800.00	₹ 4,800.00						
187	second floor	1 day	Mon 2/8/21	Mon 2/8/21	145	CARPENTER ,CARP ₹ 4,800.00	₹ 4,800.00						
188	Third floor	1 day	Mon 2/8/21	Mon 2/8/21	146	CARPENTER ,CARP ₹ 4,800.00	₹ 4,800.00						
189	Painting	82 days	Mon 2/8/21	Tue 6/1/21			₹ 0.00	₹ 0.00					
190	First floor	1 day	Tue 6/1/21	Tue 6/1/21	144		₹ 0.00	₹ 0.00					

Project: PROJECT CLOSE OUT
Date: Mon 3/28/22

Task

Split

Milestone

Summary

Project Summary

Inactive Task

Inactive Milestone

Interflow Summary

Manual Task

Duration-only

Manual Summary Rollup

Manual Summary

Start-only

Finish-only

External Tasks

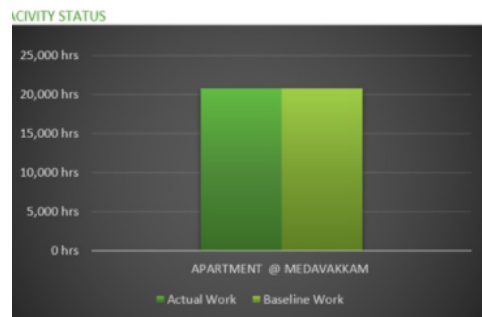
External Milestone

Deadline

Progress

Manual Progress

4D BIM = 3D + TIME TASK DURATION OVERVIEW



MANUAL CALCULATION OF DURATION

Name	Actual Duration	Baseline Duration
APARTMENT @ MEDAVAKKAM	298 days	298 days

WORK PACKAGE	DURATION
Pre construction	30DAYS
Project procurement	60 DAYS
Rcc substructure	100 DAYS
Rcc superstructure	150 DAYS
Block work	200 DAYS
Electrical work	60 DAYS
Plumbing	60 DAYS
Plastering	30 DAYS
Water proofing	200 DAYS
Floor finishing	100 DAYS
Joinery work	100 DAYS
Window	10 DAYS
Painting work	100 DAYS
Inspection	7DAYS

Fig 4.26 Project 3 -Task duration overview

5D GANTT CHART

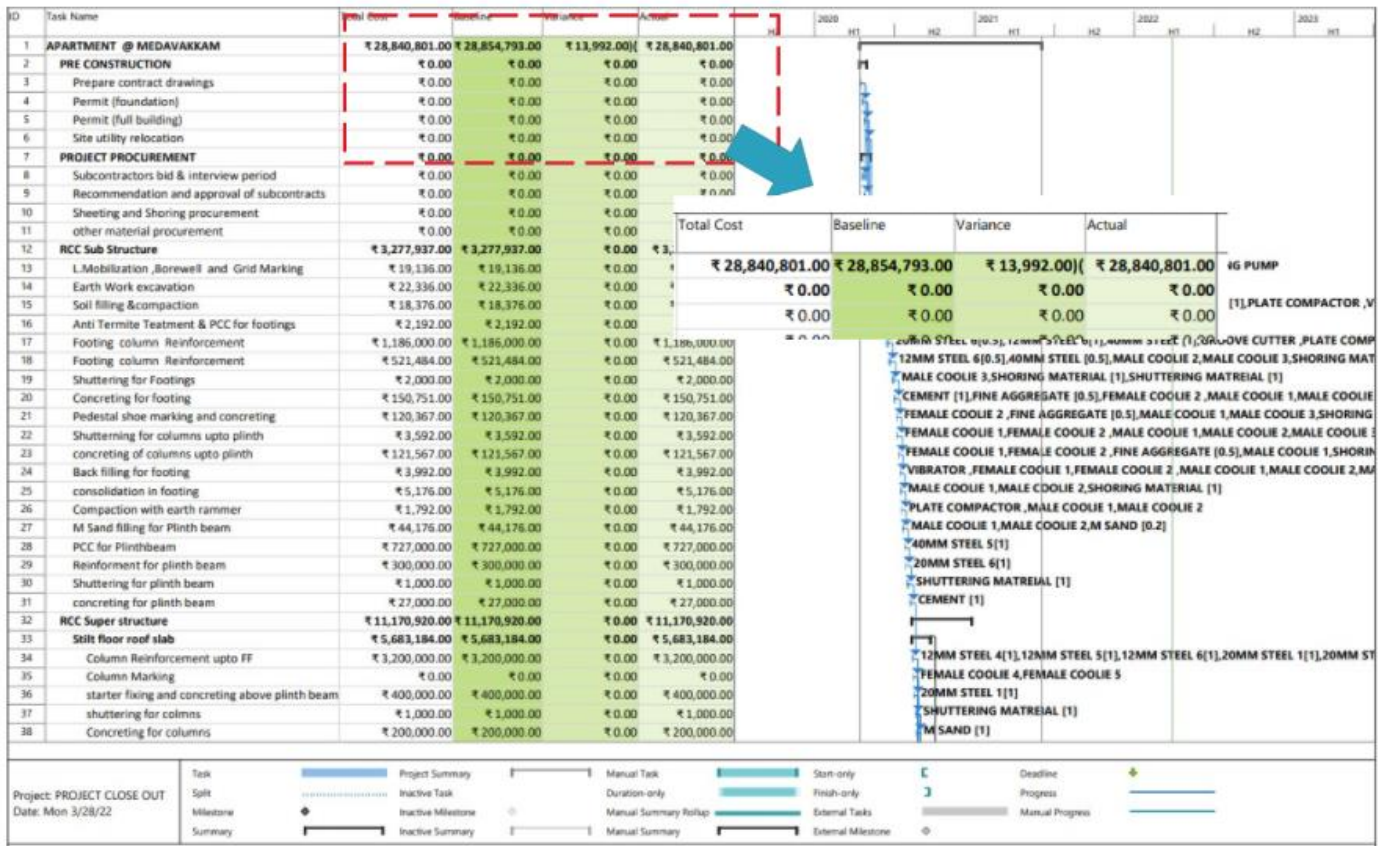


Fig 4.27 Project 3 -cost estimation

5D GANTT CHART

MANUAL CALCULATION OF BUDGET

Site : ALPHA SITE						DATE :01.12.2021		
S.NO	NAME OF WORK	START DATE	END DATE	BUDGETED COST	EXPENDITURE AS ON DATE	BALANCE COST to COMPLETE	on budget /cost over run	REMARK
				13 Cr				Without GST
					104,708,200.00			GST included
1	Internal plastering	2/1/2021	10/30/2021			59,000.00		
2	External plastering	4/1/2021	10/4/2021			97,834.60		
3	Waterproofing work	3/15/2021	8/25/2021			920,000.00		
4	Wood Works	2/25/2021	9/10/2021			2,202,947.00		
5	Window grill fixing	3/1/2021	10/25/2021			875,900.00		
6	UPVC window fixing	4/2/2021	11/20/2021			3,200,000.00		
7	Tiling & flooring works	4/18/2021	9/30/2021			889,408.00		
9	Electrical works	4/15/2021	10/31/2021			572,476.00		
10	Plumbing works	7/5/2021	10/31/2021			2,321,430.00		
11	Internal painting works	3/1/2021	11/15/2021			703,663.00		
12	External painting works	9/1/2021	11/30/2021			1,078,866.00		
13	Acid wash work	10/26/2021	12/31/2021			840,000.00		
13	Snagging,Desnagging & Housekeeping cleaning work and Other NMR works	10/26/2021	12/31/2021			900,000.00		
14	STP	5/15/2021	7/20/2021			409,000.00		
15	WTP	8/10/2021	9/25/2021			1,500,000.00		
16	Lift	6/5/2021	8/10/2021			448,400.00		
17	External Development	10/15/2021	12/10/2021			1,500,000.00		
18	Electrical panel board	10/25/2021	11/30/2021			1,500,000.00		
19	Transformer fixation	11/1/2021	12/10/2021			1,000,000.00		
20	Terrace landscape gardening	9/15/2021	11/30/2021			500,000.00		
21	Handrail	6/6/2021	8/25/2021			400,000.00		
22	GYM and Indoor Equipments					1,000,000.00		
	Total			Rs. 130,000,000.00	104,708,200.00	₹ 22,918,924.60	2,372,875.40	Above terrace landscape work not included in initial budget amount

Fig 4.28 Project 3 -manual calculation

5D BIM = 3D + BUDGET AND COST .

Actual Cost	Baseline Cost	Remaining Cost	Cost Variance
₹ 28,840,801.00	₹ 28,854,793.00	₹ 0.00	(₹ 13,992.00)

CASH FLOW



Name	Remaining Cost	Actual Cost	Cost	Baseline Cost
APARTMENT @ MEDAVAKKAM	₹ 0.00	₹ 28,840,801.00	₹ 28,840,801.00	₹ 28,854,793.00

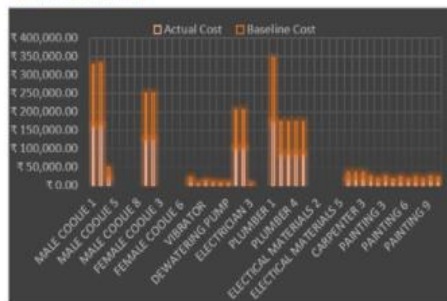
Fig 4.29 Project 3 -manual calculation

5D GANTT CHART

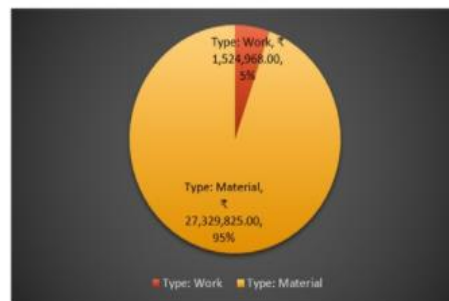
5D BIM = 3D + BUDGET AND COST .

RESOURCE COST OVERVIEW -MAN

COST STATUS FOR MAN

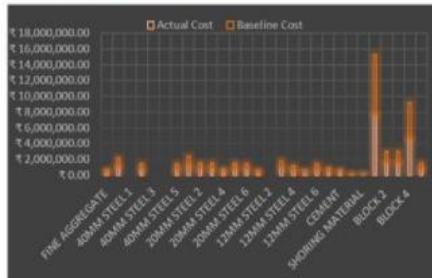


COST DISTRIBUTION FOR ALL RESOURCES



RESOURCE COST OVERVIEW - MATERIAL

COST STATUS FOR MATERIAL



COST DISTRIBUTION FOR ALL RESOURCES



Fig 4.30 Project 3 -Resource cost overview material and work

EAC

₹ 28,843,210.60

ACWP

₹ 28,840,801.00

BCWP

₹ 28,852,382.44

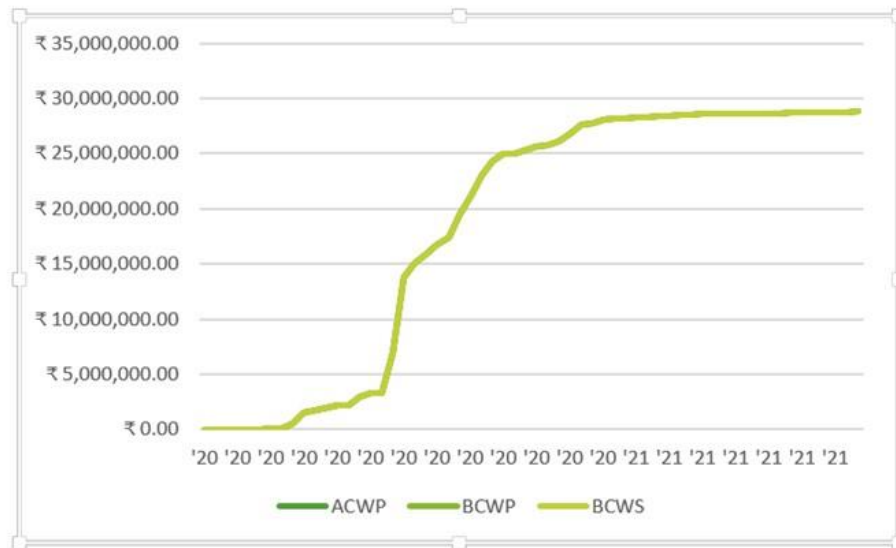


Fig 4.31 Project 3 -EVM

4.3.4 6D - MATERIAL MANAGEMENT

ID	Resource Name	Type	Material Label	Units	Q/Max. Units	Std. Rate	Qty. Rate	Cost/Use	Code
1	FINE AGGREGATE	Material	F			₹ 233,550.00		₹ 0.00	
2	40MM STEEL	Material	A			₹ 727,000.00		₹ 0.00	
3	40MM STEEL 1	Material	A			₹ 727,000.00		₹ 0.00	
4	40MM STEEL 2	Material	A			₹ 727,000.00		₹ 0.00	
5	40MM STEEL 3	Material	A			₹ 727,000.00		₹ 0.00	
6	40MM STEEL 4	Material	A			₹ 727,000.00		₹ 0.00	
7	40MM STEEL 5	Material	A			₹ 727,000.00		₹ 0.00	
8	20MM STEEL 1	Material	2			₹ 400,000.00		₹ 0.00	
9	20MM STEEL 2	Material	2			₹ 400,000.00		₹ 0.00	
10	20MM STEEL 3	Material	2			₹ 400,000.00		₹ 0.00	
11	20MM STEEL 4	Material	2			₹ 400,000.00		₹ 0.00	
12	20MM STEEL 5	Material	2			₹ 400,000.00		₹ 0.00	
13	20MM STEEL 6	Material	2			₹ 400,000.00		₹ 0.00	
14	12MM STEEL 1	Material	1			₹ 300,000.00		₹ 0.00	
15	12MM STEEL 2	Material	1			₹ 300,000.00		₹ 0.00	
16	12MM STEEL 3	Material	1			₹ 300,000.00		₹ 0.00	
17	12MM STEEL 4	Material	1			₹ 300,000.00		₹ 0.00	
18	12MM STEEL 5	Material	1			₹ 300,000.00		₹ 0.00	
19	12MM STEEL 6	Material	1			₹ 300,000.00		₹ 0.00	
20	M SAND	Material	M			₹ 200,000.00		₹ 0.00	
21	CEMENT	Material	C			₹ 27,000.00		₹ 0.00	
22	SHUTTERING MATERIAL	Material	S			₹ 1,000.00		₹ 0.00	
23	SHORING MATERIAL	Material	S			₹ 1,000.00		₹ 0.00	
24	MALE COUPLER 1	Work	M		700%	₹ 87.0		₹ 0.00	
25	MALE COUPLER 2	Work	M		700%	₹ 87.0		₹ 0.00	
26	MALE COUPLER 3	Work	M		700%	₹ 87.0		₹ 0.00	
27	MALE COUPLER 4	Work	M		700%	₹ 87.0		₹ 0.00	
28	MALE COUPLER 5	Work	M		700%	₹ 87.0		₹ 0.00	
29	MALE COUPLER 6	Work	M		700%	₹ 87.0		₹ 0.00	
30	MALE COUPLER 7	Work	M		700%	₹ 87.0		₹ 0.00	
31	MALE COUPLER 8	Work	M		700%	₹ 87.0		₹ 0.00	
32	FEMALE COUPLER 1	Work	F		800%	₹ 75.0		₹ 0.00	
33	FEMALE COUPLER 2	Work	F		800%	₹ 75.0		₹ 0.00	
34	FEMALE COUPLER 3	Work	F		1,000%	₹ 80.0		₹ 0.00	
35	FEMALE COUPLER 4	Work	F		800%	₹ 80.0		₹ 0.00	
36	FEMALE COUPLER 5	Work	F		800%	₹ 80.0		₹ 0.00	
37	FEMALE COUPLER 6	Work	F		100%	₹ 80.0		₹ 0.00	
38	ELECTRICIAN 1	Work	E		400%	₹ 200.0		₹ 0.00	
39	ELECTRICIAN 2	Work	E		400%	₹ 200.0		₹ 0.00	
40	ELECTRICIAN 3	Work	E		100%	₹ 200.0		₹ 0.00	
41	ELECTRICIAN 4	Work	E		100%	₹ 200.0		₹ 0.00	
42	ELECTRICIAN 5	Work	E		100%	₹ 200.0		₹ 0.00	
43	PLUMBER 1	Work	P		400%	₹ 100.0		₹ 0.00	
44	PLUMBER 2	Work	P		400%	₹ 100.0		₹ 0.00	
45	PLUMBER 3	Work	P		400%	₹ 100.0		₹ 0.00	
46	PLUMBER 4	Work	P		450%	₹ 100.0		₹ 0.00	

ID	Resource Name	Type	Material Label	Units	Q/Max. Units	Std. Rate	Qty. Rate	Cost/Use	Code
47	PLUMBER 5	Work	P		400%	₹ 100.00/hr	₹ 0.00/hr	₹ 0.00	
48	BLOCK 1	Material	B			₹ 1,525,000.00		₹ 0.00	
49	BLOCK 2	Material	B			₹ 1,525,000.00		₹ 0.00	
50	BLOCK 3	Material	B			₹ 1,525,000.00		₹ 0.00	
51	BLOCK 4	Material	B			₹ 1,525,000.00		₹ 0.00	
52	MALE COUPLER 3	Work	M		800%	₹ 0.00/hr	₹ 0.00/hr	₹ 0.00	
53	ELECTRICAL MATERIALS 1	Material	E			₹ 400,000.00		₹ 0.00	
54	ELECTRICAL MATERIALS 2	Work	E		100%	₹ 0.00/hr	₹ 0.00/hr	₹ 0.00	
55	ELECTRICAL MATERIALS 3	Work	E		100%	₹ 0.00/hr	₹ 0.00/hr	₹ 0.00	
56	ELECTRICAL MATERIALS 4	Work	E		100%	₹ 0.00/hr	₹ 0.00/hr	₹ 0.00	
57	ELECTRICAL MATERIALS 5	Work	E		100%	₹ 0.00/hr	₹ 0.00/hr	₹ 0.00	
58	CARPENTER 1	Work	C		600%	₹ 200.00/hr	₹ 0.00/hr	₹ 0.00	
59	CARPENTER 2	Work	C		600%	₹ 200.00/hr	₹ 0.00/hr	₹ 0.00	
60	CARPENTER 3	Work	C		700%	₹ 200.00/hr	₹ 0.00/hr	₹ 0.00	
61	PAINTING 1	Work	P		700%	₹ 100.00/hr	₹ 0.00/hr	₹ 0.00	
62	PAINTING 2	Work	P		800%	₹ 100.00/hr	₹ 0.00/hr	₹ 0.00	
63	PAINTING 3	Work	P		1,000%	₹ 100.00/hr	₹ 0.00/hr	₹ 0.00	
64	PAINTING 4	Work	P		700%	₹ 100.00/hr	₹ 0.00/hr	₹ 0.00	
65	PAINTING 5	Work	P		1,100%	₹ 100.00/hr	₹ 0.00/hr	₹ 0.00	
66	PAINTING 6	Work	P		600%	₹ 100.00/hr	₹ 0.00/hr	₹ 0.00	
67	PAINTING 7	Work	P		800%	₹ 100.00/hr	₹ 0.00/hr	₹ 0.00	
68	PAINTING 8	Work	P		600%	₹ 100.00/hr	₹ 0.00/hr	₹ 0.00	
69	PAINTING 9	Work	P		800%	₹ 100.00/hr	₹ 0.00/hr	₹ 0.00	
70	MAID	Work	M		200%	₹ 1,500.00/hr	₹ 0.00/hr	₹ 0.00	
71	JOBS	Work	J		100%	₹ 100.00/hr	₹ 0.00/hr	₹ 0.00	
72	GROOVE CUTTER	Work	G		300%	₹ 50.00/hr	₹ 0.00/hr	₹ 0.00	
73	VIBRATOR	Work	V		300%	₹ 50.00/hr	₹ 0.00/hr	₹ 0.00	
74	PLATE COMPACTOR	Work	P		300%	₹ 50.00/hr	₹ 0.00/hr	₹ 0.00	
75	POWER HAMMER AND DRILLS	Work	P		100%	₹ 50.00/hr	₹ 0.00/hr	₹ 0.00	
76	DEWATERING PUMP	Work	D		100%	₹ 50.00/hr	₹ 0.00/hr	₹ 0.00	

6D MATERIAL MANAGEMENT

6D BIM = CONSIDERING MMM CONSTRAINTS TO REDUCE WASTE.

Fig 4.32 Project 3 -material management

4.3.5 7D-QUALITY MANAGEMENT

ALPHA - A Block Progress On 08-01-2022																										
Sno	Description	1st Floor				2nd Floor				3rd Floor				4th Floor				5th Floor				Percentage Completion	Wise Completion			
		3BHK		2BHK		3BHK		2BHK		3BHK		2BHK		3BHK		2BHK		3BHK		2BHK						
		301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320					
A Civil Work																										
1	Block work	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	100%
2	Plastering work	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	97%
3	Door Frame Fixing	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	100%
4	Door Shutter Fixing Work	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	57%
5	Door fittings Fixing work	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	57%
6	Hall, Bedroom Kitchen,BalconyFloor Tile	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	46%
7	Toilet Floor Tile	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	69%
8	Toilet Wall Tile	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	69%
9	Kitchen Wall tile	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	43%
10	Kitchen Counter Granite	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	71%
11	1st Coat putty	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	100%
12	2nd coat putty	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	40%
13	Primer	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	40%
14	1st coat emulsion	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	6%
15	2nd coat Emulsion	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	6%
16	Upvc window	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	71%
17	Window Grill	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	6%
18	Corridor Granite	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	40%
B Electrical Work																										
1	Electrical Pipe Conduit work	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	97%
2	Electrical Wire Pulling	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	40%
3	Electrical Fittings work	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	9%
C Plumbing work																										
1	Toilet & Kitchen Pipe laying	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	94%
2	Plumbing Cp & Sanitary Fix	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	6%
D Terrace work																										
1	Water proofing work	Work On Progress																								
2	Brick bat work																									
3	Tile Work																									

ALPHA - B Block Progress On 08-01-2022																										
Sno	Description	1st Floor				2nd Floor				3rd Floor				4th Floor				5th Floor				Percentage Completion	Wise Completion			
		3BHK		2BHK		3BHK		2BHK		3BHK		2BHK		3BHK		2BHK		3BHK		2BHK						
		301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320					
A Civil Work																										
1	Block work	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	100%
2	Plastering work	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	100%
3	Door Frame Fixing	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	100%
4	Door Shutter Fixing work	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	60%
5	Door fittings Fixing work	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	60%
6	Hall, Bedroom Kitchen,BalconyFloor Tile	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	60%
7	Toilet Floor Tile	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	80%
8	Toilet Wall Tile	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	72%
9	Kitchen Wall tile	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-								

Fig 4.33 Project 3 -work progress checklist

CHAPTER 5

SUMMARY AND RECOMMENDATION

5.1 IMPACTS OF BIM OVER MANUAL IN PROJECT INITIATION AND PLANNING STAGE

Table 5.1 Stage 1 Project initiation and planning

RECOMMENDATIONS - STAGE 01 PROJECT INITIATION & PLANNING

DIMENSIONS USED	COM STRATEGIES	MANUAL RESULTS	BIM ORIENTED RESULTS	IMPACT OF BIM OVER MANUAL
2D = DRAWING DIMENSIONS	LAYOUT DESIGN	CAD models are helpful for an extended time to assist the creator to know and render the modifications, development and improvement of the whole construction method.	Teamwork is increased as communication across all construction phases and techniques is coordinated	
3D = SPATIAL DIMENSIONS	MODELLING	3D MODELLING could be a program used for a good vary of 3D modelling comes like field of study, interior style, architecture, and computer game style, to call a couple of its uses.	Visualisation: Throughout the whole project, 3D BIM would provide you with a full three-dimensional visual image.	
4D = TIME DIMENSIONS	SCHEDULING	It helps in maintaining bills, creating graphs, S programming things for a project, scheming sizes of beams and columns, etc.	It reduces disputes and excess delays	
5D = COST DIMENSIONS	BUDGET & ESTIMATION	Having conversations and not recording the discussions will considerably impact the timeline and budget of a project.	This is 4D BIM + Estimate or value. The perform of 5D BIM modelling is to integrate value, schedule, and style in an exceedingly 3D output. This model is charged with forecasting/predicting the flow of finance for a project and visualising the progress they need created regarding the project	
6D = SUSTAINABILITY DIMENSIONS	MATERIAL MANAGEMENT	The project management life cycle is sometimes diminished into four phases: initiation, planning, execution, and closure	6D BIM involves the addition of different relevant data that supports the facility' management and operation within the hopes that it'll bring on a far better business outcome	
7D = MAINTENANCE DIMENSIONS	QUALITY MANAGEMENT	Project management tools (checklist)	7D BIM helps to observe the management of the ability or plus right from the look stage to the demolition stage.	

RECOMMENDATIONS - STAGE 01 PROJECT INITIATION & PLANNING

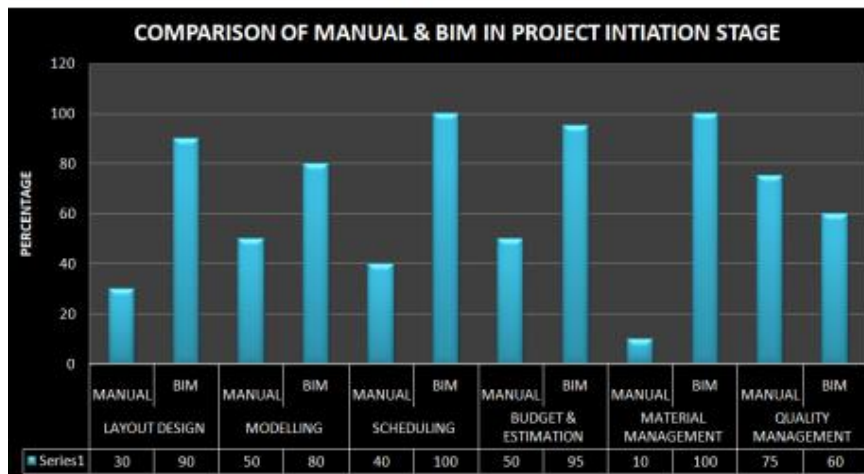


Fig 5.1 BIM and manual comparison initiation stage

5.2 IMPACTS OF BIM OVER MANUAL IN PROJECT EXECUTION AND CONTROL STAGE

Table 5.2 Stage 1 Project execution and control
RECOMMENDATIONS - STAGE 02 PROJECT EXECUTION & CONTROL

DIMENSIONS USED	COM STRATEGIES	MANUAL RESULTS	BIM ORIENTED RESULTS	IMPACT OF BIM OVER MANUAL
2D = DRAWING DIMENSIONS	LAYOUT DESIGN	CAD has replaced manual drafting and helped the engineers, architects, and construction managers in making styles in either 2nd or 3D models in order that they'll visualise the development of the project	Any clashes between completely different sets of information with reference to parts or between contractors will be known and sorted before any value is incurred in reversing the amendment.	
3D = SPATIAL DIMENSIONS	MODELLING	The program includes drawing layout practicality, surface rendering, and supports third-party plugins from the Extension Warehouse	Ensures transparency throughout the whole project.	
4D = TIME DIMENSIONS	SCHEDULING	It allows users to organise, format and calculate information with formulas employing a computer program system.	It brings a couple of sensible operating relationship and cooperation among the stakeholders with clear deadlines.	
5D = COST DIMENSIONS	BUDGET & ESTIMATION	All calculations are performed manually, which eliminates the risk of duplication mistakes and corrupt data.	Modification of project value at any given time	
6D = SUSTAINABILITY DIMENSIONS	MATERIAL MANAGEMENT	These phases frame the trail that takes project from the start to the top	During the project lifecycle, 6D BIM brings a couple of careful analysis of the economic and operational aspects of the project.	
7D = MAINTENANCE DIMENSIONS	QUALITY MANAGEMENT	Project management tools (checklist)	It makes the dynamical of building elements and general repair of a building/project throughout its entire cycle a really straightforward task	



Fig 5.2 BIM and manual comparison execution and control stage

5.3 IMPACTS OF BIM OVER MANUAL IN PROJECT CLOSEOUT STAGE

Table 5.3 Stage 3 Project close out

RECOMMENDATION - STAGE 03 PROJECT CLOSEOUT

DIMENSIONS USED	COM STRATEGIES	MANUAL RESULTS	BIM ORIENTED RESULTS	IMPACT OF BIM OVER MANUAL
2D = DRAWING DIMENSIONS	LAYOUT DESIGN	Manual 2D is not a collaborative method, although it allows the sharing of information through the exchange of drawings and diagrams	Teamwork is increased as communication across all construction phases and techniques is coordinated	90
3D = SPATIAL DIMENSIONS	MODELLING	They are better suited to finalising the lock and fit of final designs, rather than capturing concept designs. As well, the interdependencies of parametric feature-based models can increase the likelihood of potential design failures	It helps to visualize for double collision. It aids communication among the staff. Ensures transparency throughout the whole project.	80
4D = TIME DIMENSIONS	SCHEDULING	With several team members managing formulas and user errors, there will be multiple truths that nobody is aware of what the right data is.	4D BIM reduces disputes and excess delays	80
5D = COST DIMENSIONS	BUDGET & ESTIMATION	Modification of project value at any given time is not possible. Doesn't give accurate cost image	It's so much easier to explore numerous prospects together with the project using BIM	95
6D = SUSTAINABILITY DIMENSIONS	MATERIAL MANAGEMENT	Material wastage can be controlled only with Observations and work sample	Every useful and easy to save wastage of materials using various BIM techniques during closeout stage	90
7D = MAINTENANCE DIMENSIONS	QUALITY MANAGEMENT	Final inspection checklists	Easy to monitor and track repair works	50

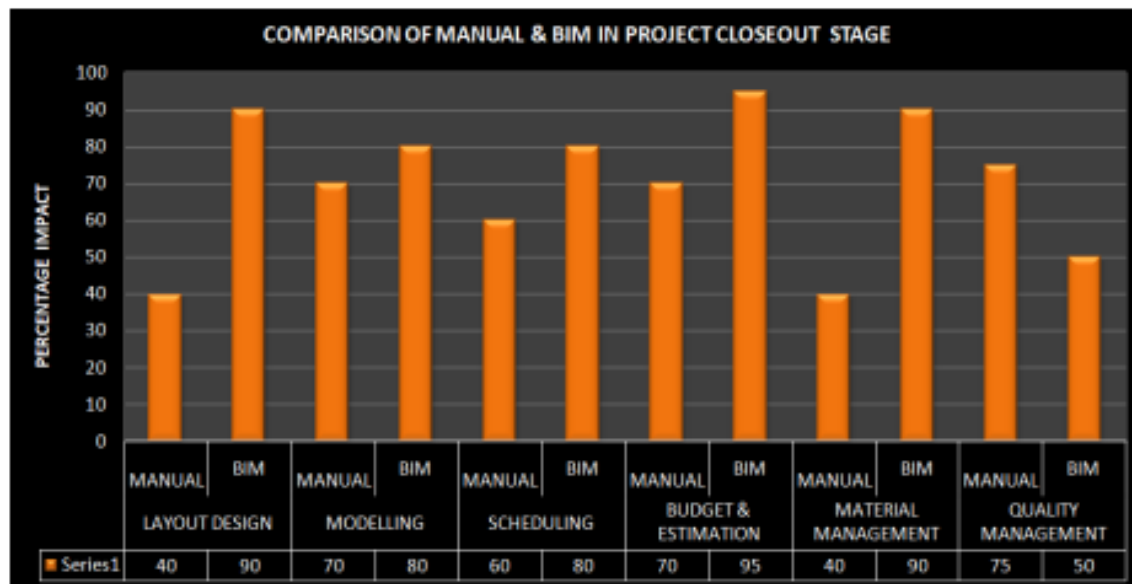


Fig 5.3 BIM and manual comparison closeout stage

CHAPTER 06

CONCLUSION BIM IN CONSTRUCTION OPERATION & MANAGEMENT

Table 6.1 comparison of BIM and manual methods impacts

CONCLUSION - BIM IN CONSTRUCTION OPERATION & MANAGEMENT						
DIMENSIONS	O&M STRATEGY	RATE OF ACCURACY	PROJECT INITIATION & PLANNING	PROJECT EXECUTION & CONTROL	PROJECT CLOSEOUT	OVERALL IMPACT USING BIM IN COM
2nd DIMENSION	LAYOUT DESIGN	MANUAL	30	30	40	90
		BIM	90	70	90	
3rd DIMENSION	MODELLING	MANUAL	50	50	30	90
		BIM	80	80	80	
4th DIMENSION	SCHEDULING	MANUAL	40	50	60	100
		BIM	100	70	80	
5th DIMENSION	BUDGET & ESTIMATION	MANUAL	50	75	70	100
		BIM	95	85	95	
6th DIMENSION	MATERIAL MANAGEMENT	MANUAL	10	50	40	70
		BIM	100	70	90	
7th DIMENSION	QUALITY MANAGEMENT	MANUAL	75	75	75	50
		BIM	60	50	50	

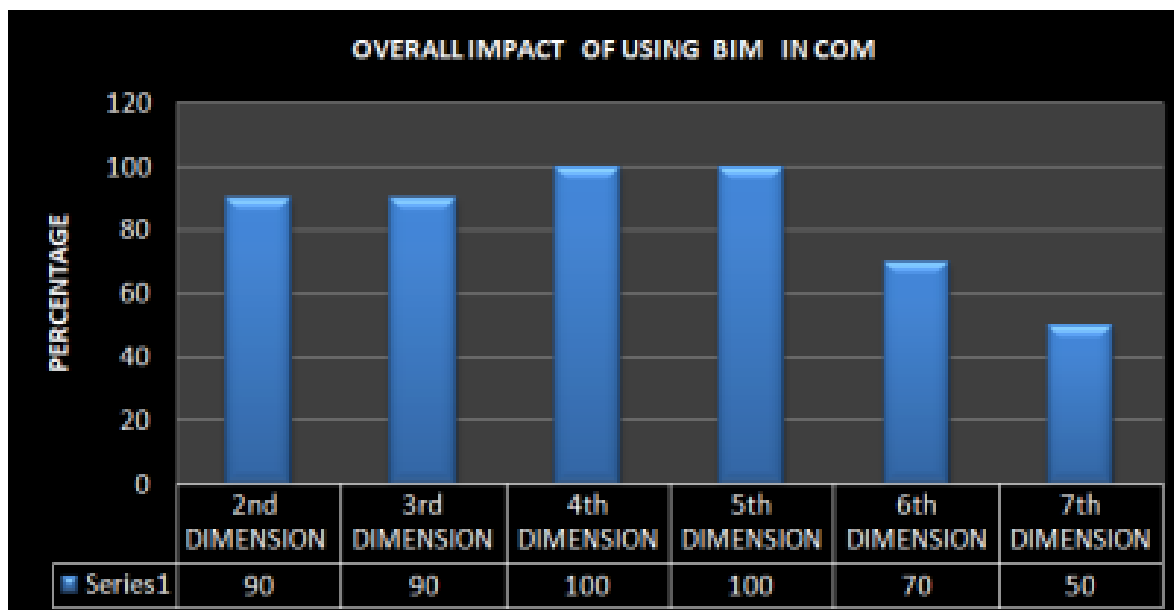


Fig 6.1 overall impact of using BIM in COM

- BIM can facilitate O&M in all Project phases but mostly during Initiation and Execution phase.
- BIM gives accurate results and Project tracking will be easy when compared to Manual.
- It gives results forehand, with which the Project can be planned and executed easily
- BIM Plays major and interesting during Scheduling and Estimation when compared to Manual.

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