

COST AND TIMELINE ANALYSIS FOR REFURBISHMENT PROJECTS

A Thesis

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

by

S.DEEPIKA (39840006)



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

SATHYABAMA

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

Accredited with Grade "A" by NAAC

JEPPIAAR NAGAR, RAJIV GANDHI SALAI, CHENNAI - 600 119

MAY 2021



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BONAFIDE CERTIFICATE

This is to certify that this Report is the bonafide work of **S.DEEPIKA (39840006)** who carried out the Thesis entitled "**CONSTRUCTION COST AND TIMELINE FOR REFURBISHMENT PROJECTS**" under our supervision from January 2021 to May 2021.

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ABSTRACT

Saving the old structures is an art where refurbishing is one among them. There are no proper template or cost analysing method or schedule or any parameters for refurbishing projects. This study designates an integrated method to analyse the cost and timeline for refurbishment projects. The purpose of refurbishing is concentratedly to make the structure beneficial for the owner. There are many types of benefits that the owner will face after refurbishing a structure and one major part of the benefit will be its cost.

Reducing the functional cost of the building is one important reason behind the refurbishing projects. In this context further analyses will be made to work over the cost estimations and timeline for refurbishing projects. Study on different refurbishing projects will be analysed for proposing solutions based on problems that are going to be identified in the case buildings. Cost analysis methods will be proposed and any one suitable method will be adopted. Preferred energy saving solutions will also be suggested in the literature part. Live case study selections will be done after this part and once the defects are analysed in the case building, the preferred solutions will be proposed. The workable solutions shall be applied accordingly where the cost analyses for those solutions shall be worked out.

The timeline for a new project is totally different from refurbishing projects. Depending on the refurbishment methodologies timeline will be created for the case buildings. A comparative analysis among the different case buildings are tabulated and suitable parameters are identified for refurbishment projects. From these the parameters ranking will be made from which the important considerations are ordered from highest to lowest ranks in selecting the parameters for any refurbishing projects.

Keyword: Refurbishment, project cost analysis, project timeline, different phases of a project, refurbishment parameters.

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CHAPTER 1

INTRODUCTION

1.1 AIM

To determine the cost analysis and the project timeline for refurbishment project from feasibility till completion of the building for 3 different building typologies and compare the refurbishing parameters & timeline among these 3 building typologies.

1.2 SCOPE AND LIMITATIONS

- To analyse the problems caused by the occupants and other sources of problems for the case buildings and propose solutions
- To frame cost estimations and schedule for the selected case buildings.
- To make a parameters comparison among the selected case buildings and to create parameters ranking.

1.3 VALID OUTCOMES

- Cost estimation and schedule will be created.
- Parameters to be considered will be framed for refurbishing projects.
- Ranking for the parameters will be given which makes it easier for considering the parameters for refurbishing projects.

1.4 INTRODUCTION

The refurbishment is the act or process of cleaning it, decorating it, and providing it with new equipment or facilities. Cost Management in the refurbishment process can yield substantial savings in running cost of the building. The healthcare sector is a complex environment that faces a broad spectrum of challenges. Hospital refurbishments increases the demand for quality healthcare, technological innovations & adaptations and demand of modernisation & expansion. Running cost play an important role for an hospital building which in turn has to provide clean and fresh air inside the building for patient's health. In this study we will make a detailed study about the present running cost of the building and the problems faced by the occupants (in case of any). For the problems identified preferred solutions shall be proposed and suitable solutions shall be applied in the building. Investment costs and benefits should be tabulated on the monthly basis. Providing a team to take these readings is advisable for proper monitoring of the services in the building. From these monthly readings cost will be found and changes shall be analysed and worked for the betterment of the building. This cost analysis is done using Net Present Value method shortly known as NPV method where the payback period shall also be analysed. These are analysed using graphs, charts and tables.

1.5 METHODOLOGY

Stage 1

- ▶ Defining the aim, scope & limitations and objectives for the research.
- ▶ Study on journal papers for the analysis on different refurbishment types and processes.
- ▶ Data collection on CBA analysis and factors to be considered for refurbishing the hospitals.



Stage 2

- ▶ Literature case studies and net study related to hospital refurbishment.
- ▶ Live case study identification and basic analysis of the building.
- ▶ Issues will be identified in the case building and suitable solutions to be proposed.



Stage 3

- ▶ From the solutions proposed different combinations of those shall be tabulated and effective combination shall be identified at the end.
- ▶ Estimation of the investment cost and annual returns on the investment to be calculated.
- ▶ Annual savings for the next 20 years should be calculated.
- ▶ The same to be represented in the form of graphs, tables and chart.



Stage 4

- ▶ Drawing conclusion from the data analysed and coming up with effective refurbishment methods.

CHAPTER 2

RESEARCH PAPER/JOURNALS STUDY

2.1 PERFORMANCE AND COST ANALYSIS OF REFURBISHING STRATEGIES APPLIED TO A SAMPLE SINGLE FAMILY HOUSE LOCATED IN NEW DELHI INDIA ASSISSTED BY TRNSYS ENERGY SIMULATION TOOL – CASE STUDY

Authors - Apeksha Shandilya Ph.D. Student, University of Innsbruck Innsbruck, Austria.
Wolfgang Streicher Ph.D. Student, University of Innsbruck Innsbruck, Austria.

ABSTRACT:

This study designates an integrated passive design approach to reduce heating and cooling demand in an existing building in New Delhi, India using an improved thermal envelope and high-efficiency windows. In this study, TRNSYS 18 was used for thermal building simulation. It was found that the heating and cooling demand could be decreased significantly by improving the building thermal envelope and substituting windows with high-efficiency windows. In this study, expanded polystyrene EPS, extruded polystyrene XPS, glass wool, and still air was chosen as insulation materials for external wall and roof. Single glazed windows were replaced with high-efficiency double pane and triple pane ½” air filled windows. In the final part of the study, an investment cost analysis done for each type of retrofitting scenario is discussed.

INTRODUCTION:

The increasing population growth in India is the main factor of increasing energy consumption in residential and commercial buildings. During the last two decades (1994–2014) primary energy has grown by 49%, and CO₂ emissions by 43%, with an average annual increase of 2% and 1.8% respectively. The building sector accounts for 40% of the total final energy consumption, occupying third place after industry and transport sectors. Moreover, the expected growth of energy use in the built environment in the next 20 years is 34%, at an average rate of 1.5% per year. The residential sector will contribute to 67% of the energy consumption in 2030 and 33% will be contributed by non-domestic sector. The residential sector will contribute to 67% of the energy consumption in 2030 and 33% will be contributed by non-domestic sector.

DESCRIPTION OF EXAMPLE CASE STUDY:

The example structure is a one-floor single-family house, which was constructed in the year 1980, in central India. The dimension of the floor is 12x9 square meters. The height of the floor is 3 meters. The whole building is defined as zone1. The ventilation air is supplied to the whole building. The example building is equipped with parking and gardening space outside. This building is characterized by 2 bedrooms and living room, Dining area, kitchen and one bathroom. In this house, a couple lives with two kids. The glazing area represents 17% of floor area.

BUILDING SIMULATION:

TRNSYS18, which is a coupled transient building and HVAC plant simulation tools, was used for this study. For the simulation in TRNSYS, the indoor temperature set point for cooling is 24°C and for heating 22°C. There is no specific control for indoor relative humidity in any of the systems. The Cooling Degree Days (CDD) and Heating Degree Days (HDD) values for the New Delhi are 2928 and 429 respectively.

RESULTS AND DISCUSSIONS:

For the actual present condition, the amount of energy required (in kWh/Year) for heating and cooling of the building in winter and summer time is 1835.2 kWh/year and 22968.30 kWh/year respectively.

Table-1: Technical data of studied example single family house

Building Volume (m ³)	324
Floor Area (m ²)	108
U-value external walls, Wm ⁻² K ⁻¹	2.15
U-value floor, Wm ⁻² K ⁻¹	1.34
U-value roof, Wm ⁻² K ⁻¹	1.12
U-value glazing, Wm ⁻² K ⁻¹	5.75

Table 2. different combinations of retrofit assembly

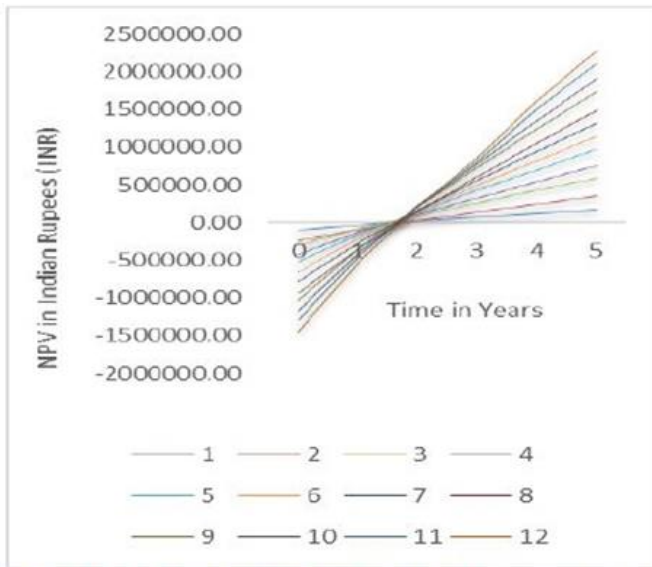
S.No.	Possible Combinations of Retrofits	Thermal Transmittance, U, Wm ⁻² K ⁻¹	Heating Energy Demand, Q, kWh/Year	Cooling Energy Demand, Q, kWh/Year	Total Energy Savings, Q, kWh/Year	Estimated Cost of Retrofit in INR (Indian Rupee)	Total Cost of Retrofit (Including labor cost @25000 INR)	Estimated cost saving /year in INR (Indian Rupee)@ 7.3/unit
0	External Wall with/o Insulation Roof with/o Insulation Window Single Glazing	2.153 1.113 5.72	1835.2	22968.30	-	-	-	-
1	External wall with Extruded Polystyrene Roof with Extruded Polystyrene Window Double Pane 1/2" air space	0.45 0.377 2.82	373.73	16527.90	7901.37	55000.0 48600.0 33880.0	162480.0	57680.001
2	external wall with Glass wool stuffing Roof with Glass Wool stuffing Window Double Pane 1/2" air space	0.211 0.193 2.82	223.31	15814.90	8764.79	75000.0 66000.0 33880.0	199880.0	63982.967
3	External Wall with Expanded Polystyrene (EPS) Roof with Expanded Polystyrene (EPS) Window Double Pane 1/2" air space	0.263 0.236 2.82	254.57	15970.90	8577.53	35000.0 30800.0 33880.0	124680.0	62615.969
4	External Wall with unmoving air Roof with Extruded Polystyrene Window Double Pane 1/2" air space	0.182 0.377 2.82	287.99	16228.80	8286.21	73100.0 48600.0 33880.0	180580.0	60489.333
5	External Wall with unmoving air Roof with Expanded Polystyrene (EPS) Window Double Pane 1/2" air space	0.182 0.236 2.82	231.68	15881.98	8689.34	73100.0 30800.0 33880.0	162780.0	63432.182
6	External Wall with unmoving air Roof with Glass wool stuffing Window Double Pane 1/2" air space	0.182 0.193 2.82	215.38	15780.96	8806.66	73100.0 66000.0 33880.0	197980.0	64288.618
7	External wall with Extruded Polystyrene Roof with Extruded Polystyrene Window Triple Pane 1/2" air space	0.45 0.377 1.69	211.17	16146.08	8445.75	55000.0 48600.0 60215.0	188815.0	61653.975
8	External wall with Glass wool stuffing Roof with Glass Wool Stuffing Window Triple Pane 1/2" air space	0.211 0.193 1.69	96.33	15452.89	9253.78	75000.0 66000.0 60215.0	226215.0	67552.594
9	External Wall with Expanded Polystyrene (EPS) Roof with Expanded Polystyrene (EPS) Window Triple Pane 1/2" air space	0.263 0.242 1.69	118.42	15602.96	9081.62	35000.0 30800.0 60215.0	151015.0	66295.826
10	external wall with unmoving air Roof with Extruded Polystyrene Window Triple Pane 1/2" air space	0.178 0.393 1.69	143.02	15856.00	8803.98	73100.0 48600.0 60215.0	206915.0	64269.054
11	External Wall with unmoving air Roof with Expanded Polystyrene (EPS) Window Triple Pane 1/2" air space	0.182 0.263 1.69	102.14	15517.95	9182.91	73100.0 30800.0 60215.0	189115.0	67035.243
12	External Wall with unmoving air Roof with Glass wool stuffing Window Triple Pane 1/2" air space	0.178 0.197 1.69	91.116	15419.97	9291.91	73100.0 66000.0 60215.0	224315.0	67830.9722

Note: Cost of retrofits are calculated using some online cost calculator websites and online Indian market portal [17] [18].

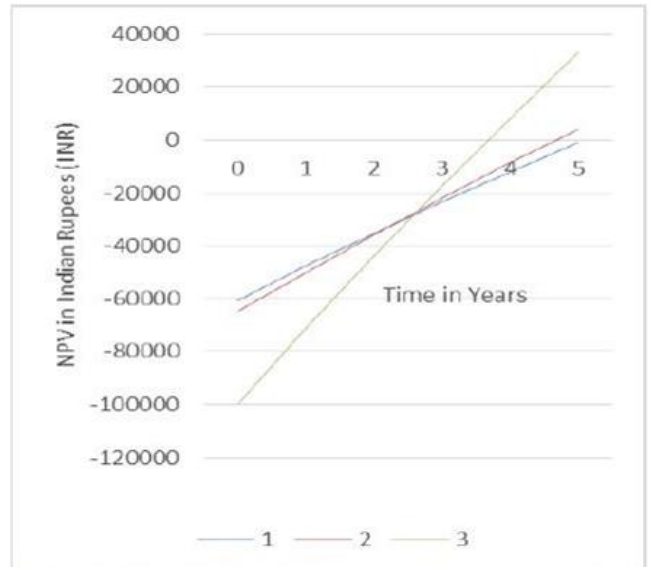
Fig 2.1 Technical Data of the Building

INVESTMENT COST ANALYSIS:

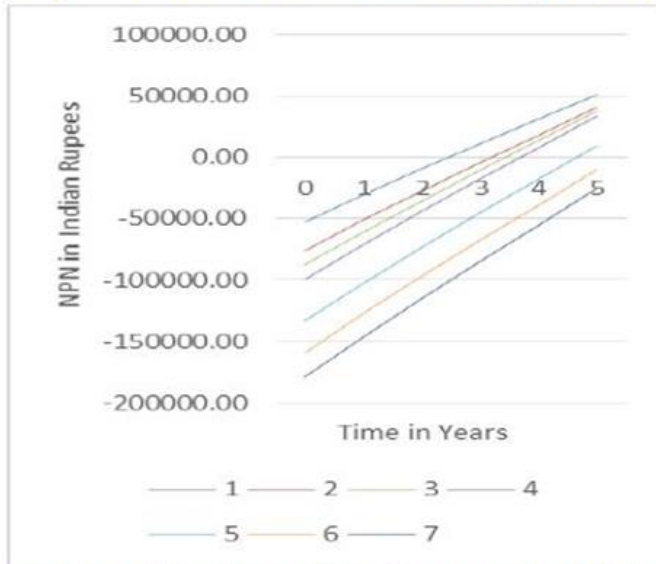
The standard tool to evaluate and compare investment propositions is the Net Present Value (NPV) method. The net present value {sometimes known as net present worth (NPW)}, is a measurement of profit calculated by subtracting the present values (PV) of cash outflows (including initial cost) from the present values of cash inflows over a period of time. A positive NPV results in profit, while a negative NPV results in a loss.



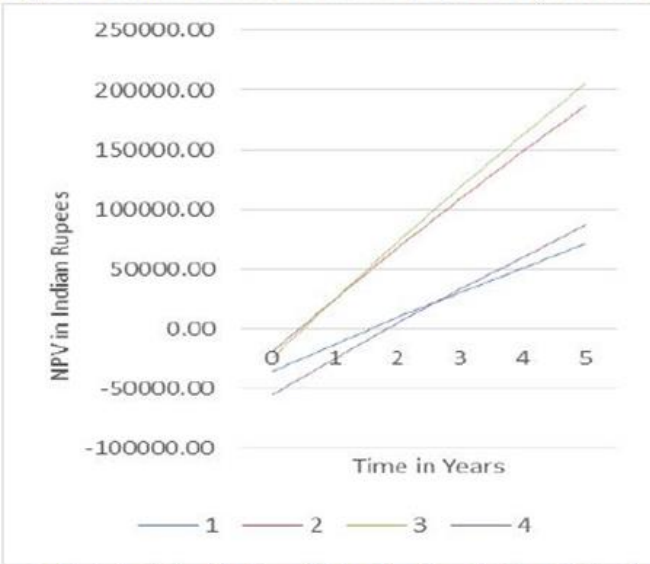
Graph 1: Cash flow for Retrofit Combinations 1-12 (see Table 2)



Graph 2: Cash flow for Retrofit Combinations 1, 2 and 3 (see Table 3)



Graph 3: Cash flow for Retrofit Combinations 1-7 (see Table 4)



Graph 4: Cash flow for Retrofit Combinations 1-4 (see Table 5)

Fig 2.2 Graphs showing cash flow for different retrofit combinations

CONCLUSIONS:

The payback time for the building located in New Delhi is **0-3 years** depending on the type of retrofit combination.

Retrofit scenario “3” under the high-efficiency windows (Table 5) is the best retrofit solution as the annual cost saving is 70% of the investment cost of the retrofits in 1st year which is the highest value among the all studied retrofit scenarios.

The maximum amount of energy savings per year can be achieved approximately 68000.00 INR for retrofit combination “12” (Table 2) when the retrofit action is applied for improved thermal envelope as well as high-efficiency windows. This retrofit can reduce approximately 37.5% of energy demand for heating and cooling purpose and the cost saving by this retrofit is 30% of the investment cost of retrofits. But it is not the best case as retrofit combination “9” (Table 2) can reduce 36.5% of heating and cooling energy demand while the cost saving by this retrofit is 44% (approximately) of the investment cost of retrofits (Table2). The U value of the wall, roof and windows are 0.18, 0.20, 1.69 and 0.26, 0.24, 1.69 respectively for scenario 12 and 9.

2.2 FINANCIAL ANALYSIS OF REFURBISHING PROJECT AND ITS ROLE IN DECISION MAKING

Authors - J.Borzouie, M.Yekrangnia, A.Mahdizadeh & H.Seyri, M.Raissi State Organization of School Renovation and Mobilization Of Islamic Republic of Iran

ABSTRACT:

Construction of more than 3000 schools is the primary result of **Iranian schools** refurbishment program that has been done by state organization of schools. The financial analysis of the project has valuable data that can be effective on revision of seismic evaluation methods and decision making of future projects. The main contribution of this paper is financial analysis of retrofitting masonry buildings and describing outcomes of this evaluation on optimizing of retrofitting projects. In this regard, in the first step, total cost and financial distribution of projects that were retrofitted by Typical Retrofitting Pattern (TRP) and complete retrofitting are compared. In the next step, cost distribution between structural elements is evaluated and compared with their overall seismic performance buildings. Finally, the effect of minor changes of structural details on the total cost of retrofitting is assessed. The results show that the TRP strategy has financial preference on other current methods and could be a useful strategy to deal with a large amount of buildings like schools. Moreover, the detail improvement, considering cost distribution between structural elements and total cost that is dedicated to architectural, electrical and mechanical facilities have considerable effect on total cost of the projects. At last, a simple procedure for prioritizing the retrofitting projects is proposed.

Keywords: Typical Retrofitting Pattern, School retrofitting, financial evaluation, decision making

Financial evaluation of different approaches towards school retrofitting:

Complete seismic evaluation and retrofitting:

- In this approach, each building and each element of the building is evaluated based on current retrofitting codes.
- Although the accuracy of this approach is very high, it takes lots of time and the final cost of the retrofitting project is much higher than the alternative strategy.
- As a result, evaluation of large number of school buildings is not practical by this approach.
- This strategy could be effective in seismic evaluation of complicated, large area or high rise school buildings.

Typical Retrofitting Pattern (TRP strategy)

- Every building is unique and it has its special deficiencies and final plan of retrofitting. However, scattering of architectural and structural plan of school buildings are less than other types of buildings.
- The TRP strategy is a new approach of retrofitting that could be effective for seismic retrofitting of a large number of buildings.
- At first glance, this approach seems cost effective and time consuming. In this regard, several methods such as: peripheral shotcrete, typical shear walls, shear boxes, center core have been proposed for seismic retrofitting of school buildings with this approach since 2010.

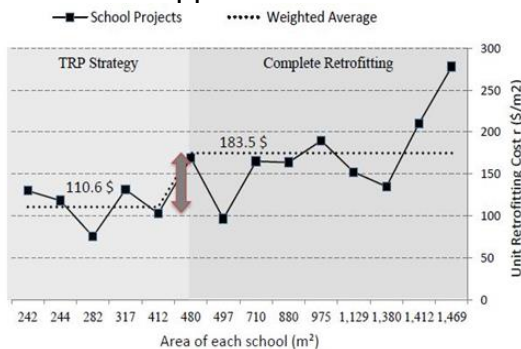


Figure1. Final cost of retrofitting per square meter with respect to square of each school for complete retrofitting and TRP approaches

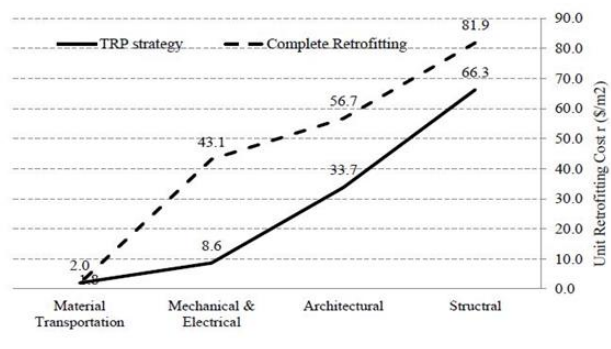


Figure2. Cost distribution between retrofitting stages per square meter for complete retrofitting and TRP strategy

Fig 2.3 Final retrofitting cost for both the approaches and Cost distribution between different retrofitting stages

COST DISTRIBUTION OF STRUCTURAL ELEMENTS:

The TRP approach tries to increase seismic performance level of similar buildings to the target level by retrofitting of similar defects. So, financial analysis of buildings which retrofitted by TRP strategy could clarify cost distribution between structural elements. In the following table the average costs for each retrofitting actions are shown based on two TRP methods: Peripheral shotcrete and shear wall.

Table1: Cost distribution between structural element in peripheral shotcrete method

Action		Percentage of Total Cost	Percentage of Total structural part
Foundation		1.26	1.72
Shotcrete	Drilling	2.15	30.23
	Meshing	9.97	
	Shotcrete	9.95	
Slab retrofitting	Diminish	8.28	68.05
	Drilling	1.16	
	Concrete placing	11.95	
	Finishing	13.28	
	Bars	7.89	
	Shear keys	7.12	

Fig 2.4 Cost distribution between structural elements in peripheral shotcrete method**Table2:** Cost distribution between structural element in shear wall method

Action		Percentage of Total Cost	Percentage of Total structural part
Foundation	Pile	14.62	29.21
	Cap pile	7.76	
Shear wall	Bars	12	23.32
	Concrete placing	5.88	
Slab retrofitting	Diminish	5.48	47.47
	Drilling	0.84	
	Concrete placing	11.08	
	Finishing	8.55	
	Bars	5.83	
	Shear keys	4.59	

Fig 2.5 Cost distribution between structural elements in shear wall method**Financial Analysis of detailing:**

This is to show how minor changes in retrofitting reflect in the total cost of retrofitting. Part of the retrofitted plan of a two-story masonry building was financially evaluated with two different details.

This area was retrofitted by shotcrete (for masonry walls) and tie bracing method (for roofs) with two different details of shotcrete.

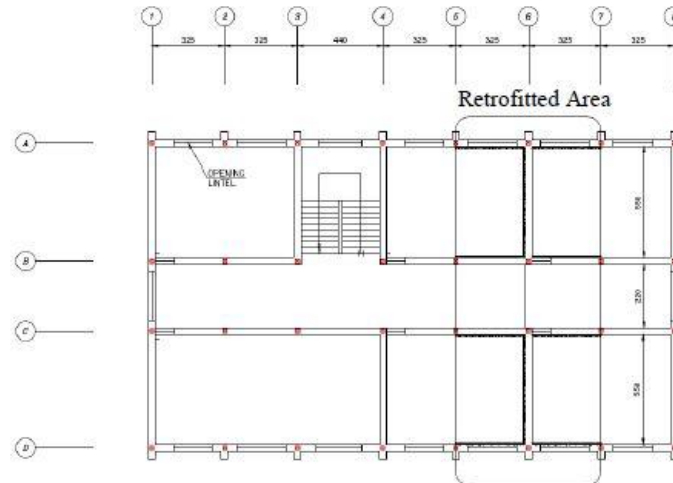


Figure3. Plan of retrofitting

Fig 2.6 Retrofitting Plan

Table3: Properties of each detail

Detail1: Prevailing detail for shotcrete that consist of:	Detail2: corrected detail of shotcrete that consist of:
- Implementation of shotcrete in one side of masonry wall : Thickness: 7 cm, Mesh Ø 6 mm 150/150 - Tie-bracing method for retrofitting of slab - Adding of top and bottom angles in shotcrete: steel Angle 100 X 100 X 10 - Dimensions of shotcrete Foundation are: 40×40cm - Floor reconstruction: In parts of building which coincide with shotcrete. (width: 1m) - Steel tie column	- Implementation of shotcrete in one side of masonry wall : Thickness: 7 cm, Mesh Ø 6 mm 150/150 - Tie-bracing method for retrofitting of slab - Adding only bottom angles in shotcrete: steel Angle 60 X 60 X 6 - Dimensions of shotcrete Foundation are: 20×20cm - Floor reconstruction: In parts of building which coincide with shotcrete. (width: 1m)

Fig 2.7 Properties of 2 different retrofitting methods

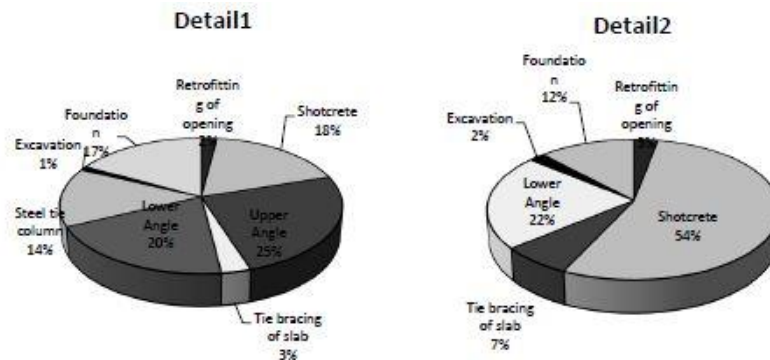


Figure5. Final cost distribution of retrofitting items

Fig 2.8 Final Cost Distribution of Retrofitting Items

Table4. Final cost of two details

Method of retrofitting	Final cost of retrofitting per m2 (\$)
1	73
2	27

Fig 2.9 Final cost of both the details

Conclusion:

The Typical Retrofitting Pattern (TRP) approach could reduce the total cost of retrofitting about 40%.

The main reason of the reduction is elimination of retrofitting in parts of building with high architectural effect or mechanical and electrical facilities; moreover, Peripheral of buildings is good parts for this purpose.

In this paper, the current detail of connection between shotcrete and jack arch roofs is investigated in order to show the high cost effect of minor changes in detail.

The financial feedbacks of this project could introduce new indices for researchers to optimize their researches.

CHAPTER 3

LITERATURE REVIEW

3.1 WHAT IS COST ANALYSIS?

- Cost analysis is designed to assess the cost compared to the benefits in the project proposal.
- This process begins with a list, which includes all the expenses of the project together with the benefits that will derive from it once the project will be successfully completed.

3.2 WHY IS COST ANALYSIS DONE FOR REFURBISHMENT PROJECT?

The cost benefit analysis process estimates the benefits and costs of an investment for two reasons:

1. To determine if the project is viable; if it is a good investment
2. To compare one project investment with other competing projects, to determine which is more feasible.

Conducting a CBA can be an expensive and cumbersome undertaking, depending on the range of input data used to determine a project's costs and benefits. Hence, these are recommended for use in projects where the potential costs of the project(s) are significant enough to justify the allocation of resources to forecast, measure and evaluate anticipated benefits, costs and impacts.

3.3 COST ANALYSIS METHODS:

3.3.1 NET PRESENT VALUE (NPV Method):

The standard tool to evaluate and compare investment propositions is the Net Present Value. The net present value {sometimes known as net present worth (NPW)}, is a measurement of profit calculated by subtracting the present values (PV) of cash outflows (including initial cost) from the present values of cash inflows over a period of time. Because of its simplicity, NPV is a useful tool to determine whether a project or investment will result in a net profit or a loss. A positive NPV results in profit, while a negative NPV results in a loss. NPV is an indicator of how much value an investment or project adds to the firm/owner.

$$\text{NPV} = \text{PV of cash inflow} - \text{PV of cash outflow}$$

$\text{NPV} \geq 0$: the investment would add value to the firm which means the invested capital is eligible to generate a return of yearly discount rate (i) per year over the period N. The number of years required to bring the value of NPV from negative to positive value. The year when NPV value crosses the zero value is summarized as DPB (Discounted Pay Back). Mathematically it is expressed as,

$$\text{NPV}(i, \text{DPB}) = 0$$

3.3.2 ESCO MODEL:

An ESCO can be involved in one or several roles associated with the lifecycle of an energy efficiency project, including:

- Performing an audit to identify energy efficiency opportunities and quantify potential savings
- Maintaining equipment to ensure maximum savings are achieved
- Reporting energy savings
- Developing customized recommendations on systems and equipment to upgrade based on past experience as well as specific conditions of the site
- Engineering, implementing, and commissioning the most energy efficient and suitable equipment
- Determining measurement and verification (M&V) protocol for each ECM2

3.3.3 TYPICAL RETROFIT PATTERN (TRP STRATEGY):

- Every building is unique and it has its special deficiencies and final plan of retrofitting.
- In that case one particular type of retrofit pattern shall be adopted when there are a huge number of buildings included for retrofitting.
- The TRP strategy is a new approach of retrofitting that could be effective for seismic retrofitting of a large number of buildings.
- Problems identified might be of similar type but cannot be the same for which one particular set of retrofitting patterns shall be determined and worked out.
- Cost distribution between different elements of the different retrofitting patterns shall be determined and accordingly one pattern with lower cost and that provides longer life span should be selected for the retrofit process.

3.3.4 SINGLE UNIT RATE METHOD:

- The most common in initial budgeting due to its simplicity. It estimates the overall unit cost per gross square meter using methods including the accommodation method and the functional area method.
- The accommodation method uses the major measure of a facility (i.e., cost per bed for hospitals).
- The functional area method specifies the functional space types within a building to account for variations in space types for specific purposes.

3.3.5 QUANTITATIVE SURVEY:

- A quantity survey can be performed when detailed design information is available.
- Quantities and unit costs or rates (for materials, labor, and equipment) are calculated for each of the individual work items and activities.

3.3.6 PARAMETRIC COST MODELLING METHOD:

- Parametric cost modeling method usually applies statistical analysis.
- This method usually uses a predetermined equation model based on the historical cost data, which is regression analysis.

3.3.7 ELEMENTAL COST ANALYSIS:

- The elemental cost analysis divides a building into elemental components to estimate the cost of each component using historical data on similar projects.
- The estimation can be modified by different alternates (e.g., construction methods and materials)

3.4 BASIC FACTORS CONSIDERED FOR ENERGY EFFICIENT REFURBISHMENT:

1. Structural Stability of the Structure
2. Adaptability of the Structure to the current Land Rules, Operational practices and Technology
 - a) Land Rules – Stairs Width and Fire Rules
 - b) Technology – Lifts, BMS system and Equipments
 - c) Operational Practices
3. Energy Efficiency of the Structure

Three important parameters that are to be considered are lower operating costs, improved patient care, and an enhanced public image.

- a) Lower Operating Costs
 - b) Improved Patient Care
 - c) Enhanced Public Image
4. Face-Lift to the façade and interiors to improve patient comfort, safety and accessibility
 5. The Project Budget

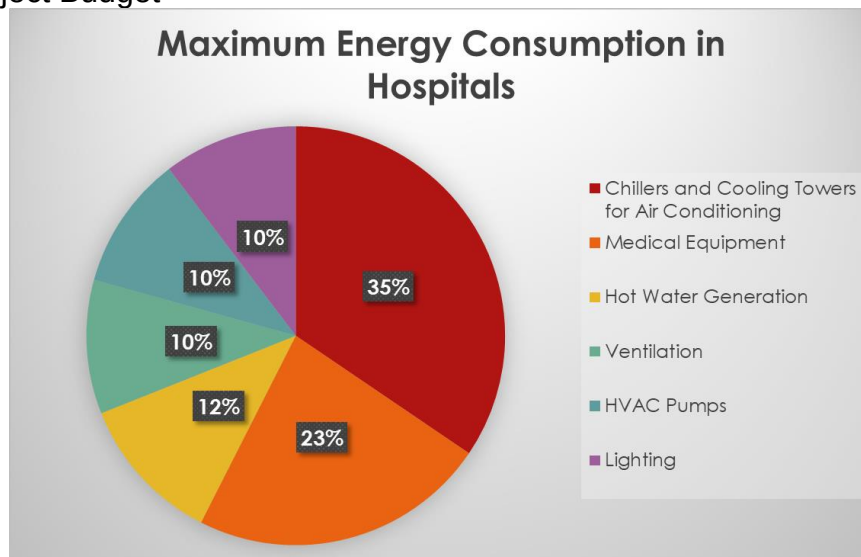


Fig 3.1 Maximum Energy Consumption in Hospitals

3.5 PREFERRED SOLUTIONS:

3.5.1 MONITORING:

Monitoring few pints to measure, visualize and record the usage such as:

- a) Main Panels
- b) Chillers
- c) Pumps
- d) Cooling Towers
- e) Different areas in hospitals, etc.

3.5.2 VENTILATION:

- a) Ceiling fans provision for in-patient rooms is something cheap for the investors and beneficial in case of energy usage.
- b) BLDC Fans to be used instead of Regular Fans. With the use of **bladc** motor in ceiling **fan** we can save 60% electricity in the ceiling **fan**.

3.5.3 SET POINT MANAGEMENT:

- a) Depending on the area inside the hospital the temperature in the air conditioner can be constantly set.
- b) Different areas will have different temperature requirements.
- c) AC models also plays an important role in this.

3.5.4 PUMPING:

- a) Older pumps can be replaced with new ones with can reduce about 50% of the current payback amount.

Parameters	Unit	Old Pump	New Pump	
Actual Power Consumption	kW	30	16.6	
Operating hours in a day	hrs/day	22	22	
Operating days in a year	days/year	240	240	
Total Annual Energy Cost	INR	1,584,000	876,480	
Total Annual Energy Cost Reduction	INR		707,520	
Cost of Pump (including taxes)	INR		350,000	
Installation Charges	INR		30,000	
Total cost	INR		380,000	
Payback Period	Years		0.54	} 8X in 5 yrs ! 53%/yr return
Energy Cost Savings in 5 Years	INR		3,537,600	
Net Benefit in 5 Years	INR		3,157,600	

Fig 3.2 Refurbished pumps and their returns

3.5.5 HOT WATER SYSTEM:

- No diesel, no geysers, no heating elements and only SOLAR or HEAT PUMP.
- **Heat pumps** are approximately three times as efficient as electric resistance **heating**, which means **you** could lower your **heating** consumption by two thirds.
- Heat pumps has to sides where the heat from one source is dumped onto the other source.

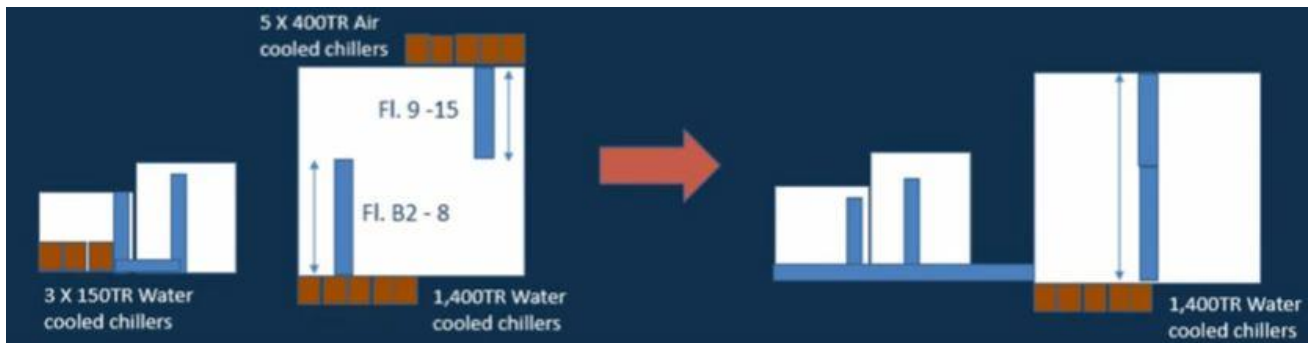


Fig 3.3 Air cooled chiller units redesign

1. An example of altering the chillers design in KIMS Hospital, Hyderabad which created a floor space of 2500 sq.ft on the ground floor by removing extra air cooled chiller units.
2. Where they can put up a small clinic occupying 40 to 50 doctors which was a pure real estate trick.
3. Area, money and benefits come from energy efficiency.

3.6 HEALTH AND WELLNESS:

1. Air changer per hour
2. HEPA filter cleaning
3. AHU regular filter cleaning

How to start up with the maintenance?

1. Form a team (Maintenance, Finance, Administration)
2. Set financial goals (Payback period, IRR) and finalize preferred business model (own investment, loan, ESCO)
3. Do some homework to identify rough saving potential
4. Get top management commitment for project execution
5. Execute, learn, repeat

CHAPTRE 4 LIVE CASE STUDY

4.1 CASE STUDY 1 – APOLLO FIRST MED HOSPITAL, KILPAUK, CHENNAI – 600010:

Name of the Project	-	Apollo First Med Hospital, Kilpauk, Chennai
Client	-	M/s. Apollo Hospitals
Total Area	-	13,900 sq.ft
No. of floors	-	Basement+G+5
Setbacks	-	Front: 4m Rear side: 6m Right Side: 6m Left side: 3.5m
Height	-	15.5 m

The Apollo First Med Hospitals is an initiative of the Apollo Hospitals group and offers the highest quality of secondary medical care across various medical disciplines. Apollo First Med Hospital located in Kilpauk is a 100 bed hospital.



A



B



C

Fig 4.1 A) Apollo Hospital Exterior, B) New Chiller of 250 TR and C) Old Chiller of 170 TR

4.1.1 AGE OF THE BUILDING:

- This structure is a 30 year old building.
- It was firstly handed by another group of hospitals.
- In the year 2002 Apollo group of Hospitals took over the building. Then the building was renovated up to those standards followed by Apollo 20 years back.

4.1.2 WHEN WAS THE BUILDING LASTLY REFURBISHED?

2 years back that is in the year 2018 only 4th floor was renovated where Operation theatre and Labour wards are located.

4.1.3 REASON FOR PRESENT REFURBISHMENT:

- The major reason for refurbishment is the age of the building.
- Since the building is a 20 year old structure the equipments used inside started getting corroded and they are in need of replacement.

4.1.4 ELEMENTS FOR REFURBISHMENT:

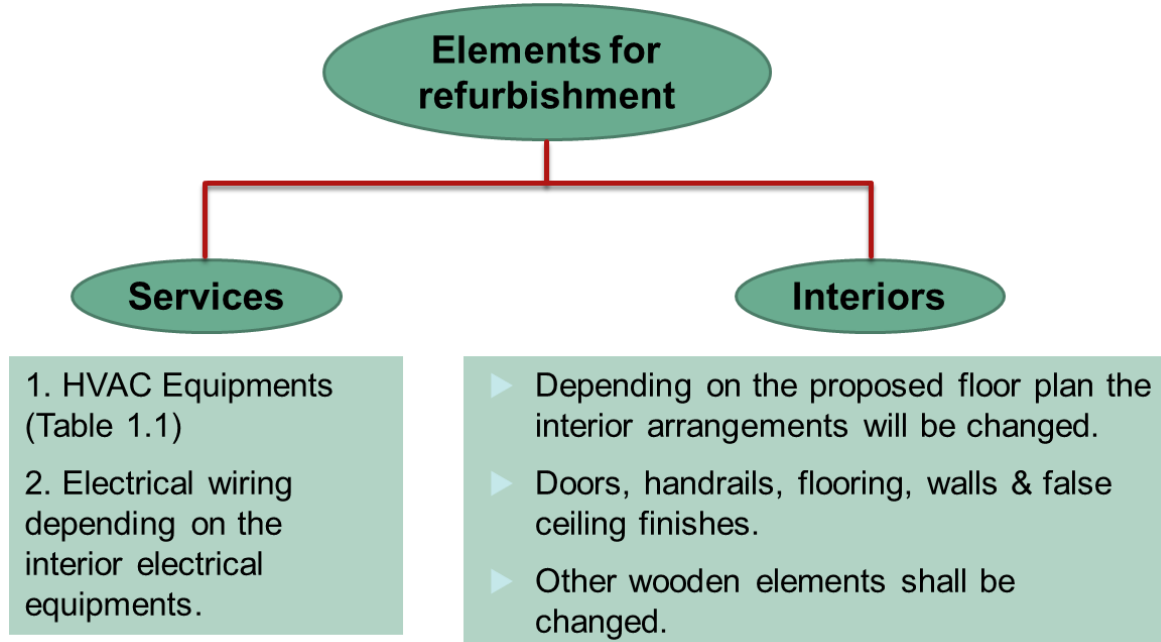


Fig 4.2 Refurbishment Elements

Table 4.1 Services Refurbishment

HVAC				
S.No	Item Description	Existing Quantity and Capacity	To be replaced	Remarks
1	Chillers	1–250 TR (Dunham Bush) 2-170 TR (Trane)	170 TR	250 TR was replaced 2 years back 170 TR to be replaced with 250 TR (DB)
2	Primary Pumps	4 nos. (old) 2 nos. (new)	4 nos.	The new ones were replaced 2 years back

S.No	Item Description	Existing Quantity and Capacity	To be replaced	Remarks
3	Secondary Pumps	7 nos.	Yes	-
4	Booster Pumps	2 nos.	Yes	-
5	Chilled Water pipelines (internal)	Lot	Yes	Leak at several places and fungus found due to dampness
6	Chilled Water pipelines (external)	Lot	Yes	Sand cement plastering damage found in few places.
7	Valves (internal and external)	Lot	Yes	Only few valves are working. Others are majorly stuck/frozen. Zone wise control to be incorporated in the refurbishing process.
8	AHU's	21 nos.	Yes	
9	FCU's	56 nos.	Yes	
10	Ducting work	Lot	Yes	New ducting to be provided.
11	Makeup water tank	2 nos.	No	To be retained.

S.No	Item Description	Existing Quantity and Capacity	To be replaced	Remarks
12	Split AC	23 nos. 15 nos.	Yes	All this have to be replaced with centralized FCU's to reduce power consumption.
13	Package type	2 nos.	Yes	
14	Tower AC	3 nos.	Yes	
15	VRF	2 nos.	Yes	
16	Filters	Lot	Yes	Filters inside the ducts and existing AHU equipment to be changed.

Table 4.2 Interior refurbishment

INTERIORS				
S.No	Item Description	Existing Quantity / Capacity / Area	To be replaced	Remarks
1	Flooring / Tiling	Every floor except 3 rd floor	Yes	Tiles have been broken in some places. So it has to be replaced with new ones.
2	Walls	Every floor except 3 rd floor	Yes	Water dampness in the walls. New walls should be 2 hours fire resistant and finishes as per the areas requirement.
3	Chairs	Every floor except 3 rd floor	Yes	To be replaced in common areas.

INTERIORS				
S.No	Item Description	Existing Quantity / Capacity / Area	To be replaced	Remarks
4	False Ceiling	Every floor except 3 rd floor	Yes	Present ceilings will be removed for refurbishing HVAC system. So false ceiling has to be refurbished.
5	Doors	Every floor except 3 rd floor	Yes	Aluminium framed door with viewing glass for the consultation rooms. Aluminium double doors with for AHU rooms and EB Panel room. Aluminium frame, tempered glass viewing window (consultation rooms, ICU wards and other scanning rooms), stainless steel kick plate and panic bar.
6	Care Taker Couch	IP rooms. ICU and Wards	Yes	Patient rooms to be equipped with comfortable care taker couches.
7	Consultation Table	Consultation rooms and Scanning areas	Yes	Doctor's consultation tables to be refurbished with proper store cabinets.
8	Nurse Station	Every floor except 3 rd floor	Yes	Tables and store cabinets to be refurbished.

INTERIORS				
S.No	Item Description	Existing Quantity / Capacity / Area	To be replaced	Remarks
9	Pneumatic Chute System	Every floor	Yes	Instead of trolleys these chute systems provide safer movement of medicines and any other requirements.
10	CCTV Cameras	Every floor	Yes	Addressable security system to be installed instead of conventional systems.
11	IP rooms closet	IP rooms	Yes	To be furnished in the proposed areas.
12	Blind and its accessories	IP rooms, ICU and Wards	Yes	Blind partition in between patient beds.
13	Toilet Fixtures	Every floor except 3 rd floor	Yes	All the bathrooms/Toilets to be refurbished with new fixtures.
14	Reception Table	Reception areas and Help desk	Yes	Table with storage cabinets

4.1.5 ORGANIZATION CHART

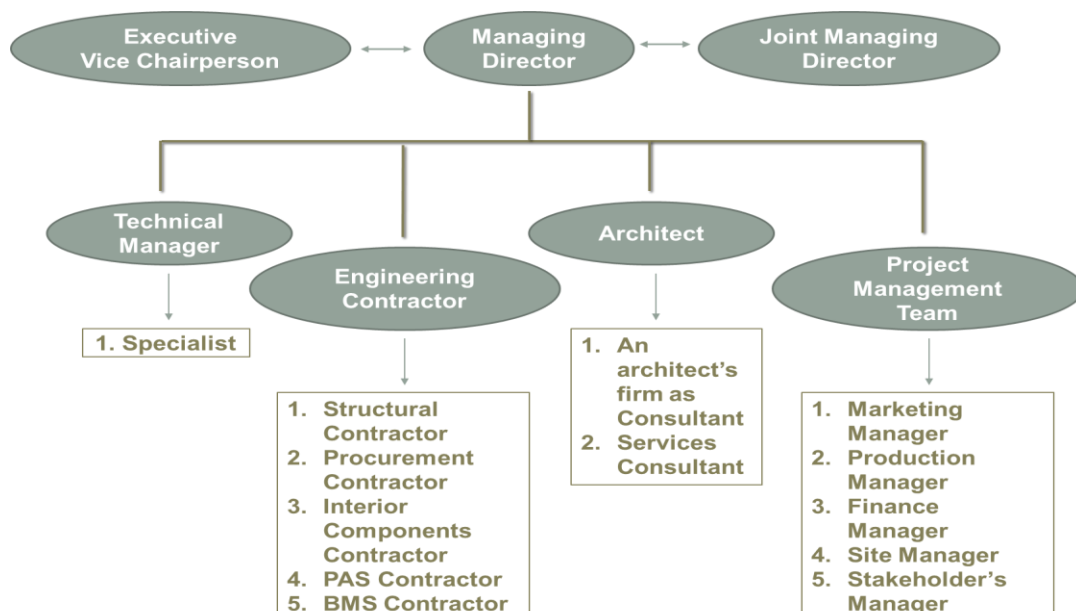


Fig 4.3 Organization Chart

4.1.6 FLOOR PLANS:

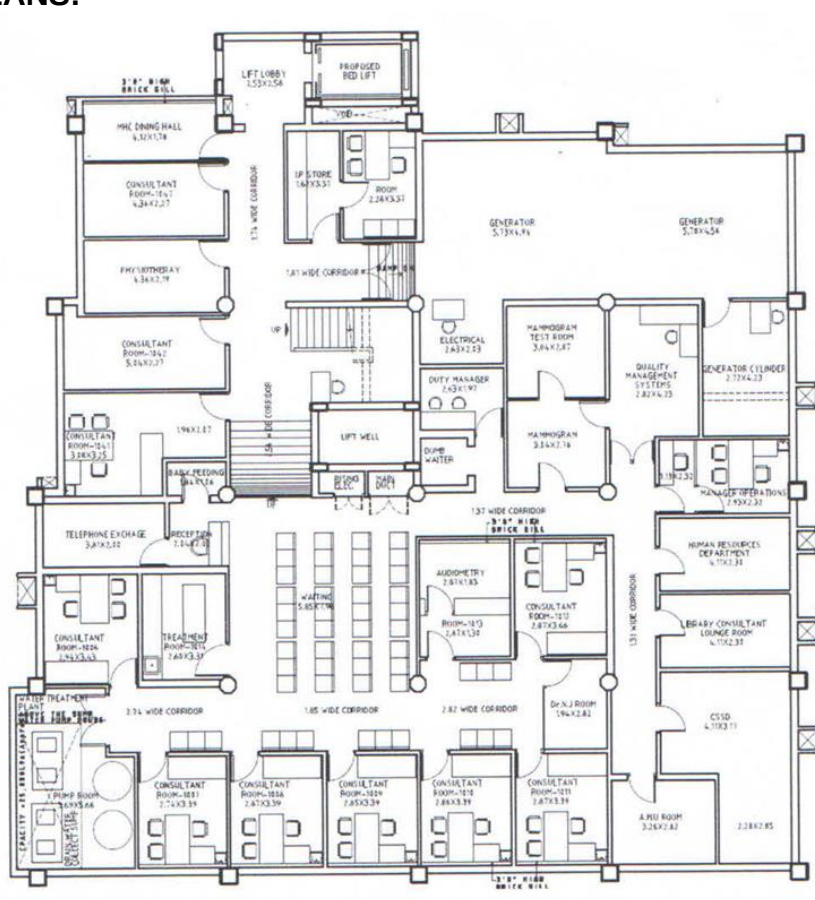


Fig 4.4 Existing Basement Plan

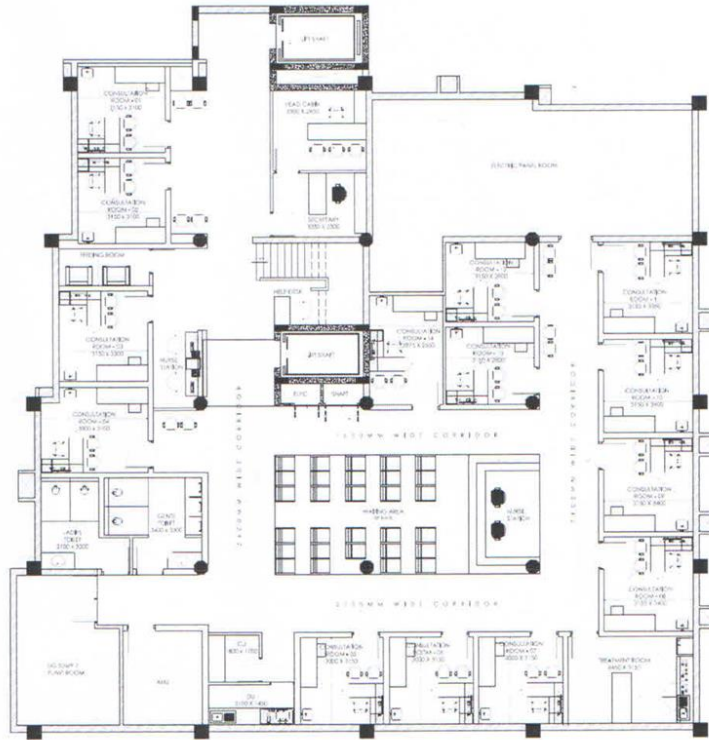


Fig 4.5 Proposed Basement Plan

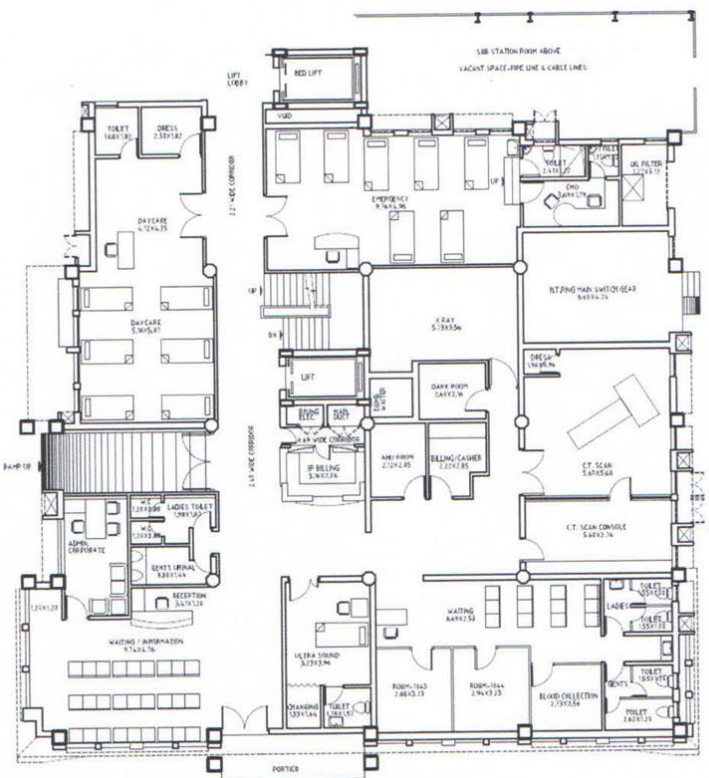


Fig 4.6 Existing Ground Floor Plan

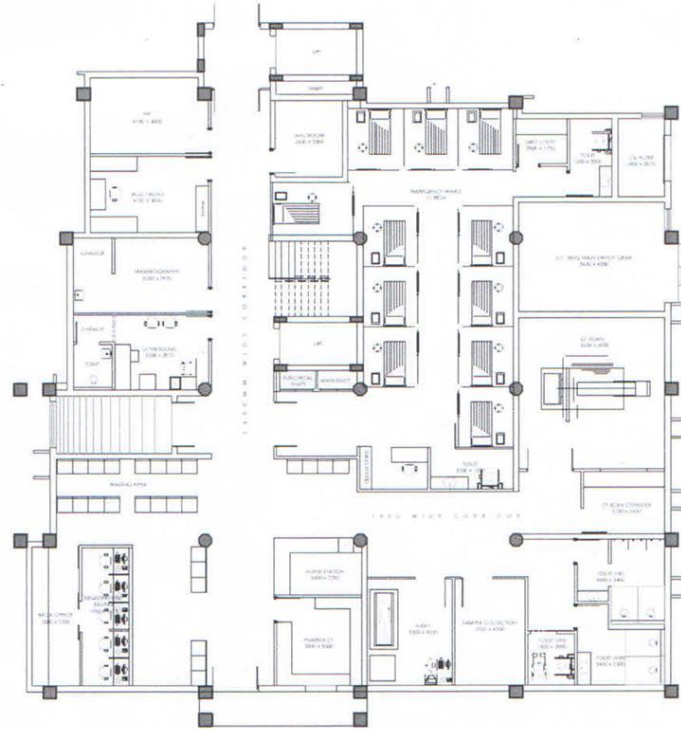


Fig 4.7 Proposed Ground Floor Plan

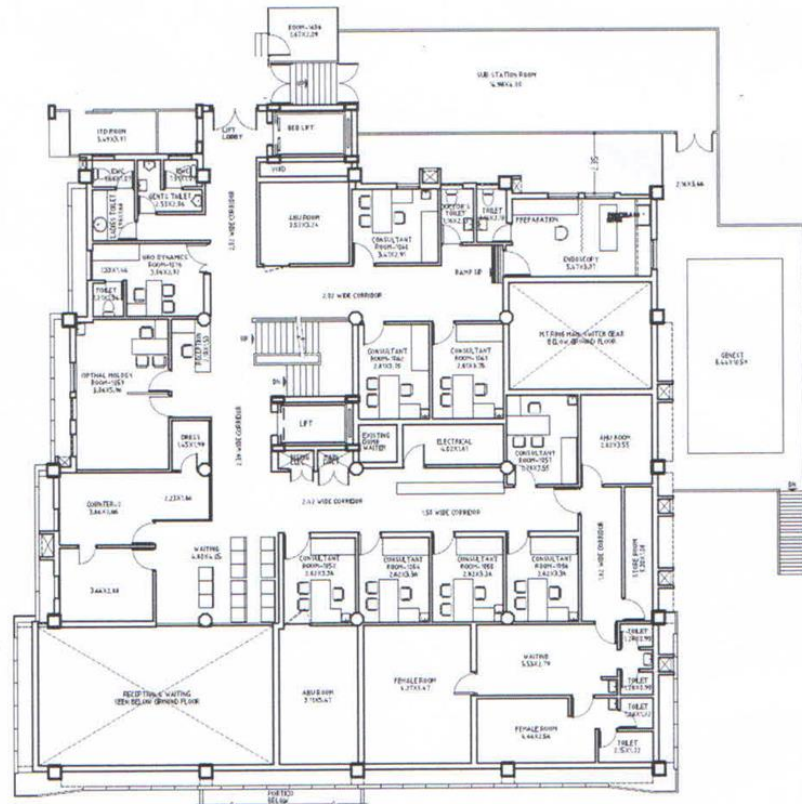


Fig 4.8 Existing First Floor Plan

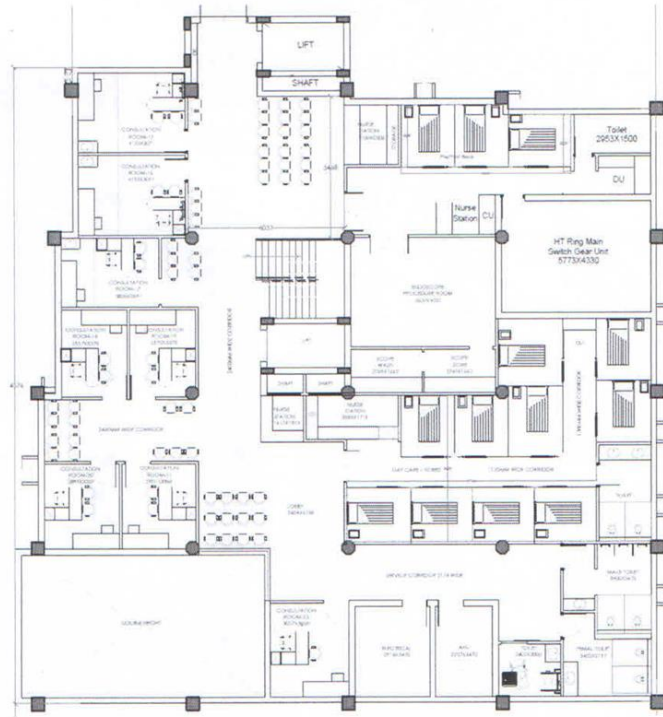


Fig 4.9 Proposed First Floor Plan

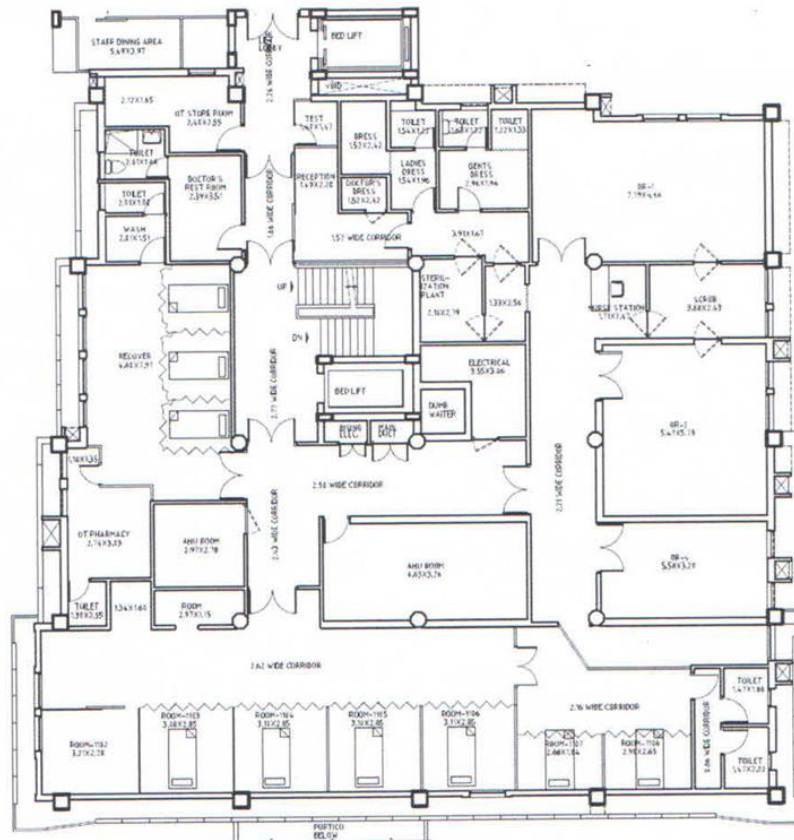


Fig 4.10 Existing Second Floor Plan

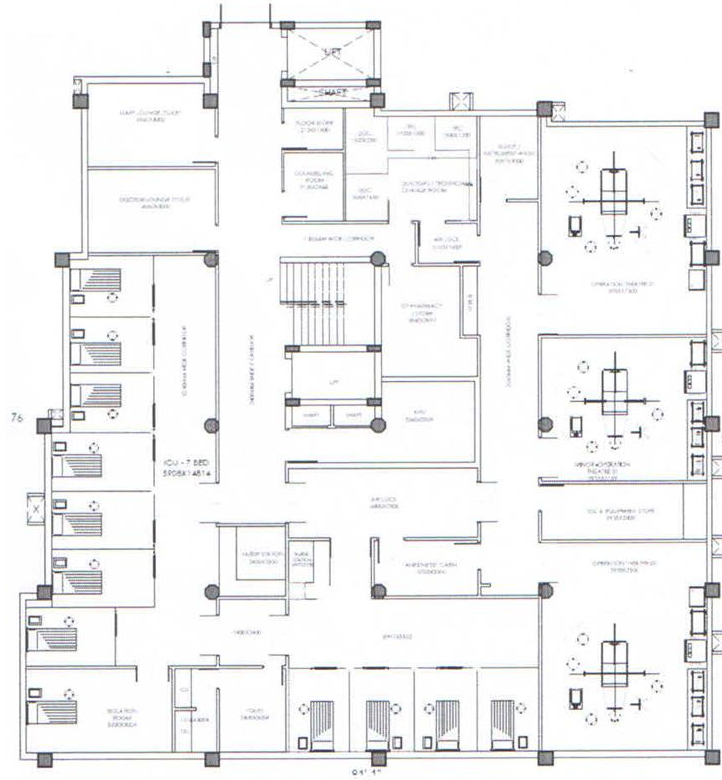


Fig 4.11 Proposed Second Floor Plan

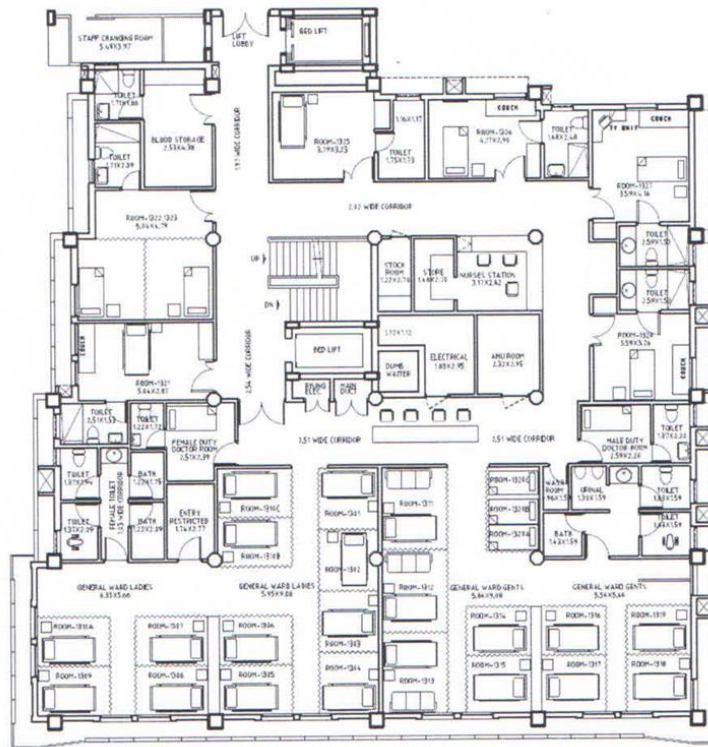


Fig 4.12 Existing Fourth Floor Plan

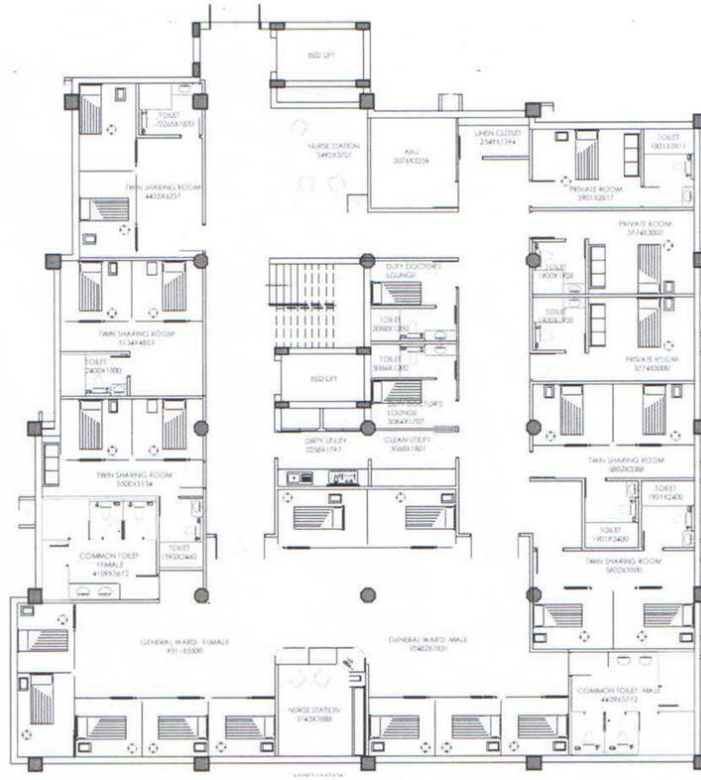


Fig 4.13 Proposed Fourth Floor Plan

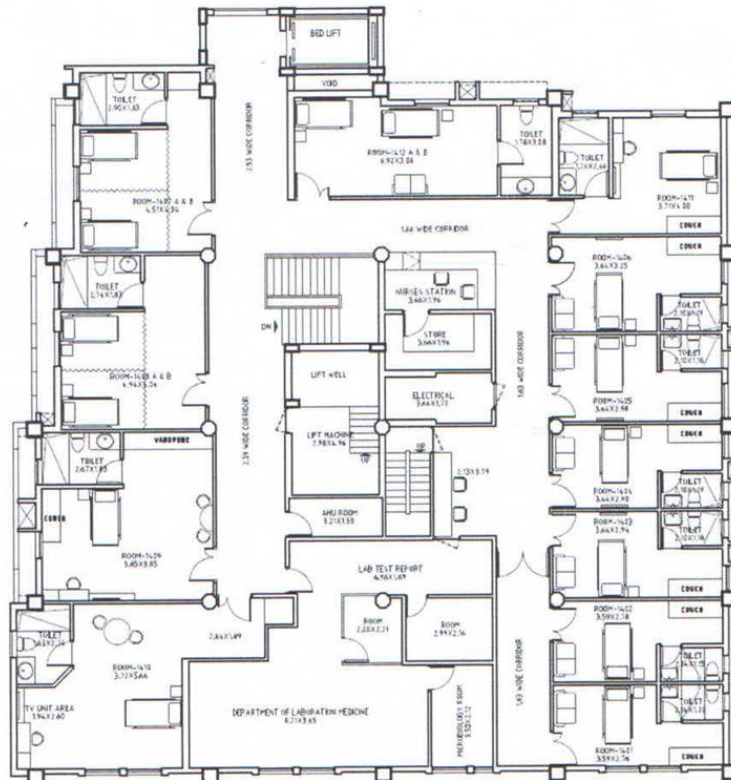


Fig 4.14 Existing Fifth Floor Plan

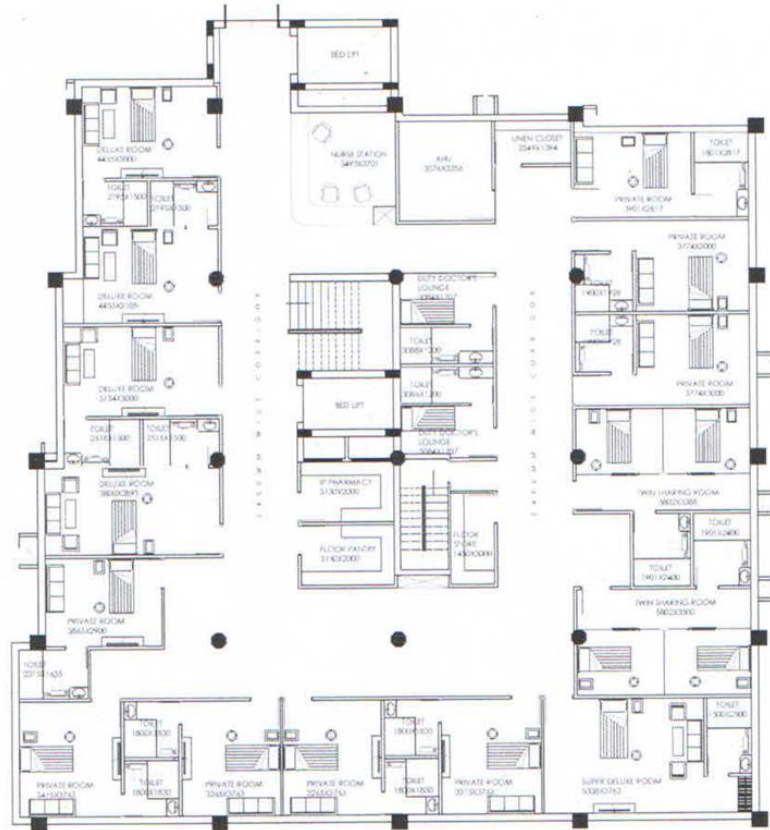


Fig 4.15 Proposed Fifth Floor Plan

4.2 PARSN MANERE, GANGAI KARAI PURAM, T.NAGAR, CHENNAI – 600006:

Name of the Project - Parsn Manere, Gangai Karai Puram, T. Nagar, Chennai - 06

Client – Parsn

Total Area – 26,569 sq.ft

No. of floors – 1 Basement and G+9

Setbacks – Front: 20m, Rear Side: 6m

Right Side: 20m; Left Side: 3.5m

Height – 30m

A residential project built at Anna Salai in Chennai, Gemini Parsn Apartments is centrally located. BRS Hospital, Cathedral Garden, Vidyodaya Girls Higher Secondary School and Hotal Palmgrove are few utility landmarks nearby.



Fig 4.16 A) & B) Parsn Manere Exterior and C) 'A' wing of Parsn Manere

4.2.1 AGE OF THE BUILDING:

This structure was built in 1981 which is a 40 year old building. It was constructed as a mixed use building and is still of same usage. Basement, ground floor and first floor are of commercial spaces. From 2nd floor to 9th floor it is all for residential.

4.2.2 WHEN WAS THIS LASTLY REFURBISHED?

2 years back in 2018 the transformer for A, B and C wings were replaced with an updated RMU unit of 11KV capacity.

4.2.3 REASONS FOR PRESENT REFURBISHMENT:

- The case building Parsn Manre is structurally strong.
- But on the services part, the electrical room and EB cables & wires are opened inside the building and there are small changes to be made in plumbing lines located in terrace.
- Since the building is a 40 year old structure the electrical room design has become outdated and water pipe lines designed using iron are all corroded and there are many leakages found.

4.2.4 ORGANIZATION CHART:

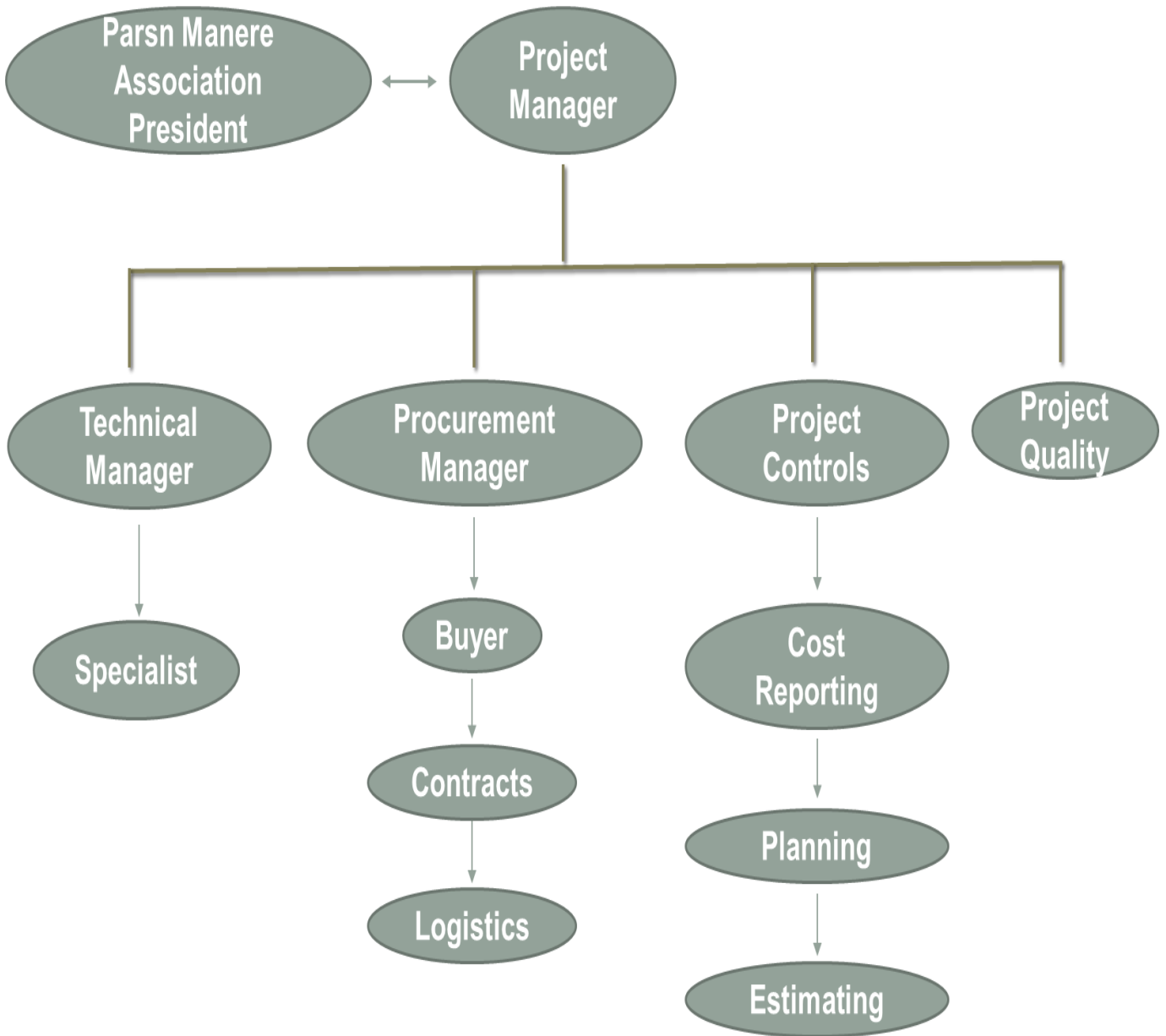


Fig 4.17 Organization Chart

4.2.5 ELEMENTS FOR REFURBISHMENT:

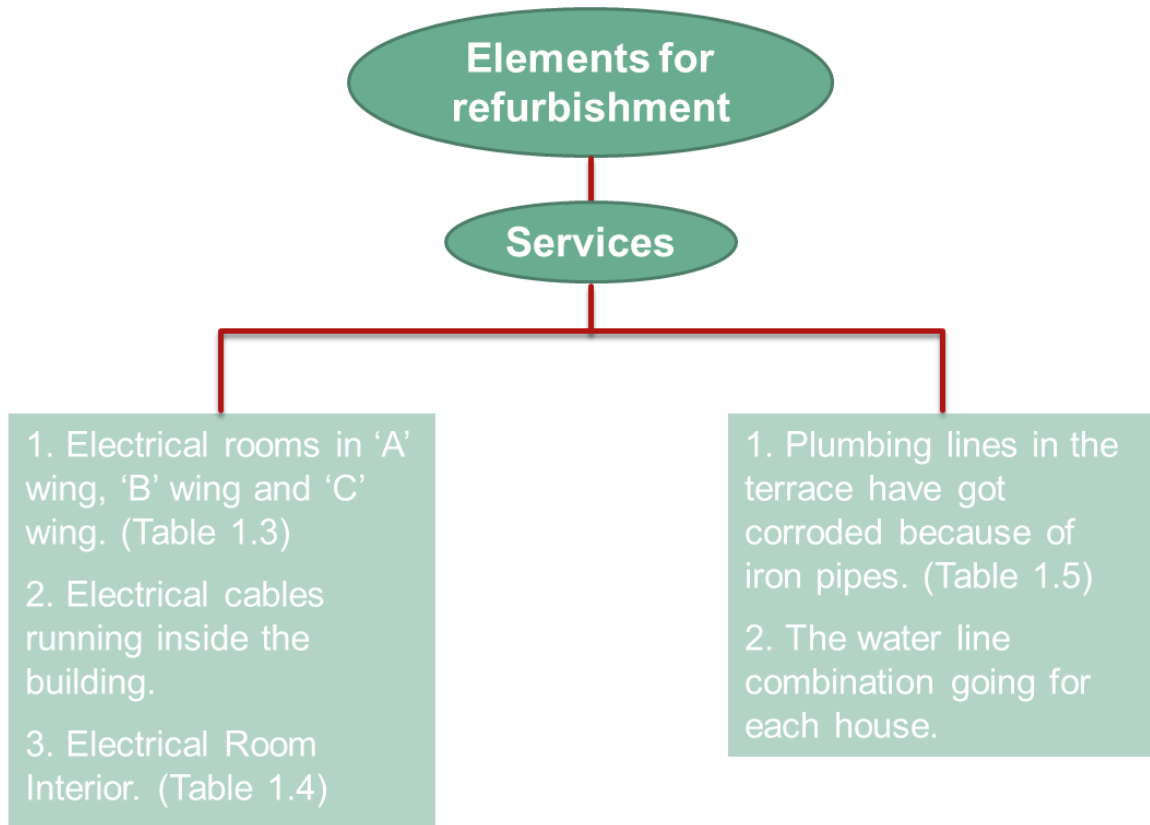


Fig 4.18 Refurbishing Elements
Table 4.3 Electrical Refurbishment

ELECTRICAL				
S.No	Item to be refurbished	Existing Quantity / Capacity	To be replaced / refurbished	Solutions
1	3 Phase Meter Boxes	32 (Residential)	Yes	These meter boxes to be fitted inside the newly prepared panel boards.
2	Single Phase Meter Boxes	Lot	Yes	These meter boxes to be fitted inside the newly prepared panel boards.
3	Main line board from the RMU	One	Yes	To be closed with well furnished metal boards

S.No	Item to be refurbished	Existing Quantity / Capacity	To be replaced / refurbished	Solutions
4	Cables	Lot	Yes	Cable trays are the best solution for this
5	Meter Boxes in the Basement EB room	48	Yes	These meter boxes to be fitted inside the newly prepared panel boards.
6	Cables running in each floor	4 cables per floor	Yes	Distribution board for each floor and submeter for every house shall be provided

Table 4.4 Electrical room refurbishment

ELECTRICAL ROOM INTERIOR				
S.No	Item to be refurbished	Existing Quantity / Capacity / Area	To be replaced / refurbished	Solutions
1	Walls	100 sq.ft Height – 10 feet	Yes	Walls to be plastered well and painted.
2	Ceiling	10ft x 10ft	Yes	Should be well plastered

There are 6 number of lifts in total. 2 lifts in each wing.
They are paying an amount of rupees 1.5 lakhs for 2 months for the EB.
1 rupee per sq.ft and 2 rupees per sq.ft has been charged as maintenance cost for the commercial floor and residential floors respectively.

4.3 CASE STUDY 3 – IIT Madras Research Park, Tharamani, Chennai - 600113

Project Name & Location - E Block, IIT Madras Research Park, Tharamani, Chennai - 113

Client – IIT Madras

Total Built up Area – 4,00,000 sq.ft

No. of floors – 1 Basement and G+8

Height – 24m

The IITM Research Park is spread across 11.42 acres and has over 1.2 million square feet of work space with several formal, informal, theme-based meeting and networking lounges. It has a courtyard surrounded by 5 individual towers interconnected by skywalks. 33 KVA substation with 100% back up power with DG sets, 24×7 water supply, drainage, STP, communication, HVAC with 1700 Tr water cooled chillers. All services are controlled and operated through an Integrated Building Management System.



A



B

Fig 4.19 A) Courtyard with 5 towers around it & B) 'E' Block



Fig 4.20 IITM Research Park Entrance

4.3.1 AGE OF THE BUILDING:

This structure was built in 2009 which is a 11 years old building. India's first university-based research park, aspires to build a knowledge and innovation ecosystem where industry leaders and scholars can collaborate with state-of-the-art technology.

4.3.2 WHEN WAS THIS LASTLY REFURBISHED:

No it was not refurbished before and this is the first refurbishment after 11 years of existence for the building.

4.3.3 REASONS FOR PRESENT REFURBISHMENT:

- Some of the fire pumps and electrical equipments have lost their efficiency within 11 years that are in need of replacement.
- In the interiors there are few damages that should to be refurbished for better look and feel environment.

4.3.4 ELEMENTS FOR REFURBISHMENT:

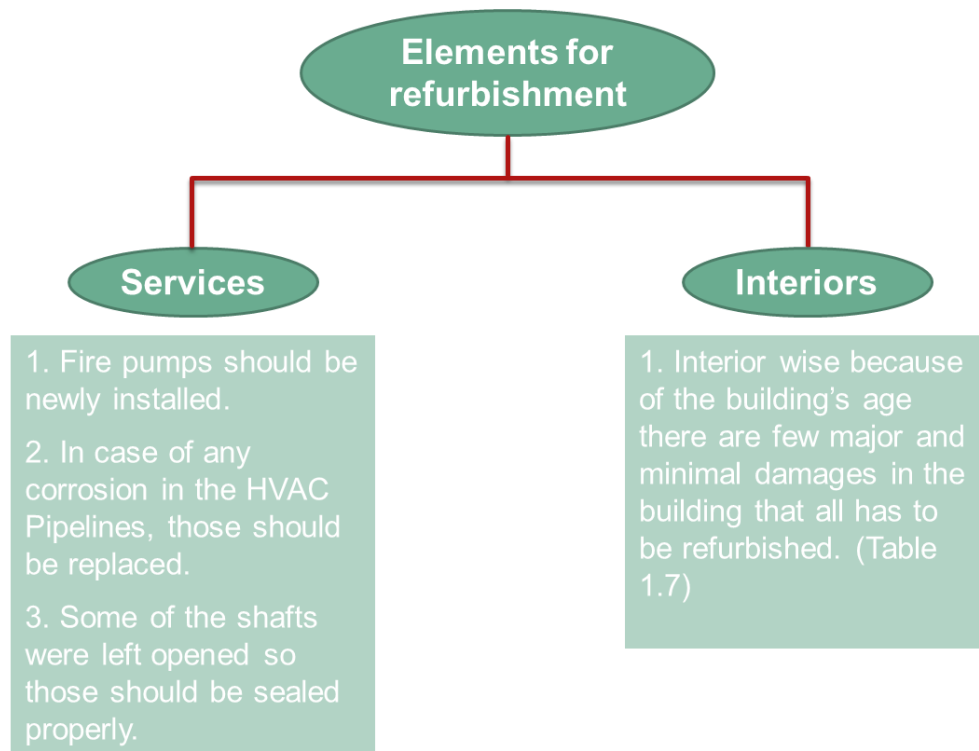


Fig 4.21 Refurbishing Elements

Table 4.5 Services Refurbishment

SERVICES				
S.No	Item to be refurbished	Existing Quantity / Capacity	To be replaced / refurbished	Solutions
1	Fire Pumps	-	Yes	Should be replaced with same capacity
2	Electrical	Lot	Yes	Some of the electrical shafts were opened where those lines were left corroded. So those should be replaced with the updated cables.

Table 4.6 Interior Refurbishment

INTERIORS				
S.No	Locations to be refurbished	Existing Quantity / Capacity / Area	To be replaced / refurbished	Solutions
1	Spiral Staircase in the basement atrium	1	Yes	The handrails and finishes have corroded and shall be replaced with stainless steel or wooden handrails.
2	Toilets in every floor	1 per floor	Yes	Wash basins should be changed since every basin was in rustic condition. Tiling to be changed. WCs should be replaced. Opened shafts should be closed inside on the walls.

S.No	Locations to be refurbished	Existing Quantity / Capacity / Area	To be replaced / refurbished	Solutions
				Ceiling can be replaced with gypsum board and proper lighting within. Wirings should be sealed.
3	Lift Lobbies	1 per floor	Yes	Flooring, walls and ceilings to be finished properly and flooring can be changed with updated tiles in the market.
4	Staircase	Every floor	Yes	Handrails to be refurbished with stainless steel and flooring shall be smoothened.
5	OTS	Ground Floor	Yes	Glass placed for lighting in the ground floor should be removed off stains or replaced.
6	Atrium	Rear side of the block	Yes	Lights should be refurbished with updated styles and wiring for the same to be concealed.
7	Sprinklers	Ground floor, 1 st floor and common areas from 2 nd to 8 th floor	Yes	Should be replaced with new ones because of corrosion.

S.No	Locations to be refurbished	Existing Quantity / Capacity / Area	To be replaced / refurbished	Solutions
8	Ramp	Rear side of the building	Yes	Handrails to be refurbished
9	Walls	Every floor	Yes	Should be repainted
10	Ceiling	Every floor	Yes	Replaced with gypsum board and better interior lighting setup

4.3.5 ORGANIZATION CHART:

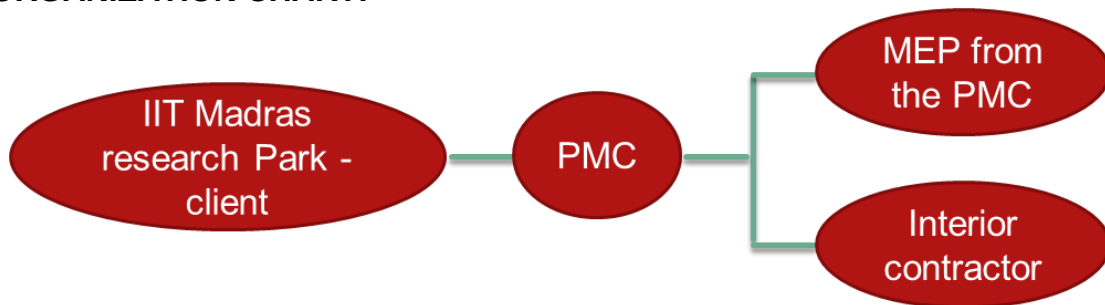


Fig 4.22 Organization Chart

CHAPTER 5

COST AND PROJECT TIMELINE TEMPLATE FOR REFURBISHMENT PROJECTS

5.1 FEASIBILITY CHECK:

Table 5.1 Feasibility Check

S.N o	Activity Involved	Time	Schedule	Cost
1	Investors benefits	May be 1 month or even 1 year	The first ever step for a refurbishment project	
2	Labour's working hours	Differs for every project	One of the important points to be noted during feasibility check for a project	
3	Material Management	Depending on the size of the site	After choosing the labours placement and purchasing should be decided	
4	Transportation in and around the site	Depending on the size of the site	Materials should be freely moved around the site	
5	Standards and codes to be followed	-	The building should be able to suit the current standards	

5.2 PROJECT PLANNING:

Table 5.2 Project Planning

S.No	Activity Involved	Time	Schedule	Cost
1	Determine local response characteristics	1 day	Before planning the phase wise construction work	

S.No	Activity Involved	Time	Schedule	Cost
2	Framing requirements	2 or 3 days	Discussion with clients after reviewing the site conditions for construction	
3	Cost estimation	2 to 3 days	Depending on the requirements 2 to 3 BOQ options shall be presented	
4	Environmental clearance	1 to 3 months	To carryout the work there should be no environmental issues	

5.3 SCHEMATIC PLANNING:

If drawings are available:

Renovation plans will be proposed from the available old drawings which are referred for the corrected retrofitting process.

Unwanted structural and non-structural elements to be removed shall be given from the drawings available as a scheme plan.

Plans will be received as per the client's requirements.

If drawings are not available:

Structural and non-structural elements that are to be removed shall be tabulated on first and then shall a scheme plan shall be developed.

After the scheme development, the renovation plan should be proposed and a rough interior layout should be sketched for client's approval.

Client's ideas/requirements should be noted and revised accordingly.

5.4 DESIGN DEVELOPMENT AND DESIGN DETAIL:

Table 5.3 Design development and design detail

S. No	Activity Involved	Time	Schedule	Cost
1	Authorized approvals	3 to 6 months	After scheme development	
2	Material Specification	1 or 2 days	During the time of approval	
3	Shutdown work	2 to 3 days	Depending on the works to be started shutdown time to be noted	

S.No	Activity Involved	Time	Schedule	Cost
4	Emerging works	1 to 2 days	Kind of problems that might emerge during the construction	
5	Time critical design	1 to 2 days	The time critical elements of the construction works should be well identified and suitably scheduled with other works	

5.5 CONSTRUCTION:

Table 5.4 Construction Phase

S.No	Activity Involved	Time	Schedule	Cost
1	Shutdown work	Depending on the project type	First ever step for a refurbishment project in a working building	
2	Excavations	Depending on the project type	Incase of any excavation work it should be done after shutdown	
3	Work outside the building	Depending on the project type		
4	Work inside the building	Depending on the project type		
5	Dismantling / Demolition work	Depending on the project type		
6	Hot Work	Depending on the project type		

S.No	Activity Involved	Time	Schedule	Cost
7	Location of construction machinery	Depending on the project type		
8	Temporary lighting	Depending on the night work		
9	Working in confined spaces	Depending on the project type		
10	Fragile, weak and unstable surface	Depending on the project type		

CHAPTER 6 ANALYSIS AND RESULTS

6.1 REFURBISHMENT SCHEDULE FOR 3 CASE BUILDINGS:

6.1.1 Feasibility Check:

In case of a retrofit project the structure when retrofitted should give fair benefits for the investors which is the major reason for retrofitting a structure. Example: In a commercial building, when the building's performance drops down it will off course create a huge loss for the owner/investor of the building and after retrofitting it should be economically beneficial for the investor/owner.

Table 6.1 Feasibility Check

Activity Involved – a) Investor's Benefits			
Case Study Building	Apollo Hospital	Parsn Manere	IITM Research Park
Schedule	First ever step in the project	Depending on which the project will proceed	Intangible benefits for the client
Cost	Rs.0	Rs.0	Rs.0
Activity Involved – b) Labour Working Hours			
Case Study Building	Apollo Hospital	Parsn Manere	IITM Research Park
Schedule	After defining the scope and objective for the project (6 a.m. To 6 p.m.)	After defining the scope and objective for the project (6 a.m. 6 p.m.)	After defining the scope and objective for the project (8 a.m. to 6 p.m.)
Cost	Rs.0	Rs.0	Rs.0
Activity Involved – c) Material Management			
Case Study Building	1. Apollo Hospital	2. Parsn Manere	3. IITM Research Park

Schedule	This is based on labour working hours and transportation facility inside the site	This is based on labour working hours	This is based on labour working hours
Cost	Rs.0	Rs.0	Rs.0
Activity Involved – d) Transportation in and around the site			
Case Study Building	Apollo Hospital	Parsn Manere	IITM Research Park
Schedule	Coincides with material management	Coincides with material management	Coincides with material management
Cost	Rs.0	Rs.0	Rs.0
Activity Involved – e) Visual Reporting (Professional)			
Case Study Building	Apollo Hospital	Parsn Manere	IITM Research Park
Schedule	After the confirmation of project	After the confirmation of project	After the confirmation of project
Cost	Rs.5000	Rs.5000	Rs.5000
Activity Involved – f) Standards and codes to be followed			
Case Study Building	1. Apollo Hospital	2. Parsn Manere	3. IITM Research Park
Schedule	Before project planning	Before project planning	Before project planning
Cost	Rs.0	Rs.0	Rs.0

6.1.2 Project Planning:

Depending on the as built drawings availability the project planning phase differs for every refurbishing project.

Table 6.2 Project Planning Stage

Activity Involved – a) Determine Local Response Characteristics			
Case Study Building	Apollo Hospital	Parsn Manere	IITM Research Park
Schedule	After the feasibility check and before drafting the scheme plan	After the feasibility check and before drafting the scheme plan	After the feasibility check and before drafting the scheme plan
Cost	Rs.0	Rs.0	Rs.0
Activity Involved – b) Framing Requirements			
Case Study Building	Apollo Hospital	Parsn Manere	IITM Research Park
Schedule	After the feasibility check	After the feasibility check	After the feasibility check
Cost	Rs.0	Rs.0	Rs.0
Activity Involved – c) Cost Estimation			
Case Study Building	1. Apollo Hospital	2. Parsn Manere	3. IITM Research Park
Schedule	Based on the requirements and proposed planning BOQs are prepared	Based on the requirements BOQs are prepared	Based on the interior requirements BOQs are prepared
Cost	Rs.0	Rs.0	Rs.0

Activity Involved – d) Environmental Clearance			
Case Study Building	1. Apollo Hospital	2. Parsn Manere	3. IITM Research Park
Schedule	Before starting up with the site work and after sorting out the BOQ works	Before starting up with the site work and after sorting out the BOQ works	Before starting up with the site work and after sorting out the BOQ works
Cost	Rs.5,00,000	Rs.1,00,000	Rs.50,000

6.1.3 Schematic Design:

1. Apollo First Med Hospital, Kilapuk.

- Drawings are available:
- Renovation plans were proposed from the available old drawings which are referred for the corrected refurbishment process.
- Internal arrangements of the rooms are totally refurbished according to the improved requirements
- Plans will be received as per the client's requirements.

2. Parsn Manere, T.Nagar:

- Floor plan is available:
- Floor Plan
- Point and box locations
- Electrical Wiring drawing or SLD
- Slab Conduit Routing Drawing
- Material make and Size Selection
- Load Calculation and Labour Charge

3. IIT Madras Research Park, Taramani:

- Drawings are not available
- Only methodology of how to proceed with the repair works shall be given.

6.1.4 Design development and Design detail:

Detailed design is the stage where schematic drawings are developed and freezed, most importantly with the client's approval.

Table 6.3 Design development and design detail stage

Activity Involved – a) Authorized Approvals			
Case Building	1. Apollo Hospital	2. Parsn Manere	3. IITM Research Park
Schedule	After freezing the Schematic Design with client's approval	After freezing the Schematic Design with client's approval	After freezing the Schematic Design with client's approval
Cost	Rs.10,00,000	Rs.2,00,000	Rs.2,00,000
Activity Involved – b) Material Specification			
Case Building	1. Apollo Hospital	2. Parsn Manere	3. IITM Research Park
Schedule	Before starting the on site works	Before starting the on site works	Before starting the on site works
Cost	Rs.0	Rs.0	Rs.0
Activity Involved – c) Shutdown Works to be determined			
Case Building	1. Apollo Hospital	2. Parsn Manere	3. IITM Research Park
Schedule	After getting the approvals	After getting the approvals	After getting the approvals
Cost	Rs.0	Rs.0	Rs.0
Activity Involved – d) Emerging Works			
Case Building	1. Apollo Hospital	2. Parsn Manere	3. IITM Research Park
Schedule	After determining the shutdown works and the critical time for the project completion	After determining the shutdown works	After determining the shutdown works and identifying the critical time for project completion
Cost	Rs.0	Rs.0	Rs.0

Activity Involved – e) Time Critical Design			
Case Building	1. Apollo Hospital	2. Parsn Manere	3. IITM Research Park
Schedule	Before starting up with the construction work	Before starting up with the construction work	Before starting up with the construction work
Cost	Rs.0	Rs.0	Rs.0

6.1.5 Construction Phase:

Detailed design is the stage where schematic drawings are developed and freezed, most importantly with the client's approval.

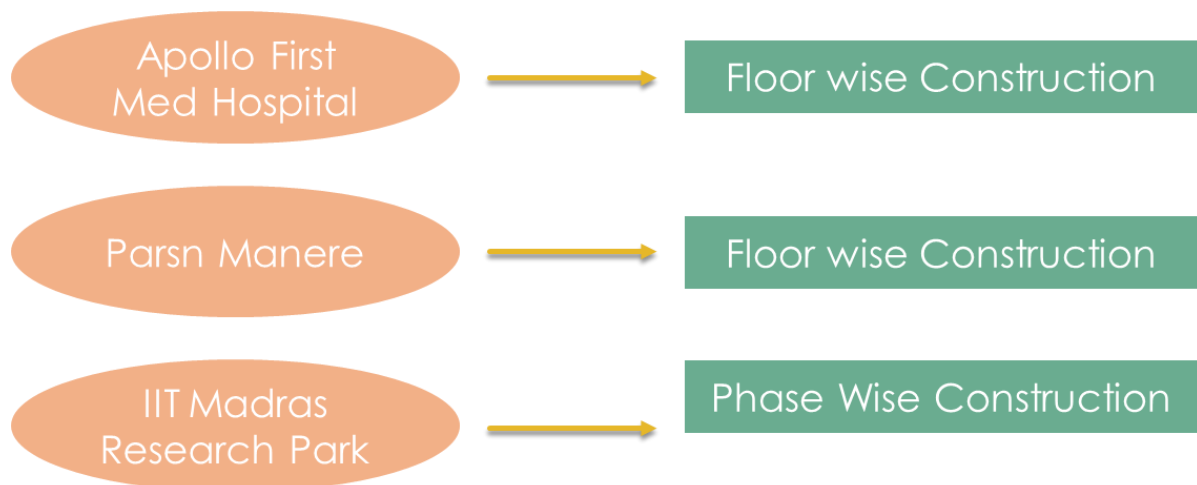


Fig 6.1 Refurbishment Construction phases for different building typologies

6.1.5.1 Apollo First Med Hospital, Kilpauk – Floor wise construction: Basement Floor:

Table 6.4 Construction Phase (Apollo)

S.No.	Activity Involved	Schedule	Labour Cost + Material Cost
1.	Pre-Shutdown Works	Before shutdown.	Rs.24,000 per floor

Table 6.5 Pre-Shutdown Work Details

ITEMS TO BE REMOVED	NO. OF LABOUR	LABOUR COST
Furnitures	6	Rs.4,800
Plumbing Fixtures	1	Rs.800
Fire Fighting Equipments	1	Rs.800
Electrical Fixtures	4	Rs.3,200
False Ceiling Fixtures	4	Rs.3,200
POINTS TO BE CLOSED	NO. OF LABOUR	LABOUR COST
Electrical conduits to be temporarily sealed / closed	4	Rs.3,200
Plumbing lines to be temporarily sealed / closed	4	Rs.3,200
PFA Points to be temporarily sealed / closed	2	Rs.1,600
HVAC supply opens to be temporarily sealed / closed	4	Rs.3,200

Table 6.4 Construction Phase (Apollo) (Continuation)

S.No.	Activity Involved	Schedule	Labour Cost + Material Cost
2.	Shutdown	Before starting the demolition work (Just before fixing scaffolding)	Rs.1600
3.	Temporary Lighting inside	After Shutdown	Rs.1600
4.	Demolition	After shutdown	Rs.

S.No.	Activity Involved	Schedule	Labour Cost + Material Cost
5.	Scaffolding	To be fixed beside the walls to be demolished	Rs.24,800 (for 9 days)
6.	Construction of new walls	After demolition of existing walls (Till lintel – 2 days Lintel beam – 2 days Curing – 1 day)	Rs.1,56,000
7.	Removal of Scaffolding	During Curing for the newly constructed walls	Rs.1600
8.	Removing the existing tiles	Floor tile and skirting during the removal of scaffolding	Rs.82,000
9.	Removing the tile debris	After breaking the existing tiles	Rs.9,600
10.	Tile Laying	After cleaning the tile debris	Rs.5,70,150
11.	Tile cover (PVC)	After laying the tiles	Rs.11,40,300
12.	False Ceiling (Gypsum Board)	Front side of basement floor after tile cover	Rs.2,44,350
13.	False Ceiling (Gypsum Board)	Rear side of basement floor	Rs.2,44,350
14.	Waiting Chair(Stainless steel - 3 seater & 2 seater)	For waiting area during ceiling work in the rear side of the floor	Rs.70,600
15.	Consultation room Doors and CU room door (7 rooms)	Installed in the front side, during ceiling work in the rear side of the floor	Rs.1,42,000
16.	Stainless Steel door (AHU room and Pump Room)	Installed in the front side, during ceiling work in the rear side of the floor	Rs.1,21,600

S.No.	Activity Involved	Schedule	Labour Cost + Material Cost
17.	Consultation Table and Store Cabinet (6 rooms)	Consultation rooms in the front side, during ceiling work in the rear side of the floor	Rs.20,320
18.	Nurse Station	After ceiling work in rear side of the floor	Rs.2,350
19.	Water Closet for bathroom	Installed in M/F toilets during ceiling work in the rear side of the floor	Rs.59,160
20.	Urinals	Installed in Male toilets during ceiling work in the rear side of the floor	Rs.36,100
21.	Counter Top Wash basin	Installed in 6 consultation rooms and 2 in M/F toilets	Rs.16,400
22.	Steel Sink	Installed in DU	Rs.3800
23.	Consultation room Doors and CU room door (9 rooms)	Rear side of basement floor	Rs.1,92,000
24.	Patient bed in consultation room	In the consultation rooms after fixing the doors	Rs.2,48,030
25.	Counter Top Wash basin	Installed in 9 rooms in the rear side of the floor	Rs.18,450
26.	Reception table	Installed in the waiting area	Rs.20,000
27.	Secretary Table	Installed in the rooms outside the manager room	Rs.10,000
TOTAL COST (Excluding the Demolition Cost)			Rs.34,61,160

Delay Assumptions in Apollo First Med Hospital:

1. Delays can never be judged for a hospital refurbishment because it might be due to patients condition, VIP visits to hospitals, any emergency cases to be treated, doctor's additions over their requirements, etc.
2. Only at the time of delay the schedule will be altered.

Apollo Hospital (Basement Floor)–Project Timeline

ID Task	Task Description	Task Duration (In days)	Start Date	End Date	20 January 2020	20 March 2020	19 May 2020	18 July 2020	16 September 2020	15 November 2020	22 January 2021	23 January 2021	24 January 2021	25 January 2021	26 January 2021	27 January 2021	28 January 2021	29 January 2021	30 January 2021	31 January 2021	01 February 2021	02 February 2021	03 February 2021	04 February 2021	05 February 2021	06 February 2021	07 February 2021
1) Feasibility Check																											
1	Investor's Benefits	368	20 January 2020	22 January 2021																							
2	Labour Working Hours	1	27 January 2021	27 January 2021																							
3	Material Management	2	28 January 2021	29 January 2021																							
4	Transportatin in and around the site	2	28 January 2021	29 January 2021																							
5	Visual reporting	2	30 January 2021	31 January 2021																							
6	Standards and codes to be followed	1	01 February 2021	01 February 2021																							
2) Project Planning																											
1	Determing Local response Characteristics	2	03 February 2021	04 February 2021																							
2	Framing requirements	3	05 February 2021	07 February 2021																							
3	Rough Cost Estimation	2	08 February 2021	10 February 2021																							
4	Environmental clearance	28	11 February 2021	11 March 2021																							
3) Schematic design																											
1	Revise the old drawings	2	11 March 2021	12 March 2021																							
2	Frame the engineering considerations	1	12 March 2021	12 March 2021																							
3	Revision 1 - Freeze for approvals	2	13 March 2021	14 March 2021																							
4	Design revision as per the specific materials, equipments and areas to be altered	1	15 March 2021	15 March 2021																							
5	Finalise the Scheme Plan	1	17 March 2021	17 March 2021																							
4) Design Development and Design Detail																											
1	Authorized approvals	65	14 March 2021	15 May 2021																							
2	Material Specification	1	15 May 2021	15 May 2021																							
3	Shutdown works to be determined	1	17 May 2021	17 May 2021																							
4	Determine the emerging works	2	18 May 2021	18 May 2021																							
5	Determine the Time Critical Design	1	19 May 2021	19 May 2021																							
5) Construction (Basement Floor)																											
1	Pre-shutdown works	1	21 May 2021	21 May 2021																							
2	Shutdown	1	22 May 2021	22 May 2021																							
3	Temporary Lighting Inside	1	22 May 2021	22 May 2021																							
4	Demolition	2	24 May 2021	25 May 2021																							
5	Scaffolding (Besdies the walls to be demolished)	1	24 May 2021	24 May 2021																							
6	New wall construction	6	26 May 2021	31 May 2021																							
7	Formwork removal	1	31 May 2021	31 May 2021																							
8	Remove the existing tiles	1	31 May 2021	31 May 2021																							
9	Removing the tile debris	1	31 May 2021	31 May 2021																							
10	Tile laying	3	01 June 2021	03 June 2021																							
11	Tile cover (PVC)	2	04 June 2021	05 June 2021																							
12	False Ceiling (Gypsum Board)	14	07 June 2021	21 June 2021																							
13	False Ceiling (Gypsum Board)	14	22 June 2021	05 July 2021																							
14	Waiting Chair (Stainless steel - 3 seater & 2 seater	1	22 June 2021	22 June 2021																							
15	Consultation room doors and CU room door (7 rooms)	1	22 June 2021	22 June 2021																							
16	Stainless steel door (AHU room and Pump room)	1	22 June 2021	22 June 2021																							
17	Consultation Table and Store Cabinet	1	23 June 2021	23 June 2021																							
18	Nurse Station	1	05 July 2021	05 July 2021																							
19	Water closet for bathroom	1	21 June 2021	21 June 2021																							
20	Urinals	1	21 June 2021	21 June 2021																							
21	Counter top wash basin	1	22 June 2021	22 June 2021																							
22	Steel sink	1	14 June 2021	14 June 2021																							
23	Consultation room doors and CU room door (9 rooms)	1	05 July 2021	05 July 2021																							
24	Pateint bed in consultation room (front side)	1	22 June 2021	22 June 2021																							
25	Pateint bed in consultation room (rear side)	1	05 July 2021	05 July 2021																							
26	Counter top wash basin	1	22 June 2021	22 June 2021																							
27	Reception Table	1	22 June 2021	22 June 2021																							
28	Secretarcy Table	1	22 June 2021	22 June 2021																							

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4	Demolition	2	24 May 2021	25 May 2021																							
5	Scaffolding (Besides the walls to be demolished)	1	24 May 2021	24 May 2021																							
6	New wall construction	6	26 May 2021	31 May 2021																							
7	Formwork removal	1	31 May 2021	31 May 2021																							
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14	Waiting Chair (Stainless steel - 3 seater & 2 seater	1	22 June 2021	22 June 2021																							
15	Consultation room doors and CU room door (7 rooms)	1	22 June 2021	22 June 2021																							
16	Stainless steel door (AHU room and Pump room)	1	22 June 2021	22 June 2021																							
17	Consultation Table and Store Cabinet	1	23 June 2021	23 June 2021																							
18	Nurse Station	1	05 July 2021	05 July 2021																							
19	Water closet for bathroom	1	21 June 2021	21 June 2021																							
20	Urinals	1	21 June 2021	21 June 2021																							
21	Counter top wash basin	1	22 June 2021	22 June 2021																							
22	Steel sink	1	14 June 2021	14 June 2021																							
23	Consultation room doors and CU room door (9 rooms)	1	05 July 2021	05 July 2021																							
24	Pateint bed in consultation room (front side)	1	22 June 2021	22 June 2021																							
25	Pateint bed in consultation room (rear side)	1	05 July 2021	05 July 2021																							
26	Counter top wash basin	1	22 June 2021	22 June 2021																							
27	Reception Table	1	22 June 2021	22 June 2021																							
28	Secretary Table	1	22 June 2021	22 June 2021																							

ID Task	Task Description	Task Duration (In days)	Start Date	End Date	31 March 2021	01 April 2021	02 April 2021	03 April 2021	04 April 2021	05 April 2021	06 April 2021	07 April 2021	08 April 2021	09 April 2021	10 April 2021	11 April 2021	12 April 2021	13 April 2021	14 April 2021	15 April 2021	16 April 2021	17 April 2021	18 April 2021	19 April 2021	20 April 2021	21 April 2021	22 April 2021
1) Feasibility Check																											
1	Investor's Benefits	368	20 January 2020	22 January 2021																							
2	Labour Working Hours	1	27 January 2021	27 January 2021																							
3	Material Management	2	28 January 2021	29 January 2021																							
4	Transportatin in and around the site	2	28 January 2021	29 January 2021																							
5	Visual reporting	2	30 January 2021	31 January 2021																							
6	Standards and codes to be followed	1	01 February 2021	01 February 2021																							
2) Project Planning																											
1	Determing Local response Characteristics	2	03 February 2021	04 February 2021																							
2	Framing requirements	3	05 February 2021	07 February 2021																							
3	Rough Cost Estimation	2	08 February 2021	10 February 2021																							
4	Environmental clearance	28	11 February 2021	11 March 2021																							
3) Schematic design																											
1	Revise the old drawings	2	11 March 2021	12 March 2021																							
2	Frame the engineering considerations	1	12 March 2021	12 March 2021																							
3	Revision 1 - Freeze for approvals	2	13 March 2021	14 March 2021																							
4	Design revision as per the specific materials, equipments and areas to be altered	1	15 March 2021	15 March 2021																							
5	Finalise the Scheme Plan	1	17 March 2021	17 March 2021																							
4) Design Development and Design Detail																											
1	Authorized approvals	65	14 March 2021	15 May 2021																							
2	Material Specification	1	15 May 2021	15 May 2021																							
3	Shutdown works to be determined	1	17 May 2021	17 May 2021																							
4	Determine the emerging works	2	18 May 2021	18 May 2021																							
5	Determine the Time Critical Design	1	19 May 2021	19 May 2021																							
5) Construction (Basement Floor)																											
1	Pre-shutdown works	1	21 May 2021	21 May 2021																							
2	Shutdown	1	22 May 2021	22 May 2021																							
3	Temporary Lighting Inside	1	22 May 2021	22 May 2021																							
4	Demolition	2	24 May 2021	25 May 2021																							
5	Scaffolding (Besdies the walls to be demolished)	1	24 May 2021	24 May 2021																							
6	New wall construction	6	26 May 2021	31 May 2021																							
7	Formwork removal	1	31 May 2021	31 May 2021																							
8	Remove the existing tiles	1	31 May 2021	31 May 2021																							
9	Removing the tile debris	1	31 May 2021	31 May 2021																							
10	Tile laying	3	01 June 2021	03 June 2021																							
11	Tile cover (PVC)	2	04 June 2021	05 June 2021																							
12	False Ceiling (Gypsum Board)	14	07 June 2021	21 June 2021																							
13	False Ceiling (Gypsum Board)	14	22 June 2021	05 July 2021																							
14	Waiting Chair (Stainless steel - 3 seater & 2 seater	1	22 June 2021	22 June 2021																							
15	Consultation room doors and CU room door (7 rooms)	1	22 June 2021	22 June 2021																							
16	Stainless steel door (AHU room and Pump room)	1	22 June 2021	22 June 2021																							
17	Consultation Table and Store Cabinet	1	23 June 2021	23 June 2021																							
18	Nurse Station	1	05 July 2021	05 July 2021																							
19	Water closet for bathroom	1	21 June 2021	21 June 2021																							
20	Urinals	1	21 June 2021	21 June 2021																							
21	Counter top wash basin	1	22 June 2021	22 June 2021																							
22	Steel sink	1	14 June 2021	14 June 2021																							
23	Consultation room doors and CU room door (9 rooms)	1	05 July 2021	05 July 2021																							
24	Pateint bed in consultation room (front side)	1	22 June 2021	22 June 2021																							
25	Pateint bed in consultation room (rear side)	1	05 July 2021	05 July 2021																							
26	Counter top wash basin	1	22 June 2021	22 June 2021																							
27	Reception Table	1	22 June 2021	22 June 2021																							
28	Secretary Table	1	22 June 2021	22 June 2021																							

ID Task	Task Description	Task Duration (In days)	Start Date	End Date	23 April 2021	24 April 2021	25 April 2021	26 April 2021	27 April 2021	28 April 2021	29 April 2021	30 April 2021	01 May 2021	02 May 2021	03 May 2021	04 May 2021	05 May 2021	06 May 2021	07 May 2021	08 May 2021	09 May 2021	10 May 2021	11 May 2021	12 May 2021	13 May 2021	14 May 2021	15 May 2021
1) Feasibility Check																											
1	Investor's Benefits	368	20 January 2020	22 January 2021																							
2	Labour Working Hours	1	27 January 2021	27 January 2021																							
3	Material Management	2	28 January 2021	29 January 2021																							
4	Transportatin in and around the site	2	28 January 2021	29 January 2021																							
5	Visual reporting	2	30 January 2021	31 January 2021																							
6	Standards and codes to be followed	1	01 February 2021	01 February 2021																							
2) Project Planning																											
1	Determing Local response Characteristics	2	03 February 2021	04 February 2021																							
2	Framing requirements	3	05 February 2021	07 February 2021																							
3	Rough Cost Estimation	2	08 February 2021	10 February 2021																							
4	Environmental clearance	28	11 February 2021	11 March 2021																							
3) Schematic design																											
1	Revise the old drawings	2	11 March 2021	12 March 2021																							
2	Frame the engineering considerations	1	12 March 2021	12 March 2021																							
3	Revision 1 - Freeze for approvals	2	13 March 2021	14 March 2021																							
4	Design revision as per the specific materials, equipments and areas to be altered	1	15 March 2021	15 March 2021																							
5	Finalise the Scheme Plan	1	17 March 2021	17 March 2021																							
4) Design Development and Design Detail																											
1	Authorized approvals	65	14 March 2021	15 May 2021																							
2	Material Specification	1	15 May 2021	15 May 2021																							
3	Shutdown works to be determined	1	17 May 2021	17 May 2021																							
4	Determine the emerging works	2	18 May 2021	18 May 2021																							
5	Determine the Time Critical Design	1	19 May 2021	19 May 2021																							
5) Construction (Basement Floor)																											
1	Pre-shutdown works	1	21 May 2021	21 May 2021																							
2	Shutdown	1	22 May 2021	22 May 2021																							
3	Temporary Lighting Inside	1	22 May 2021	22 May 2021																							
4	Demolition	2	24 May 2021	25 May 2021																							
5	Scaffholding (Besdies the walls to be demolished)	1	24 May 2021	24 May 2021																							
6	New wall construction	6	26 May 2021	31 May 2021																							
7	Formwork removal	1	31 May 2021	31 May 2021																							
8	Remove the existing tiles	1	31 May 2021	31 May 2021																							
9	Removing the tile debris	1	31 May 2021	31 May 2021																							
10	Tile laying	3	01 June 2021	03 June 2021																							
11	Tile cover (PVC)	2	04 June 2021	05 June 2021																							
12	False Ceiling (Gypsum Board)	14	07 June 2021	21 June 2021																							
13	False Ceiling (Gypsum Board)	14	22 June 2021	05 July 2021																							
14	Waiting Chair (Stainless steel - 3 seater & 2 seater	1	22 June 2021	22 June 2021																							
15	Consultation room doors and CU room door (7 rooms)	1	22 June 2021	22 June 2021																							
16	Stainless steel door (AHU room and Pump room)	1	22 June 2021	22 June 2021																							
17	Consultation Table and Store Cabinet	1	23 June 2021	23 June 2021																							
18	Nurse Station	1	05 July 2021	05 July 2021																							
19	Water closet for bathroom	1	21 June 2021	21 June 2021																							
20	Urinals	1	21 June 2021	21 June 2021																							
21	Counter top wash basin	1	22 June 2021	22 June 2021																							
22	Steel sink	1	14 June 2021	14 June 2021																							
23	Consultation room doors and CU room door (9 rooms)	1	05 July 2021	05 July 2021																							
24	Pateint bed in consultation room (front side)	1	22 June 2021	22 June 2021																							
25	Pateint bed in consultation room (rear side)	1	05 July 2021	05 July 2021																							
26	Counter top wash basin	1	22 June 2021	22 June 2021																							
27	Reception Table	1	22 June 2021	22 June 2021																							
28	Secretary Table	1	22 June 2021	22 June 2021																							

ID Task	Task Description	Task Duration (In days)	Start Date	End Date	16 May 2021	17 May 2021	18 May 2021	19 May 2021	20 May 2021	21 May 2021	22 May 2021	23 May 2021	24 May 2021	25 May 2021	26 May 2021	27 May 2021	28 May 2021	29 May 2021	30 May 2021	31 May 2021	01 June 2021	02 June 2021	03 June 2021	04 June 2021	05 June 2021	06 June 2021	07 June 2021
1) Feasibility Check																											
1	Investor's Benefits	368	20 January 2020	22 January 2021																							
2	Labour Working Hours	1	27 January 2021	27 January 2021																							
3	Material Management	2	28 January 2021	29 January 2021																							
4	Transportatin in and around the site	2	28 January 2021	29 January 2021																							
5	Visual reporting	2	30 January 2021	31 January 2021																							
6	Standards and codes to be followed	1	01 February 2021	01 February 2021																							
2) Project Planning																											
1	Determing Local response Characteristics	2	03 February 2021	04 February 2021																							
2	Framing requirements	3	05 February 2021	07 February 2021																							
3	Rough Cost Estimation	2	08 February 2021	10 February 2021																							
4	Environmental clearance	28	11 February 2021	11 March 2021																							
3) Schematic design																											
1	Revise the old drawings	2	11 March 2021	12 March 2021																							
2	Frame the engineering considerations	1	12 March 2021	12 March 2021																							
3	Revision 1 - Freeze for approvals	2	13 March 2021	14 March 2021																							
4	Design revision as per the specific materials, equipments and areas to be altered	1	15 March 2021	15 March 2021																							
5	Finalise the Scheme Plan	1	17 March 2021	17 March 2021																							
4) Design Development and Design Detail																											
1	Authorized approvals	65	14 March 2021	15 May 2021																							
2	Material Specification	1	15 May 2021	15 May 2021																							
3	Shutdown works to be determined	1	17 May 2021	17 May 2021																							
4	Determine the emerging works	2	18 May 2021	18 May 2021																							
5	Determine the Time Critical Design	1	19 May 2021	19 May 2021																							
5) Construction (Basement Floor)																											
1	Pre-shutdown works	1	21 May 2021	21 May 2021																							
2	Shutdown	1	22 May 2021	22 May 2021																							
3	Temporary Lighting Inside	1	22 May 2021	22 May 2021																							
4	Demolition	2	24 May 2021	25 May 2021																							
5	Scaffolding (Besides the walls to be demolished)	1	24 May 2021	24 May 2021																							
6	New wall construction	6	26 May 2021	31 May 2021																							
7	Formwork removal	1	31 May 2021	31 May 2021																							
8	Remove the existing tiles	1	31 May 2021	31 May 2021																							
9	Removing the tile debris	1	31 May 2021	31 May 2021																							
10	Tile laying	3	01 June 2021	03 June 2021																							
11	Tile cover (PVC)	2	04 June 2021	05 June 2021																							
12	False Ceiling (Gypsum Board)	14	07 June 2021	21 June 2021																							
13	False Ceiling (Gypsum Board)	14	22 June 2021	05 July 2021																							
14	Waiting Chair (Stainless steel - 3 seater & 2 seater	1	22 June 2021	22 June 2021																							
15	Consultation room doors and CU room door (7 rooms)	1	22 June 2021	22 June 2021																							
16	Stainless steel door (AHU room and Pump room)	1	22 June 2021	22 June 2021																							
17	Consultation Table and Store Cabinet	1	23 June 2021	23 June 2021																							
18	Nurse Station	1	05 July 2021	05 July 2021																							
19	Water closet for bathroom	1	21 June 2021	21 June 2021																							
20	Urinals	1	21 June 2021	21 June 2021																							
21	Counter top wash basin	1	22 June 2021	22 June 2021																							
22	Steel sink	1	14 June 2021	14 June 2021																							
23	Consultation room doors and CU room door (9 rooms)	1	05 July 2021	05 July 2021																							
24	Pateint bed in consultation room (front side)	1	22 June 2021	22 June 2021																							
25	Pateint bed in consultation room (rear side)	1	05 July 2021	05 July 2021																							
26	Counter top wash basin	1	22 June 2021	22 June 2021																							
27	Reception Table	1	22 June 2021	22 June 2021																							
28	Secretary Table	1	22 June 2021	22 June 2021																							

ID Task	Task Description	Task Duration (In days)	Start Date	End Date	08 June 2021	09 June 2021	10 June 2021	11 June 2021	12 June 2021	13 June 2021	14 June 2021	15 June 2021	16 June 2021	17 June 2021	18 June 2021	19 June 2021	20 June 2021	21 June 2021	22 June 2021	23 June 2021	24 June 2021	25 June 2021	26 June 2021	27 June 2021	28 June 2021	29 June 2021	30 June 2021	01 July 2021	02 July 2021	03 July 2021	04 July 2021	05 July 2021
1) Feasibility Check																																
1	Investor's Benefits	368	20 January 2020	22 January 2021																												
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2) Project Planning																																
1	Determing Local response Characteristics	2	03 February 2021	04 February 2021																												
2	Framing requirements	3	05 February 2021	07 February 2021																												
3	Rough Cost Estimation	2	08 February 2021	10 February 2021																												
4	Environmental clearance	28	11 February 2021	11 March 2021																												
3) Schematic design																																
1	Revise the old drawings	2	11 March 2021	12 March 2021																												
2	Frame the engineering considerations	1	12 March 2021	12 March 2021																												
3	Revision 1 - Freeze for approvals	2	13 March 2021	14 March 2021																												
4	Design revision as per the specific materials, equipments and areas to be altered	1	15 March 2021	15 March 2021																												
5	Finalise the Scheme Plan	1	17 March 2021	17 March 2021																												
4) Design Development and Design Detail																																
1	Authorized approvals	65	14 March 2021	15 May 2021																												
2	Material Specification	1	15 May 2021	15 May 2021																												
3	Shutdown works to be determined	1	17 May 2021	17 May 2021																												
4	Determine the emerging works	2	18 May 2021	18 May 2021																												
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5) Construction (Basement Floor)																																
1	Pre-shutdown works	1	21 May 2021	21 May 2021																												
2	Shutdown	1	22 May 2021	22 May 2021																												
3	Temporary Lighting Inside	1	22 May 2021	22 May 2021																												
4	Demolition	2	24 May 2021	25 May 2021																												
5	Scaffolding (Besides the walks to be demolished)	1	24 May 2021	24 May 2021																												
6	New wall construction	6	26 May 2021	31 May 2021																												
7	Formwork removal	1	31 May 2021	31 May 2021																												
8	Remove the existing tiles	1	31 May 2021	31 May 2021																												
9	Removing the tile debris	1	31 May 2021	31 May 2021																												

6.1.5.3 Parsn Manere, T.Nagar – Floor Wise Construction:

Table 6.6 Construction Phase – ‘A’ wing

S.No.	Activity Involved	Schedule	Labour Cost + Material Cost
1.	One day full shutdown – ‘A’ Wing (for painting the electrical room)	Before starting the panel board works	Rs.4000
2.	Bring the prefabricated panel boards to the site	On day 1 while painting the electrical room	Rs.1000
3.	Panel Board Rate for wing ‘A’		Rs.2,75,000
4.	Panel Board Fixing Shutdown from 2 nd to 7 th floor	First day of fixing the panel board	Rs.3000

Panel Board Cost for Electrical Room at ‘A’ wing:
Rs.25,000 per 8 meter boxes; Rs.25,000 x 11 = Rs.2,75,000



Fig 6.2 Panel Boards with 24-meter boxes

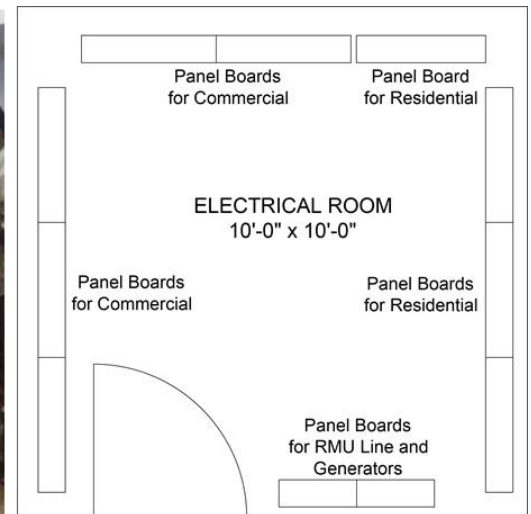


Fig 6.3 EB Room Floor Plan

S.No.	Activity Involved	Schedule	Labour Cost + Material Cost
5.	Panel Board Fixing – Shutdown 8 th and 9 th floors	2 nd phase of fixing the panel board	Rs.3000
6.	Panel board Fixing – Shutdown the Basement, Ground and 1 st Floor	3 rd phase of fixing the panel board	Rs.6000
7.	Panel board Fixing – Full shutdown for 1 day for RMU Line and generator	4 th phase of fixing the panel board	Rs.3000
8.	Prefabricated cable trays arrival at site	During the last phase of fixing the panel boards	Rs.5,800
9.	Creating wall mount for Distribution Board in every flat	While fixing panel board	Rs.4000
10.	Creating wall mount for Distribution Board in every shop	While fixing panel board	Rs.24,000
11.	Fixing the Distribution Board at 2 nd floor to 9 th floor	After fixing all the panel boards	Rs.9,76,000
12.	Fixing the Distribution Board at Ground floor	After fixing the panel boards	Rs.12,04,000

- Cable Trays Material Cost:
a) Rs.200 per sq.ft; Rs.200 x 24 = Rs.4,800
- Wall mount Details for Flats & Commercial Spaces (4 days)
a) 2 labours for 4 floors = Rs.1000 per labour (4 labours for 4 days)
Completing 8 floors in 4 days = 4 labours x 1000 = Rs.4000
b) 4 labours per floor = Rs.1000 per labour (12 labours for 2 days)
Completing 3 floors in 2 days (12x2=24) = 12 labours x 1000 = Rs.4000

S.No.	Activity Involved	Schedule	Labour Cost + Material Cost
13.	Fixing the Distribution Board at First floor	After fixing the DB in GF	Rs.12,04,000
14.	Fixing the Distribution Board at Basement	After fixing the DB in First Floor	Rs.6,04,000
15.	Plastic Cable Raceways Ground Floor to 3 rd Floor	After fixing the DB with MCB and ELCB	Rs.56,640
16.	Plastic Cable Raceways 4 th to 7 th floor	After fixing the cable raceway from GF to 3 rd floor	Rs.56,640
17.	Plastic Cable Raceways 8 th floor, 9 th floor and Basement	After fixing the cable raceway from 4 th to 7 th floor	Rs.42,480
TOTAL COST			Rs.44,72,560

- Plastic Cable Raceway cost details
 - a) Plastic Cables Raceway per floor = Rs.12,160
8 labours for 4 floors (1 day) = Rs.8000
4 floors per day = Rs.8000 + (Rs.12,160 x 4 floors) = Rs.56,640
For GF to 7th Floor = Rs.56,640 x 2 = Rs.1,13,280
 - b) 3 floors per day = Rs.6000 + (Rs.12,160 x 3 floors) = Rs.42,480

Table 6.7 Total Cost for electrical Refurbishment

S.No.	Total Cost in 'A' WING	Total Cost in 'B' WING	Total Cost in 'C' WING	TOTAL COST FOR ELECTRICAL REFURBISHMENT
1.	Rs.44,72,560	Rs.44,72,560	Rs.44,72,560	Rs.1,34,17,680

Delay assumptions in Parsn Manere, T.Nagar:

- If the shop owners in ground floor are not accepting for shutdown on Thursdays and Fridays, the project is getting delayed by 20 days where the labour cost and material cost gets increased.
- If the shop owners in ground and first floor are not accepting shutdown and works on Mondays and Tuesdays. The project might get delayed by 6 months where the cost goes out of control.

- If the residential owners are not accepting for shutdown on certain days again the work might get delayed by 1 month where the cost is again a problem.

6.1.5.4 Parsn Manere – Project Timeline for Electrical room and Electrical Refurbishment:

Project Name	Duration	Start date	End Date
Parsn Manere, T.Nagar.	141	01 February 2021	22 June 2021

Parsn Manere – Project Timeline

ID Task	Task Description	Task Duration	Start Date	End Date	01 February 2021	02 February 2021	03 February 2021	04 February 2021	05 February 2021	06 February 2021	07 February 2021	08 February 2021	09 February 2021	10 February 2021	11 February 2021
1) Feasibility Check															
1	Investor's Benefits	30	01 February 2021	03 March 2021											
2	Labour's working Hours	1	04 March 2021	04 March 2021											
3	Material Management	1	05 March 2021	05 March 2021											
4	Transportation in and around the site	1	06 March 2021	06 March 2021											
5	Visual Reporting	1	08 March 2021	09 March 2021											
6	Standards and codes to be followed	1	10 March 2021	10 March 2021											
2) Project Planning															
1	Determine local response characteristics	2	11 March 2021	12 March 2021											
2	Framing requirements	1	13 March 2021	13 March 2021											
3	Cost Estimation	1	14 March 2021	14 March 2021											
4	Environmental Clearance	31	16 March 2021	16 April 2021											
3) Schematic Design															
1	Revise the old drawings	2	20 April 2021	21 April 2021											
2	Frame the engineering considerations	1	22 April 2021	22 April 2021											
3	Revision 1 - Freeze for approvals	3	23 April 2021	25 April 2021											
4	Design revision as per the specific materials, equipments and areas to be altered	1	26 April 2021	26 April 2021											
5	Finalise the Scheme Plan	1	27 April 2021	27 April 2021											
4) Design development and design detail															
1	Authorized approvals	30	26 April 2021	26 May 2021											
2	Material Specification	1	27 May 2021	27 May 2021											
3	Shutdown works to be determined	1	28 May 2021	28 May 2021											
4	Determine the emerging works	1	29 May 2021	29 May 2021											
5	Determine the Time Critical Design	1	30 May 2021	30 May 2021											
		112													
5) Construction															
1	One day full shutdown – 'A' Wing (for painting the electrical room)	1	07 June 2021	07 June 2021											
2	Bring the prefabricated panels to the site	1	07 June 2021	07 June 2021											
3	Panel Board Fixing Shutdown from 2nd to 7th floor	1	08 June 2021	08 June 2021											
4	Panel Board Fixing Shutdown 8th and 9th floors	1	09 June 2021	09 June 2021											
5	Panel board Fixing – Shutdown the Basement, Ground and 1st Floor	1	10 June 2021	10 June 2021											
6	Panel board Fixing – Full shutdown for 1 day for RMU Line and generator	1	11 June 2021	11 June 2021											
7	Prefabricated cable trays arrival at site	1	10 June 2021	10 June 2021											
8	Creating wall mount for distribution board in every flat	4	08 June 2021	11 June 2021											
9	Creating wall mount for distribution board in every shop	4	08 June 2021	11 June 2021											
10	Fixing the distribution board at 2nd floor to 9th floor	4	14 June 2021	17 June 2021											
11	Fixing the distribution board at ground floor	4	14 June 2021	17 June 2021											
12	Fixing the Distribution Board at First floor	1	15 June 2021	15 June 2021											
13	Fixing the Distribution Board at Basement	1	16 June 2021	16 June 2021											
14	Plastic cable raceways - Ground floor to 3rd floor	1	18 June 2021	18 June 2021											
15	Plastic Cable Raceways - 4th to 7th floor	1	21 June 2021	21 June 2021											
16	Plastic Cable Raceways 8th floor, 9th floor and Basement	1	22 June 2021	22 June 2021											

ID Task	Task Description	Task Duration	Start Date	End Date	12 February 2021	13 February 2021	14 February 2021	15 February 2021	16 February 2021	17 February 2021	18 February 2021	19 February 2021	20 February 2021	21 February 2021	22 February 2021	23 February 2021	24 February 2021	25 February 2021	26 February 2021	27 February 2021	28 February 2021	01 March 2021	02 March 2021	03 March 2021	04 March 2021	05 March 2021
1) Feasibility Check																										
1	Investor's Benefits	30	01 February 2021	03 March 2021																						
2	Labour's working Hours	1	04 March 2021	04 March 2021																						
3	Material Management	1	05 March 2021	05 March 2021																						
4	Transportation in and around the site	1	06 March 2021	06 March 2021																						
5	Visual Reporting	1	08 March 2021	09 March 2021																						
6	Standards and codes to be followed	1	10 March 2021	10 March 2021																						
2) Project Planning																										
1	Determine local response characteristics	2	11 March 2021	12 March 2021																						
2	Framing requirements	1	13 March 2021	13 March 2021																						
3	Cost Estimation	1	14 March 2021	14 March 2021																						
4	Environmental Clearance	31	16 March 2021	16 April 2021																						
3) Schematic Design																										
1	Revise the old drawings	2	20 April 2021	21 April 2021																						
2	Frame the engineering considerations	1	22 April 2021	22 April 2021																						
3	Revision 1 - Freeze for approvals	3	23 April 2021	25 April 2021																						
4	Design revision as per the specific materials, equipments and areas to be altered	1	26 April 2021	26 April 2021																						
5	Finalise the Scheme Plan	1	27 April 2021	27 April 2021																						
4) Design development and design detail																										
1	Authorized approvals	30	26 April 2021	26 May 2021																						
2	Material Specification	1	27 May 2021	27 May 2021																						
3	Shutdown works to be determined	1	28 May 2021	28 May 2021																						
4	Determine the emerging works	1	29 May 2021	29 May 2021																						
5	Determine the Time Critical Design	1	30 May 2021	30 May 2021																						
5) Construction																										
1	One day full shutdown – 'A' Wing (for painting the electrical room)	1	07 June 2021	07 June 2021																						
2	Bring the prefabricated panels to the site	1	07 June 2021	07 June 2021																						
3	Panel Board Fixing Shutdown from 2nd to 7th floor	1	08 June 2021	08 June 2021																						
4	Panel Board Fixing Shutdown 8th and 9th floors	1	09 June 2021	09 June 2021																						
5	Panel board Fixing – Shutdown the Basement, Ground and 1st Floor	1	10 June 2021	10 June 2021																						
6	Panel board Fixing – Full shutdown for 1 day for RMU Line and generator	1	11 June 2021	11 June 2021																						
7	Prefabricated cable trays arrival at site	1	10 June 2021	10 June 2021																						
8	Creating wall mount for distribution board in every flat	4	08 June 2021	11 June 2021																						
9	Creating wall mount for distribution board in every shop	4	08 June 2021	11 June 2021																						
10	Fixing the distribution board at 2nd floor to 9th floor	4	14 June 2021	17 June 2021																						
11	Fixing the distribution board at ground floor	4	14 June 2021	17 June 2021																						
12	Fixing the Distribution Board at First floor	1	15 June 2021	15 June 2021																						
13	Fixing the Distribution Board at Basement	1	16 June 2021	16 June 2021																						
14	Plastic cable raceways - Ground floor to 3rd floor	1	18 June 2021	18 June 2021																						
15	Plastic Cable Raceways - 4th to 7th floor	1	21 June 2021	21 June 2021																						
16	Plastic Cable Raceways 8th floor, 9th floor and Basement	1	22 June 2021	22 June 2021																						

ID Task	Task Description	Task Duration	Start Date	End Date	06 March 2021	07 March 2021	08 March 2021	09 March 2021	10 March 2021	11 March 2021	12 March 2021	13 March 2021	14 March 2021	15 March 2021	16 March 2021	17 March 2021	18 March 2021	19 March 2021	20 March 2021	21 March 2021	22 March 2021	23 March 2021	24 March 2021	25 March 2021	26 March 2021	27 March 2021		
1) Feasibility Check																												
1	Investor's Benefits	30	01 February 2021	03 March 2021																								
2	Labour's working Hours	1	04 March 2021	04 March 2021																								
3	Material Management	1	05 March 2021	05 March 2021																								
4	Transportation in and around the site	1	06 March 2021	06 March 2021																								
5	Visual Reporting	1	08 March 2021	09 March 2021																								
6	Standards and codes to be followed	1	10 March 2021	10 March 2021																								
2) Project Planning																												
1	Determine local response characteristics	2	11 March 2021	12 March 2021																								
2	Framing requirements	1	13 March 2021	13 March 2021																								
3	Cost Estimation	1	14 March 2021	14 March 2021																								
4	Environmental Clearance	31	16 March 2021	16 April 2021																								
3) Schematic Design																												
1	Revise the old drawings	2	20 April 2021	21 April 2021																								
2	Frame the engineering considerations	1	22 April 2021	22 April 2021																								
3	Revision 1 - Freeze for approvals	3	23 April 2021	25 April 2021																								
4	Design revision as per the specific materials, equipments and areas to be altered	1	26 April 2021	26 April 2021																								
5	Finalise the Scheme Plan	1	27 April 2021	27 April 2021																								
4) Design development and design detail																												
1	Authorized approvals	30	26 April 2021	26 May 2021																								
2	Material Specification	1	27 May 2021	27 May 2021																								
3	Shutdown works to be determined	1	28 May 2021	28 May 2021																								
4	Determine the emerging works	1	29 May 2021	29 May 2021																								
5	Determine the Time Critical Design	1	30 May 2021	30 May 2021																								
5) Construction																												
1	One day full shutdown – 'A' Wing (for painting the electrical room)	1	07 June 2021	07 June 2021																								
2	Bring the prefabricated panels to the site	1	07 June 2021	07 June 2021																								
3	Panel Board Fixing Shutdown from 2nd to 7th floor	1	08 June 2021	08 June 2021																								
4	Panel Board Fixing Shutdown 8th and 9th floors	1	09 June 2021	09 June 2021																								
5	Panel board Fixing – Shutdown the Basement, Ground and 1st Floor	1	10 June 2021	10 June 2021																								
6	Panel board Fixing – Full shutdown for 1 day for RMU Line and generator	1	11 June 2021	11 June 2021																								
7	Prefabricated cable trays arrival at site	1	10 June 2021	10 June 2021																								
8	Creating wall mount for distribution board in every flat	4	08 June 2021	11 June 2021																								
9	Creating wall mount for distribution board in every shop	4	08 June 2021	11 June 2021																								
10	Fixing the distribution board at 2nd floor to 9th floor	4	14 June 2021	17 June 2021																								
11	Fixing the distribution board at ground floor	4	14 June 2021	17 June 2021																								
12	Fixing the Distribution Board at First floor	1	15 June 2021	15 June 2021																								
13	Fixing the Distribution Board at Basement	1	16 June 2021	16 June 2021																								
14	Plastic cable raceways - Ground floor to 3rd floor	1	18 June 2021	18 June 2021																								
15	Plastic Cable Raceways - 4th to 7th floor	1	21 June 2021	21 June 2021																								
16	Plastic Cable Raceways 8th floor, 9th floor and Basement	1	22 June 2021	22 June 2021																								

ID Task	Task Description	Task Duration	Start Date	End Date	28 March 2021	29 March 2021	30 March 2021	31 March 2021	01 April 2021	02 April 2021	03 April 2021	04 April 2021	05 April 2021	06 April 2021	07 April 2021	08 April 2021	09 April 2021	10 April 2021	11 April 2021	12 April 2021	13 April 2021	14 April 2021	15 April 2021	16 April 2021	17 April 2021	18 April 2021
1) Feasibility Check																										
1	Investor's Benefits	30	01 February 2021	03 March 2021																						
2	Labour's working Hours	1	04 March 2021	04 March 2021																						
3	Material Management	1	05 March 2021	05 March 2021																						
4	Transportation in and around the site	1	06 March 2021	06 March 2021																						
5	Visual Reporting	1	08 March 2021	09 March 2021																						
6	Standards and codes to be followed	1	10 March 2021	10 March 2021																						
2) Project Planning																										
1	Determine local response characteristics	2	11 March 2021	12 March 2021																						
2	Framing requirements	1	13 March 2021	13 March 2021																						
3	Cost Estimation	1	14 March 2021	14 March 2021																						
4	Environmental Clearance	31	16 March 2021	16 April 2021																						
3) Schematic Design																										
1	Revise the old drawings	2	20 April 2021	21 April 2021																						
2	Frame the engineering considerations	1	22 April 2021	22 April 2021																						
3	Revision 1 - Freeze for approvals	3	23 April 2021	25 April 2021																						
4	Design revision as per the specific materials, equipments and areas to be altered	1	26 April 2021	26 April 2021																						
5	Finalise the Scheme Plan	1	27 April 2021	27 April 2021																						
4) Design development and design detail																										
1	Authorized approvals	30	26 April 2021	26 May 2021																						
2	Material Specification	1	27 May 2021	27 May 2021																						
3	Shutdown works to be determined	1	28 May 2021	28 May 2021																						
4	Determine the emerging works	1	29 May 2021	29 May 2021																						
5	Determine the Time Critical Design	1	30 May 2021	30 May 2021																						
5) Construction																										
1	One day full shutdown – 'A' Wing (for painting the electrical room)	1	07 June 2021	07 June 2021																						
2	Bring the prefabricated panels to the site	1	07 June 2021	07 June 2021																						
3	Panel Board Fixing Shutdown from 2nd to 7th floor	1	08 June 2021	08 June 2021																						
4	Panel Board Fixing Shutdown 8th and 9th floors	1	09 June 2021	09 June 2021																						
5	Panel board Fixing – Shutdown the Basement, Ground and 1st Floor	1	10 June 2021	10 June 2021																						
6	Panel board Fixing – Full shutdown for 1 day for RMU Line and generator	1	11 June 2021	11 June 2021																						
7	Prefabricated cable trays arrival at site	1	10 June 2021	10 June 2021																						
8	Creating wall mount for distribution board in every flat	4	08 June 2021	11 June 2021																						
9	Creating wall mount for distribution board in every shop	4	08 June 2021	11 June 2021																						
10	Fixing the distribution board at 2nd floor to 9th floor	4	14 June 2021	17 June 2021																						
11	Fixing the distribution board at ground floor	4	14 June 2021	17 June 2021																						
12	Fixing the Distribution Board at First floor	1	15 June 2021	15 June 2021																						
13	Fixing the Distribution Board at Basement	1	16 June 2021	16 June 2021																						
14	Plastic cable raceways - Ground floor to 3rd floor	1	18 June 2021	18 June 2021																						
15	Plastic Cable Raceways - 4th to 7th floor	1	21 June 2021	21 June 2021																						
16	Plastic Cable Raceways 8th floor, 9th floor and Basement	1	22 June 2021	22 June 2021																						

ID Task	Task Description	Task Duration	Start Date	End Date	19 April 2021	20 April 2021	21 April 2021	22 April 2021	23 April 2021	24 April 2021	25 April 2021	26 April 2021	27 April 2021	28 April 2021	29 April 2021	30 April 2021	01 May 2021	02 May 2021	03 May 2021	04 May 2021	05 May 2021	06 May 2021	07 May 2021	08 May 2021	09 May 2021	10 May 2021
1) Feasibility Check																										
1	Investor's Benefits	30	01 February 2021	03 March 2021																						
2	Labour's working Hours	1	04 March 2021	04 March 2021																						
3	Material Management	1	05 March 2021	05 March 2021																						
4	Transportation in and around the site	1	06 March 2021	06 March 2021																						
5	Visual Reporting	1	08 March 2021	09 March 2021																						
6	Standards and codes to be followed	1	10 March 2021	10 March 2021																						
2) Project Planning																										
1	Determine local response characteristics	2	11 March 2021	12 March 2021																						
2	Framing requirements	1	13 March 2021	13 March 2021																						
3	Cost Estimation	1	14 March 2021	14 March 2021																						
4	Environmental Clearance	31	16 March 2021	16 April 2021																						
3) Schematic Design																										
1	Revise the old drawings	2	20 April 2021	21 April 2021																						
2	Frame the engineering considerations	1	22 April 2021	22 April 2021																						
3	Revision 1 - Freeze for approvals	3	23 April 2021	25 April 2021																						
4	Design revision as per the specific materials, equipments and areas to be altered	1	26 April 2021	26 April 2021																						
5	Finalise the Scheme Plan	1	27 April 2021	27 April 2021																						
4) Design development and design detail																										
1	Authorized approvals	30	26 April 2021	26 May 2021																						
2	Material Specification	1	27 May 2021	27 May 2021																						
3	Shutdown works to be determined	1	28 May 2021	28 May 2021																						
4	Determine the emerging works	1	29 May 2021	29 May 2021																						
5	Determine the Time Critical Design	1	30 May 2021	30 May 2021																						
5) Construction																										
1	One day full shutdown – 'A' Wing (for painting the electrical room)	1	07 June 2021	07 June 2021																						
2	Bring the prefabricated panels to the site	1	07 June 2021	07 June 2021																						
3	Panel Board Fixing Shutdown from 2nd to 7th floor	1	08 June 2021	08 June 2021																						
4	Panel Board Fixing Shutdown 8th and 9th floors	1	09 June 2021	09 June 2021																						
5	Panel board Fixing – Shutdown the Basement, Ground and 1st Floor	1	10 June 2021	10 June 2021																						
6	Panel board Fixing – Full shutdown for 1 day for RMU Line and generator	1	11 June 2021	11 June 2021																						
7	Prefabricated cable trays arrival at site	1	10 June 2021	10 June 2021																						
8	Creating wall mount for distribution board in every flat	4	08 June 2021	11 June 2021																						
9	Creating wall mount for distribution board in every shop	4	08 June 2021	11 June 2021																						
10	Fixing the distribution board at 2nd floor to 9th floor	4	14 June 2021	17 June 2021																						
11	Fixing the distribution board at ground floor	4	14 June 2021	17 June 2021																						
12	Fixing the Distribution Board at First floor	1	15 June 2021	15 June 2021																						
13	Fixing the Distribution Board at Basement	1	16 June 2021	16 June 2021																						
14	Plastic cable raceways - Ground floor to 3rd floor	1	18 June 2021	18 June 2021																						
15	Plastic Cable Raceways - 4th to 7th floor	1	21 June 2021	21 June 2021																						
16	Plastic Cable Raceways 8th floor, 9th floor and Basement	1	22 June 2021	22 June 2021																						

ID Task	Task Description	Task Duration	Start Date	End Date	11 May 2021	12 May 2021	13 May 2021	14 May 2021	15 May 2021	16 May 2021	17 May 2021	18 May 2021	19 May 2021	20 May 2021	21 May 2021	22 May 2021	23 May 2021	24 May 2021	25 May 2021	26 May 2021	27 May 2021	28 May 2021	29 May 2021	30 May 2021	31 May 2021	01 June 2021
1) Feasibility Check																										
1	Investor's Benefits	30	01 February 2021	03 March 2021																						
2	Labour's working Hours	1	04 March 2021	04 March 2021																						
3	Material Management	1	05 March 2021	05 March 2021																						
4	Transportation in and around the site	1	06 March 2021	06 March 2021																						
5	Visual Reporting	1	08 March 2021	09 March 2021																						
6	Standards and codes to be followed	1	10 March 2021	10 March 2021																						
2) Project Planning																										
1	Determine local response characteristics	2	11 March 2021	12 March 2021																						
2	Framing requirements	1	13 March 2021	13 March 2021																						
3	Cost Estimation	1	14 March 2021	14 March 2021																						
4	Environmental Clearance	31	16 March 2021	16 April 2021																						
3) Schematic Design																										
1	Revise the old drawings	2	20 April 2021	21 April 2021																						
2	Frame the engineering considerations	1	22 April 2021	22 April 2021																						
3	Revision 1 - Freeze for approvals	3	23 April 2021	25 April 2021																						
4	Design revision as per the specific materials, equipments and areas to be altered	1	26 April 2021	26 April 2021																						
5	Finalise the Scheme Plan	1	27 April 2021	27 April 2021																						
4) Design development and design detail																										
1	Authorized approvals	30	26 April 2021	26 May 2021																						
2	Material Specification	1	27 May 2021	27 May 2021																						
3	Shutdown works to be determined	1	28 May 2021	28 May 2021																						
4	Determine the emerging works	1	29 May 2021	29 May 2021																						
5	Determine the Time Critical Design	1	30 May 2021	30 May 2021																						
5) Construction																										
1	One day full shutdown – 'A' Wing (for painting the electrical room)	1	07 June 2021	07 June 2021																						
2	Bring the prefabricated panels to the site	1	07 June 2021	07 June 2021																						
3	Panel Board Fixing Shutdown from 2nd to 7th floor	1	08 June 2021	08 June 2021																						
4	Panel Board Fixing Shutdown 8th and 9th floors	1	09 June 2021	09 June 2021																						
5	Panel board Fixing – Shutdown the Basement, Ground and 1st Floor	1	10 June 2021	10 June 2021																						
6	Panel board Fixing – Full shutdown for 1 day for RMU Line and generator	1	11 June 2021	11 June 2021																						
7	Prefabricated cable trays arrival at site	1	10 June 2021	10 June 2021																						
8	Creating wall mount for distribution board in every flat	4	08 June 2021	11 June 2021																						
9	Creating wall mount for distribution board in every shop	4	08 June 2021	11 June 2021																						
10	Fixing the distribution board at 2nd floor to 9th floor	4	14 June 2021	17 June 2021																						
11	Fixing the distribution board at ground floor	4	14 June 2021	17 June 2021																						
12	Fixing the Distribution Board at First floor	1	15 June 2021	15 June 2021																						
13	Fixing the Distribution Board at Basement	1	16 June 2021	16 June 2021																						
14	Plastic cable raceways - Ground floor to 3rd floor	1	18 June 2021	18 June 2021																						
15	Plastic Cable Raceways - 4th to 7th floor	1	21 June 2021	21 June 2021																						
16	Plastic Cable Raceways 8th floor, 9th floor and Basement	1	22 June 2021	22 June 2021																						

ID Task	Task Description	Task Duration	Start Date	End Date	02 June 2021	03 June 2021	04 June 2021	05 June 2021	06 June 2021	07 June 2021	08 June 2021	09 June 2021	10 June 2021	11 June 2021	12 June 2021	13 June 2021	14 June 2021	15 June 2021	16 June 2021	17 June 2021	18 June 2021	19 June 2021	20 June 2021	21 June 2021	22 June 2021
1) Feasibility Check																									
1	Investor's Benefits	30	01 February 2021	03 March 2021																					
2	Labour's working Hours	1	04 March 2021	04 March 2021																					
3	Material Management	1	05 March 2021	05 March 2021																					
4	Transportation in and around the site	1	06 March 2021	06 March 2021																					
5	Visual Reporting	1	08 March 2021	09 March 2021																					
6	Standards and codes to be followed	1	10 March 2021	10 March 2021																					
2) Project Planning																									
1	Determine local response characteristics	2	11 March 2021	12 March 2021																					
2	Framing requirements	1	13 March 2021	13 March 2021																					
3	Cost Estimation	1	14 March 2021	14 March 2021																					
4	Environmental Clearance	31	16 March 2021	16 April 2021																					
3) Schematic Design																									
1	Revise the old drawings	2	20 April 2021	21 April 2021																					
2	Frame the engineering considerations	1	22 April 2021	22 April 2021																					
3	Revision 1 - Freeze for approvals	3	23 April 2021	25 April 2021																					
4	Design revision as per the specific materials, equipments and areas to be altered	1	26 April 2021	26 April 2021																					
5	Finalise the Scheme Plan	1	27 April 2021	27 April 2021																					
4) Design development and design detail																									
1	Authorized approvals	30	26 April 2021	26 May 2021																					
2	Material Specification	1	27 May 2021	27 May 2021																					
3	Shutdown works to be determined	1	28 May 2021	28 May 2021																					
4	Determine the emerging works	1	29 May 2021	29 May 2021																					
5	Determine the Time Critical Design	1	30 May 2021	30 May 2021																					
5) Construction		28																							
1	One day full shutdown – 'A' Wing (for painting the electrical room)	1	07 June 2021	07 June 2021																					
2	Bring the prefabricated panels to the site	1	07 June 2021	07 June 2021																					
3	Panel Board Fixing Shutdown from 2nd to 7th floor	1	08 June 2021	08 June 2021																					
4	Panel Board Fixing Shutdown 8th and 9th floors	1	09 June 2021	09 June 2021																					
5	Panel board Fixing – Shutdown the Basement, Ground and 1st Floor	1	10 June 2021	10 June 2021																					
6	Panel board Fixing – Full shutdown for 1 day for RMU Line and generator	1	11 June 2021	11 June 2021																					
7	Prefabricated cable trays arrival at site	1	10 June 2021	10 June 2021																					
8	Creating wall mount for distribution board in every flat	4	08 June 2021	11 June 2021																					
9	Creating wall mount for distribution board in every shop	4	08 June 2021	11 June 2021																					
10	Fixing the distribution board at 2nd floor to 9th floor	4	14 June 2021	17 June 2021																					
11	Fixing the distribution board at ground floor	4	14 June 2021	17 June 2021																					
12	Fixing the Distribution Board at First floor	1	15 June 2021	15 June 2021																					
13	Fixing the Distribution Board at Basement	1	16 June 2021	16 June 2021																					
14	Plastic cable raceways - Ground floor to 3rd floor	1	18 June 2021	18 June 2021																					
15	Plastic Cable Raceways - 4th to 7th floor	1	21 June 2021	21 June 2021																					
16	Plastic Cable Raceways 8th floor, 9th floor and Basement	1	22 June 2021	22 June 2021																					

Delay assumption in Parsn Manere, T.Nagar:

Project Name	Duration	Start date	End Date
Delay assumptions in Parsn Manere, T.Nagar.	161	01 February 2021	12 July 2021

ID Task	Task Description	Task Duration	Start Date	End Date	01 February 2021	02 February 2021	03 February 2021	04 February 2021	05 February 2021	06 February 2021	07 February 2021	08 February 2021	09 February 2021	10 February 2021	11 February 2021	12 February 2021	13 February 2021	14 February 2021	15 February 2021	16 February 2021	17 February 2021	18 February 2021	19 February 2021	20 February 2021	21 February 2021	22 February 2021	23 February 2021	24 February 2021	25 February 2021	26 February 2021	27 February 2021
1) Feasibility Check																															
1	Investor's Benefits	30	01 February 2021	03 March 2021																											
2	Labour's working Hours	1	04 March 2021	04 March 2021																											
3	Material Management	1	05 March 2021	05 March 2021																											
4	Transportation in and around the site	1	06 March 2021	06 March 2021																											
5	Visual Reporting	1	08 March 2021	09 March 2021																											
6	Standards and codes to be followed	1	10 March 2021	10 March 2021																											
2) Project Planning																															
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3	Cost Estimation	1	14 March 2021	14 March 2021																											
4	Environmental Clearance	31	16 March 2021	16 April 2021																											
3) Schematic Design																															
1	Revise the old drawings	2	20 April 2021	21 April 2021																											
2	Frame the engineering considerations	1	22 April 2021	22 April 2021																											
3	Revision 1 - Freeze for approvals	3	23 April 2021	25 April 2021																											
4	Design revision as per the specific materials, equipments and areas to be altered	1	26 April 2021	26 April 2021																											
5	Finalise the Scheme Plan	1	27 April 2021	27 April 2021																											
4) Design development and design detail																															
1	Authorized approvals	30	26 April 2021	26 May 2021																											
2	Material Specification	1	27 May 2021	27 May 2021																											
3	Shutdown works to be determined	1	28 May 2021	28 May 2021																											
4	Determine the emerging works	1	29 May 2021	29 May 2021																											
5	Determine the Time Critical Design	1	30 May 2021	30 May 2021																											
5) Construction																															
1	One day full shutdown - 'A' Wing (for installation of electrical room)	1	07 June 2021	07 June 2021																											
2	Bring the prefabricated panels to the site	1	07 June 2021	07 June 2021																											
3	Panel Board Fixing Shutdown from 2nd to 7th floor	1	08 June 2021	08 June 2021																											
4	Panel Board Fixing Shutdown 8th and 9th floor	1	09 June 2021	09 June 2021																											
DELAYED WORKS																															
5	Panel board Fixing - Shutdown the Basement, Ground and 1st floor	1	10 June 2021	10 June 2021																											
6	Panel board Fixing - Full shutdown for 1 day for RMU Line and generator	1	11 June 2021	11 June 2021																											
7	Prefabricated cable trays arrival at site	1	10 June 2021	10 June 2021																											
8	Creating wall mount for distribution board in every flat	4	08 June 2021	11 June 2021																											
9	Creating wall mount for distribution board in every shop	4	08 June 2021	11 June 2021																											
10	DELAY DUE TO SHOPOWNERS NOT ACCEPTING FOR SHUTDOWN ON THURSDAY AND FRIDAY (GROUND FLOOR)		10 June 2021	13 June 2021																											
11	Panel board Fixing - Shutdown the Basement, Ground and 1st floor	1	14 June 2021	14 June 2021																											
12	Panel board Fixing - Full shutdown for 1 day for RMU Line and generator	1	15 June 2021	15 June 2021																											
13	Prefabricated cable trays arrival at site	1	14 June 2021	14 June 2021																											
14	Creating wall mount for distribution board in every flat	4	14 June 2021	21 June 2021																											
15	Creating wall mount for distribution board in every shop	4	14 June 2021	21 June 2021																											
16	Fixing the distribution board at 2nd floor to 9th floor	4	22 June 2021	29 June 2021																											
17	Fixing the distribution board at ground floor	4	22 June 2021	29 June 2021																											
18	Fixing the Distribution Board at First floor	1	30 June 2021	30 June 2021																											
19	Fixing the Distribution Board at Basement	1	05 July 2021	05 July 2021																											
20	Plastic cable raceways - Ground floor to 3rd floor	1	06 July 2021	06 July 2021																											
21	Plastic Cable Raceways - 4th to 7th floor	1	07 July 2021	07 July 2021																											
22	Plastic Cable Raceways 8th floor, 9th floor and Basement	1	12 July 2021	12 July 2021																											
13	Replace the sprinklers in common areas from basement till 8th floor.	2	12 July 2021	13 July 2021																											
14	Smoothen the ramp handrails in the rear side	1	06 July 2021	06 July 2021																											

ID Task	Task Description	Task Duration	Start Date	End Date	28 February 2021	01 March 2021	02 March 2021	03 March 2021	04 March 2021	05 March 2021	06 March 2021	07 March 2021	08 March 2021	09 March 2021	10 March 2021	11 March 2021	12 March 2021	13 March 2021	14 March 2021	15 March 2021	16 March 2021	17 March 2021	18 March 2021	19 March 2021	20 March 2021	21 March 2021	22 March 2021	23 March 2021	24 March 2021	25 March 2021	26 March 2021
1) Feasibility Check																															
1	Investor's Benefits	30	01 February 2021	03 March 2021																											
2	Labour's working Hours	1	04 March 2021	04 March 2021																											
3	Material Management	1	05 March 2021	05 March 2021																											
4	Transportation in and around the site	1	06 March 2021	06 March 2021																											
5	Visual Reporting	1	08 March 2021	09 March 2021																											
6	Standards and codes to be followed	1	10 March 2021	10 March 2021																											
2) Project Planning																															
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3	Cost Estimation	1	14 March 2021	14 March 2021																											
4	Environmental Clearance	31	16 March 2021	16 April 2021																											
3) Schematic Design																															
1	Revise the old drawings	2	20 April 2021	21 April 2021																											
2	Frame the engineering considerations	1	22 April 2021	22 April 2021																											
3	Revision 1 - Freeze for approvals	3	23 April 2021	25 April 2021																											
4	Design revision as per the specific materials, equipments and areas to be altered	1	26 April 2021	26 April 2021																											
5	Finalise the Scheme Plan	1	27 April 2021	27 April 2021																											
4) Design development and design detail																															
1	Authorized approvals	30	26 April 2021	26 May 2021																											
2	Material Specification	1	27 May 2021	27 May 2021																											
3	Shutdown works to be determined	1	28 May 2021	28 May 2021																											
4	Determine the emerging works	1	29 May 2021	29 May 2021																											
5	Determine the Time Critical Design	1	30 May 2021	30 May 2021																											
5) Construction																															
1	One day full shutdown – 'A' Wing (for maintenance the electrical room)	1	07 June 2021	07 June 2021																											
2	Bring the prefabricated panels to the site	1	07 June 2021	07 June 2021																											
3	Panel Board Fixing Shutdown from 2nd to 7th floor	1	08 June 2021	08 June 2021																											
4	Panel Board Fixing Shutdown 8th and 9th floor	1	09 June 2021	09 June 2021																											
DELAYED WORKS																															
5	Panel board Fixing – Shutdown the Basement, Ground and 1st floor	1	10 June 2021	10 June 2021																											
6	Panel board Fixing – Full shutdown for 1 day for RMU Line and generator	1	11 June 2021	11 June 2021																											
7	Prefabricated cable trays arrival at site	1	10 June 2021	10 June 2021																											
8	Creating wall mount for distribution board in every flat	4	08 June 2021	11 June 2021																											
9	Creating wall mount for distribution board in every shop	4	08 June 2021	11 June 2021																											
10	DELAY DUE TO SHOPOWNERS NOT ACCEPTING FOR SHUTDOWN ON THURSDAY AND FRIDAY (GROUND FLOOR)		10 June 2021	13 June 2021																											
11	Panel board Fixing – Shutdown the Basement, Ground and 1st floor	1	14 June 2021	14 June 2021																											
12	Panel board Fixing – Full shutdown for 1 day for RMU Line and generator	1	15 June 2021	15 June 2021																											
13	Prefabricated cable trays arrival at site	1	14 June 2021	14 June 2021																											
14	Creating wall mount for distribution board in every flat	4	14 June 2021	21 June 2021																											
15	Creating wall mount for distribution board in every shop	4	14 June 2021	21 June 2021																											
16	Fixing the distribution board at 2nd floor to 9th floor	4	22 June 2021	29 June 2021																											
17	Fixing the distribution board at ground floor	4	22 June 2021	29 June 2021																											
18	Fixing the Distribution Board at First floor	1	30 June 2021	30 June 2021																											
19	Fixing the Distribution Board at Basement	1	05 July 2021	05 July 2021																											
20	Plastic cable raceways - Ground floor to 3rd floor	1	06 July 2021	06 July 2021																											
21	Plastic Cable Raceways - 4th to 7th floor	1	07 July 2021	07 July 2021																											
22	Plastic Cable Raceways 8th floor, 9th floor and Basement	1	12 July 2021	12 July 2021																											
13	Replace the sprinklers in common areas from basement till 8th floor.	2	12 July 2021	13 July 2021																											
14	Smoothen the ramp handrails in the rear side	1	06 July 2021	06 July 2021																											

ID Task	Task Description	Task Duration	Start Date	End Date	27 March 2021	28 March 2021	29 March 2021	30 March 2021	31 March 2021	01 April 2021	02 April 2021	03 April 2021	04 April 2021	05 April 2021	06 April 2021	07 April 2021	08 April 2021	09 April 2021	10 April 2021	11 April 2021	12 April 2021	13 April 2021	14 April 2021	15 April 2021	16 April 2021	17 April 2021	18 April 2021	19 April 2021	20 April 2021	21 April 2021	22 April 2021
1) Feasibility Check																															
1	Investor's Benefits	30	01 February 2021	03 March 2021																											
2	Labour's working Hours	1	04 March 2021	04 March 2021																											
3	Material Management	1	05 March 2021	05 March 2021																											
4	Transportation in and around the site	1	06 March 2021	06 March 2021																											
5	Visual Reporting	1	08 March 2021	09 March 2021																											
6	Standards and codes to be followed	1	10 March 2021	10 March 2021																											
2) Project Planning																															
1	Determine local response characteristics	2	11 March 2021	12 March 2021																											
2	Framing requirements	1	13 March 2021	13 March 2021																											
3	Cost Estimation	1	14 March 2021	14 March 2021																											
4	Environmental Clearance	31	16 March 2021	16 April 2021																											
3) Schematic Design																															
1	Revise the old drawings	2	20 April 2021	21 April 2021																											
2	Frame the engineering considerations	1	22 April 2021	22 April 2021																											
3	Revision 1 - Freeze for approvals	3	23 April 2021	25 April 2021																											
4	Design revision as per the specific materials, equipments and areas to be altered	1	26 April 2021	26 April 2021																											
5	Finalise the Scheme Plan	1	27 April 2021	27 April 2021																											
4) Design development and design detail																															
1	Authorized approvals	30	26 April 2021	26 May 2021																											
2	Material Specification	1	27 May 2021	27 May 2021																											
3	Shutdown works to be determined	1	28 May 2021	28 May 2021																											
4	Determine the emerging works	1	29 May 2021	29 May 2021																											
5	Determine the Time Critical Design	1	30 May 2021	30 May 2021																											
5) Construction																															
1	One day full shutdown - 'A' Wing (for isolation the electrical room)	1	07 June 2021	07 June 2021																											
2	Bring the prefabricated panels to the site	1	07 June 2021	07 June 2021																											
3	Panel Board Fixing Shutdown from 2nd to 3rd floor	1	08 June 2021	08 June 2021																											
4	Panel Board Fixing Shutdown 8th and 9th floor	1	09 June 2021	09 June 2021																											
DELAYED WORKS																															
5	Panel board Fixing - Shutdown the Basement, Ground and 1st Floor	1	10 June 2021	10 June 2021																											
6	Panel board Fixing - Full shutdown for 1 day for RMU Line and generator	1	11 June 2021	11 June 2021																											
7	Prefabricated cable trays arrival at site	1	10 June 2021	10 June 2021																											
8	Creating wall mount for distribution board in every flat	4	08 June 2021	11 June 2021																											
9	Creating wall mount for distribution board in every shop	4	08 June 2021	11 June 2021																											
10	DELAY DUE TO SHOPOWNERS NOT ACCEPTING FOR SHUTDOWN ON THURSDAY AND FRIDAY (GROUND FLOOR)		10 June 2021	13 June 2021																											
11	Panel board Fixing - Shutdown the Basement, Ground and 1st Floor	1	14 June 2021	14 June 2021																											
12	Panel board Fixing - Full shutdown for 1 day for RMU Line and generator	1	15 June 2021	15 June 2021																											
13	Prefabricated cable trays arrival at site	1	14 June 2021	14 June 2021																											
14	Creating wall mount for distribution board in every flat	4	14 June 2021	21 June 2021																											
15	Creating wall mount for distribution board in every shop	4	14 June 2021	21 June 2021																											
16	Fixing the distribution board at 2nd floor to 9th floor	4	22 June 2021	29 June 2021																											
17	Fixing the distribution board at ground floor	4	22 June 2021	29 June 2021																											
18	Fixing the Distribution Board at First floor	1	30 June 2021	30 June 2021																											
19	Fixing the Distribution Board at Basement	1	05 July 2021	05 July 2021																											
20	Plastic cable raceways - Ground floor to 3rd floor	1	06 July 2021	06 July 2021																											
21	Plastic Cable Raceways - 4th to 7th floor	1	07 July 2021	07 July 2021																											
22	Plastic Cable Raceways 8th floor, 9th floor and Basement	1	12 July 2021	12 July 2021																											
13	Replace the sprinklers in common areas from basement till 8th floor.	2	12 July 2021	13 July 2021																											
14	Smoothen the ramp handrails in the rear side	1	06 July 2021	06 July 2021																											

ID Task	Task Description	Task Duration	Start Date	End Date	23 April 2021	24 April 2021	25 April 2021	26 April 2021	27 April 2021	28 April 2021	29 April 2021	30 April 2021	01 May 2021	02 May 2021	03 May 2021	04 May 2021	05 May 2021	06 May 2021	07 May 2021	08 May 2021	09 May 2021	10 May 2021	11 May 2021	12 May 2021	13 May 2021	14 May 2021	15 May 2021	16 May 2021	17 May 2021	18 May 2021	19 May 2021
1) Feasibility Check																															
1	Investor's Benefits	30	01 February 2021	03 March 2021																											
2	Labour's working Hours	1	04 March 2021	04 March 2021																											
3	Material Management	1	05 March 2021	05 March 2021																											
4	Transportation in and around the site	1	06 March 2021	06 March 2021																											
5	Visual Reporting	1	08 March 2021	09 March 2021																											
6	Standards and codes to be followed	1	10 March 2021	10 March 2021																											
2) Project Planning																															
1	Determine local response characteristics	2	11 March 2021	12 March 2021																											
2	Framing requirements	1	13 March 2021	13 March 2021																											
3	Cost Estimation	1	14 March 2021	14 March 2021																											
4	Environmental Clearance	31	16 March 2021	16 April 2021																											
3) Schematic Design																															
1	Revise the old drawings	2	20 April 2021	21 April 2021																											
2	Frame the engineering considerations	1	22 April 2021	22 April 2021																											
3	Revision 1 - Freeze for approvals	3	23 April 2021	25 April 2021																											
4	Design revision as per the specific materials, equipments and areas to be altered	1	26 April 2021	26 April 2021																											
5	Finalise the Scheme Plan	1	27 April 2021	27 April 2021																											
4) Design development and design detail																															
1	Authorized approvals	30	26 April 2021	26 May 2021																											
2	Material Specification	1	27 May 2021	27 May 2021																											
3	Shutdown works to be determined	1	28 May 2021	28 May 2021																											
4	Determine the emerging works	1	29 May 2021	29 May 2021																											
5	Determine the Time Critical Design	1	30 May 2021	30 May 2021																											
5) Construction																															
1	One day full shutdown – 'A' Wing (for activities the electrical room)	1	07 June 2021	07 June 2021																											
2	Bring the prefabricated panels to the site	1	07 June 2021	07 June 2021																											
3	Panel Board Fixing Shutdown from 2nd to 7th floor	1	08 June 2021	08 June 2021																											
4	Panel Board Fixing Shutdown 8th and 9th floor	1	09 June 2021	09 June 2021																											
DELAYED WORKS																															
5	Panel board Fixing – Shutdown the Basement, Ground and 1st Floor	1	10 June 2021	10 June 2021																											
6	Panel board Fixing – Full shutdown for 1 day for RMU Line and generator	1	11 June 2021	11 June 2021																											
7	Prefabricated cable trays arrival at site	1	10 June 2021	10 June 2021																											
8	Creating wall mount for distribution board in every flat	4	08 June 2021	11 June 2021																											
9	Creating wall mount for distribution board in every shop	4	08 June 2021	11 June 2021																											
10	DELAY DUE TO SHOPOWNERS NOT ACCEPTING FOR SHUTDOWN ON THURSDAY AND FRIDAY (GROUND FLOOR)		10 June 2021	13 June 2021																											
11	Panel board Fixing – Shutdown the Basement, Ground and 1st Floor	1	14 June 2021	14 June 2021																											
12	Panel board Fixing – Full shutdown for 1 day for RMU Line and generator	1	15 June 2021	15 June 2021																											
13	Prefabricated cable trays arrival at site	1	14 June 2021	14 June 2021																											
14	Creating wall mount for distribution board in every flat	4	14 June 2021	21 June 2021																											
15	Creating wall mount for distribution board in every shop	4	14 June 2021	21 June 2021																											
16	Fixing the distribution board at 2nd floor to 9th floor	4	22 June 2021	29 June 2021																											
17	Fixing the distribution board at ground floor	4	22 June 2021	29 June 2021																											
18	Fixing the Distribution Board at First floor	1	30 June 2021	30 June 2021																											
19	Fixing the Distribution Board at Basement	1	05 July 2021	05 July 2021																											
20	Plastic cable raceways - Ground floor to 3rd floor	1	06 July 2021	06 July 2021																											
21	Plastic Cable Raceways - 4th to 7th floor	1	07 July 2021	07 July 2021																											
22	Plastic Cable Raceways 8th floor, 9th floor and Basement	1	12 July 2021	12 July 2021																											
13	Replace the sprinklers in common areas from basement till 8th floor.	2	12 July 2021	13 July 2021																											
14	Smoothen the ramp handrails in the rear side	1	06 July 2021	06 July 2021																											

ID Task	Task Description	Task Duration	Start Date	End Date	30 May 2021	31 May 2021	01 June 2021	02 June 2021	03 June 2021	04 June 2021	05 June 2021	06 June 2021	07 June 2021	08 June 2021	09 June 2021	10 June 2021	11 June 2021	12 June 2021	13 June 2021	14 June 2021	15 June 2021
1) Feasibility Check																					
1	Investor's Benefits	30	01 February 2021	03 March 2021																	
2	Labour's working Hours	1	04 March 2021	04 March 2021																	
3	Material Management	1	05 March 2021	05 March 2021																	
4	Transportation in and around the site	1	06 March 2021	06 March 2021																	
5	Visual Reporting	1	08 March 2021	09 March 2021																	
6	Standards and codes to be followed	1	10 March 2021	10 March 2021																	
2) Project Planning																					
1	Determine local response characteristics	2	11 March 2021	12 March 2021																	
2	Framing requirements	1	13 March 2021	13 March 2021																	
3	Cost Estimation	1	14 March 2021	14 March 2021																	
4	Environmental Clearance	31	16 March 2021	16 April 2021																	
3) Schematic Design																					
1	Revise the old drawings	2	20 April 2021	21 April 2021																	
2	Frame the engineering considerations	1	22 April 2021	22 April 2021																	
3	Revision 1 - Freeze for approvals	3	23 April 2021	25 April 2021																	
4	Design revision as per the specific materials, equipments and areas to be altered	1	26 April 2021	26 April 2021																	
5	Finalise the Scheme Plan	1	27 April 2021	27 April 2021																	
4) Design development and design detail																					
1	Authorized approvals	30	26 April 2021	26 May 2021																	
2	Material Specification	1	27 May 2021	27 May 2021																	
3	Shutdown works to be determined	1	28 May 2021	28 May 2021																	
4	Determine the emerging works	1	29 May 2021	29 May 2021																	
5	Determine the Time Critical Design	1	30 May 2021	30 May 2021																	
5) Construction																					
1	One day full shutdown - 'A' Wing (for installation of the electrical room)	1	07 June 2021	07 June 2021																	
2	Bring the prefabricated panels to the site	1	07 June 2021	07 June 2021																	
3	Panel Board Fixing Shutdown from 2nd to 7th floor	1	08 June 2021	08 June 2021																	
4	Panel Board Fixing - Shutdown 8th and 9th floor	1	09 June 2021	09 June 2021																	
DELAYED WORKS																					
5	Panel board Fixing - Shutdown the Basement, Ground and 1st Floor	1	10 June 2021	10 June 2021																	
6	Panel board Fixing - Full shutdown for 1 day for RMU Line and generator	1	11 June 2021	11 June 2021																	
7	Prefabricated cable trays arrival at site	1	10 June 2021	10 June 2021																	
8	Creating wall mount for distribution board in every flat	4	08 June 2021	11 June 2021																	
9	Creating wall mount for distribution board in every shop	4	08 June 2021	11 June 2021																	
10	DELAY DUE TO SHOPOWNERS NOT ACCEPTING FOR SHUTDOWN ON THURSDAY AND FRIDAY (GROUND FLOOR)		10 June 2021	13 June 2021																	
11	Panel board Fixing - Shutdown the Basement, Ground and 1st Floor	1	14 June 2021	14 June 2021																	
12	Panel board Fixing - Full shutdown for 1 day for RMU Line and generator	1	15 June 2021	15 June 2021																	
13	Prefabricated cable trays arrival at site	1	14 June 2021	14 June 2021																	
14	Creating wall mount for distribution board in every flat	4	14 June 2021	21 June 2021																	
15	Creating wall mount for distribution board in every shop	4	14 June 2021	21 June 2021																	
16	Fixing the distribution board at 2nd floor to 9th floor	4	22 June 2021	29 June 2021																	
17	Fixing the distribution board at ground floor	4	22 June 2021	29 June 2021																	
18	Fixing the Distribution Board at First floor	1	30 June 2021	30 June 2021																	
19	Fixing the Distribution Board at Basement	1	05 July 2021	05 July 2021																	
20	Plastic cable raceways - Ground floor to 3rd floor	1	06 July 2021	06 July 2021																	
21	Plastic Cable Raceways - 4th to 7th floor	1	07 July 2021	07 July 2021																	
22	Plastic Cable Raceways 8th floor, 9th floor and Basement	1	12 July 2021	12 July 2021																	
13	Replace the sprinklers in common areas from basement till 8th floor.	2	12 July 2021	13 July 2021																	
14	Smoothen the ramp handrails in the rear side	1	06 July 2021	06 July 2021																	

ID Task	Task Description	Task Duration	Start Date	End Date	16 June 2021	17 June 2021	18 June 2021	19 June 2021	20 June 2021	21 June 2021	22 June 2021	23 June 2021	24 June 2021	25 June 2021	26 June 2021	27 June 2021	28 June 2021	29 June 2021	30 June 2021	01 July 2021	02 July 2021	03 July 2021	04 July 2021	05 July 2021	06 July 2021	07 July 2021	08 July 2021	09 July 2021	10 July 2021	11 July 2021	12 July 2021
1) Feasibility Check																															
1	Investor's Benefits	30	01 February 2021	03 March 2021																											
2	Labour's working Hours	1	04 March 2021	04 March 2021																											
3	Material Management	1	05 March 2021	05 March 2021																											
4	Transportation in and around the site	1	06 March 2021	06 March 2021																											
5	Visual Reporting	1	08 March 2021	09 March 2021																											
6	Standards and codes to be followed	1	10 March 2021	10 March 2021																											
2) Project Planning																															
1	Determine local response characteristics	2	11 March 2021	12 March 2021																											
2	Framing requirements	1	13 March 2021	13 March 2021																											
3	Cost Estimation	1	14 March 2021	14 March 2021																											
4	Environmental Clearance	31	16 March 2021	16 April 2021																											
3) Schematic Design																															
1	Revise the old drawings	2	20 April 2021	21 April 2021																											
2	Frame the engineering considerations	1	22 April 2021	22 April 2021																											
3	Revision 1 - Freeze for approvals	3	23 April 2021	25 April 2021																											
4	Design revision as per the specific materials, equipments and areas to be altered	1	26 April 2021	26 April 2021																											
5	Finalise the Scheme Plan	1	27 April 2021	27 April 2021																											
4) Design development and design detail																															
1	Authorized approvals	30	26 April 2021	26 May 2021																											
2	Material Specification	1	27 May 2021	27 May 2021																											
3	Shutdown works to be determined	1	28 May 2021	28 May 2021																											
4	Determine the emerging works	1	29 May 2021	29 May 2021																											
5	Determine the Time Critical Design	1	30 May 2021	30 May 2021																											
5) Construction																															
1	One day full shutdown - 'A' Wing (for isolation the electrical room)	1	07 June 2021	07 June 2021																											
2	Bring the prefabricated panels to the site	1	07 June 2021	07 June 2021																											
3	Panel Board Fixing Shutdown from 2nd to 7th floor	1	08 June 2021	08 June 2021																											
4	Panel Board Fixing Shutdown 8th and 9th floor	1	09 June 2021	09 June 2021																											
DELAYED WORKS																															
5	Panel board Fixing - Shutdown the Basement, Ground and 1st Floor	1	10 June 2021	10 June 2021																											
6	Panel board Fixing - Full shutdown for 1 day for RMU Line and generator	1	11 June 2021	11 June 2021																											
7	Prefabricated cable trays arrival at site	1	10 June 2021	10 June 2021																											
8	Creating wall mount for distribution board in every flat	4	08 June 2021	11 June 2021																											
9	Creating wall mount for distribution board in every shop	4	08 June 2021	11 June 2021																											
10	DELAY DUE TO SHOPOWNERS NOT ACCEPTING FOR SHUTDOWN ON THURSDAY AND FRIDAY (GROUND FLOOR)		10 June 2021	13 June 2021																											
11	Panel board Fixing - Shutdown the Basement, Ground and 1st Floor	1	14 June 2021	14 June 2021																											
12	Panel board Fixing - Full shutdown for 1 day for RMU Line and generator	1	15 June 2021	15 June 2021																											
13	Prefabricated cable trays arrival at site	1	14 June 2021	14 June 2021																											
14	Creating wall mount for distribution board in every flat	4	14 June 2021	21 June 2021																											
15	Creating wall mount for distribution board in every shop	4	14 June 2021	21 June 2021																											
16	Fixing the distribution board at 2nd floor to 9th floor	4	22 June 2021	29 June 2021																											
17	Fixing the distribution board at ground floor	4	22 June 2021	29 June 2021																											
18	Fixing the Distribution Board at First floor	1	30 June 2021	30 June 2021																											
19	Fixing the Distribution Board at Basement	1	05 July 2021	05 July 2021																											
20	Plastic cable raceways - Ground floor to 3rd floor	1	06 July 2021	06 July 2021																											
21	Plastic Cable Raceways - 4th to 7th floor	1	07 July 2021	07 July 2021																											
22	Plastic Cable Raceways 8th floor, 9th floor and Basement	1	12 July 2021	12 July 2021																											
13	Replace the sprinklers in common areas from basement till 8th floor.	2	12 July 2021	13 July 2021																											
14	Smoothen the ramp handrails in the rear side	1	06 July 2021	06 July 2021																											

6.1.5.5 E Block, IIT Madras Research Park, Tharamani, Chennai – 113 – Phase Wise Construction:

Table 6.8 Phase 1 – Services (Basement, Ground Floor and 1st Floor)

S.No.	Activity Involved	Schedule	Labour Cost + Material Cost
1.	Pre-shutdown works	Just before the partial shutdown	Rs.8000

Table 6.9 Pre-shutdown work details (Services) – Parsn Manere

POINTS TO BE CLOSED	NO. OF LABOUR	LABOUR COST
Electrical conduits to be temporarily sealed / closed	2	Rs.2000
Plumbing lines to be temporarily sealed / closed	2	Rs.2000
PFA Points to be temporarily sealed / closed	2	Rs.2000
HVAC supply opens to be temporarily sealed / closed	2	Rs.2000

Table 6.8 Phase 1 – Services (Basement, Ground Floor and 1st Floor) (Continuation)

S.No.	Activity Involved	Schedule	Labour Cost + Material Cost
2.	Partial Shutdown	Before commencing the works	Rs.2000
3.	Install base and diesel pump	First step of fire pump installation	Rs.1,02,000
4.	Install Valves and jockey pump	Second step of fire pump installation	
5.	Install electric pump and valves	Third step of fire pump installation	
6.	Install suction and discharge pipe	Fourth step of fire pump installation	

S.No.	Activity Involved	Schedule	Labour Cost + Material Cost
7.	Install diesel engine and security guard	Fifth step of fire pump installation	
8.	Install electric motor and control panel	Final step of fire pump installation	
9.	Identify the opened electrical shafts and conceal them	2 nd element of services refurbishment	Rs.11,800

Table 6.10 Phase 2 – Interiors (Basement, Ground Floor and 1st Floor)

S.No.	Activity Involved	Schedule	Labour Cost + Material Cost
1.	Pre-shutdown works	Just before the partial shutdown	Rs.6000

Table 6.11 Pre-Shutdown Work Details (Interiors) – Parsn Manere

POINTS TO BE CLOSED	NO. OF LABOUR	LABOUR COST
Electrical conduits to be temporarily sealed / closed	2	Rs.2000
Plumbing lines to be temporarily sealed / closed	2	Rs.2000
PFA Points to be temporarily sealed / closed	2	Rs.2000

Table 6.10 Phase 2 – Interiors (Basement, Ground Floor and 1st Floor) (Continuation)

S.No.	Activity Involved	Schedule	Labour Cost + Material Cost
2.	Shutdown works	Just before the partial shutdown	Rs.2000
3.	Tile Laying	After cleaning the tile debris	Rs.5,73,450
4.	Counter Top Wash basin in bathrooms	Installed in basement, ground floor and 1 st floor bathrooms (9 nos.)	Rs.18,450+Rs.6000

S.No.	Activity Involved	Schedule	Labour Cost + Material Cost
5.	WCs	After laying the tiles	Rs.1,88,300
6.	Break the tiles in Lift Lobbies Basement and G+8	After shutdown	Rs.45,000
7.	Tile Laying	After removing the debris	Rs.3,15,000
8.	Paint for walls and ceiling	After laying the floor tiles	Rs.33,000
9.	Steel Staircase in the Atrium	After shutdown	Rs.1,42,000
10.	Glass in the OTS to be cleaned	After shutdown	Rs.2,000
11.	LED Lights in the atrium (Rear side of the building)	After staircase erection in the atrium	Rs.10,250
12.	Replace the Sprinklers in ground floor and 1 st floor	After fixing the lights in the atrium	Rs.3,450
13.	Replace the sprinklers in common areas from basement till 8 th floor.	After fixing the lights in the atrium (rear side)	Rs.6,350
14.	Smoothen the ramp handrails in the rear side	After shutdown	Rs.1500
TOTAL COST (Services + Interiors)			Rs.14,76,550

Delay assumptions in IIT Madras Research Park:

1. Since it is a phase wise construction the stages before this proposed stage might get delay the project completion, which in turn results in cost uncertainties.

6.1.5.6 IIT Madras Research Park – Project Timeline:

Project Name	Duration	Start date	End Date
E' Block (Basement, Ground floor and 1st floor), IIT Madras research Park, Kanagam Taramani.	160	04 January 2021	13 June 2021

IIT Madras research Park – Project Timeline

ID Task	Task Description	Task Duration	Start Date	End Date	04 January 2021	05 January 2021	06 January 2021	07 January 2021	08 January 2021	09 January 2021	10 January 2021	11 January 2021	12 January 2021	13 January 2021	14 January 2021	15 January 2021	16 January 2021	17 January 2021	18 January 2021	19 January 2021	20 January 2021	21 January 2021	22 January 2021	23 January 2021	24 January 2021	25 January 2021	26 January 2021	27 January 2021	28 January 2021	29 January 2021	30 January 2021
1) FEASIBILITY CHECK																															
1	Investor's Benefits		04 January 2021	03 February 2021																											
2	Labour's Working Hours		08 February 2021	08 February 2021																											
3	Material Management		09 February 2021	09 February 2021																											
4	Transportation in and around the site		10 February 2021	10 February 2021																											
5	Visual Reporting		11 February 2021	11 February 2021																											
6	Standards and codes to be followed		12 February 2021	12 February 2021																											
2) PROJECT PLANNING																															
1	Determine local response characteristics	2	13 February 2021	15 February 2021																											
2	Framing requirements		16 February 2021	16 February 2021																											
3	Rough Cost Estimation		17 February 2021	18 February 2021																											
4	Environmental Clearance		19 February 2021	22 March 2021																											
3) SCHEMATIC PLANNING																															
1	Revise the old drawings	2	23 March 2021	24 March 2021																											
2	Frame the engineering considerations	1	25 March 2021	25 March 2021																											
3	Revision 1 - Freeze for approvals	3	26 March 2021	29 March 2021																											
4	Design revision as per the specific materials, equipments and areas to be altered	1	30 March 2021	30 March 2021																											
5	Finalise the Scheme Plan	1	31 March 2021	31 March 2021																											
4) DESIGN DEVELOPMENT AND DESIGN DETAIL																															
1	Authorized approvals	62	30 March 2021	31 May 2021																											
2	Material Specification	2	31 May 2021	01 June 2021																											
3	Shutdown works to be determined	1	02 June 2021	02 June 2021																											
4	Determine the emerging works	2	03 June 2021	04 June 2021																											
5	Determine the Time Critical Design	1	05 June 2021	05 June 2021																											
5) CONSTRUCTION																															
SERVICES																															
1	Pre-shutdown works	1	07 June 2021	07 June 2021																											
2	Shutdown in basement floor	1	08 June 2021	08 June 2021																											
3	Install base and diesel pump	1	08 June 2021	08 June 2021																											
4	Install Valves and jockey pump	1	08 June 2021	08 June 2021																											
5	Install electric pump and valves	1	08 June 2021	08 June 2021																											
6	Install suction and discharge	1	08 June 2021	08 June 2021																											
7	Install diesel engine and security	1	08 June 2021	08 June 2021																											
8	Install electric motor and control	1	08 June 2021	08 June 2021																											
9	Identify the opened electrical shafts and conceal them	1	09 June 2021	09 June 2021																											
INTERIORS																															
1	Pre-shutdown works	1	09 June 2021	09 June 2021																											
2	Shutdown works	1	09 June 2021	09 June 2021																											
3	Cleaning the debris and Tile Laying	3	09 June 2021	11 June 2021																											
4	Counter Top Wash basin in bathrooms	1	12 June 2021	12 June 2021																											
5	Installing WCs	1	12 June 2021	12 June 2021																											
6	Break the tiles in life lobbies - Basement, G+8	2	09 June 2021	10 June 2021																											
7	Tile Laying	1	12 June 2021	12 June 2021																											
8	Paint for walls and ceiling	1	13 June 2021	13 June 2021																											
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6.2 PARAMETERS OF REFURBISHMENT

1. **Building age** – Depending on the age of the building the refurbishment scope and objectives will be framed.
2. **Refurbishment Type** – Upgrades & improvement, conservation or restoration and change of use.
3. **Structure Stability** – Whatever be the age, building's structural strength should be well analysed by the professionals. 3 levels of structural inspection are: Visual Inspection, Non-destructive Testing and Building Classification into Categories.
4. **Refurbishment Approach** – Depending on the refurbishment areas this is tabulated and planned.
5. **Components Upgradation** – Comparison among the percentage of components that are going to be upgraded.
6. **Work in Specific Areas** – This is done instead of full building renovation.
7. **Miscellaneous works** – Apart from the planned major refurbishment parts, other small scale works will come under this section.
8. **Client's interaction** – One important part for any kind of project and especially when it is about refurbishment, client's needs and perspective should be well discussed and carried out.
9. **Drawings availability** – Depending on the existing drawing's availability, the refurbishment process will be faster.
10. **Occupants in the building** – The most challenging part of refurbishment.
11. **Percentage of risk involved** – Arising risk factors in the refurbishment process.
12. **Labour's working hours** – Depending on which the refurbishment process is planned.
13. **Progress meeting** – Regular meeting should be arranged among the PM's teams to effectively proceed the work.
14. **Consultant's meeting** – Consultants related to every different parts of the project should have regular meeting with the client and the architect to complete the project on time without any delay.
15. **Level of refurbishment** – Major / Minor / Medium
16. **Refurbishing Elements** – Services and interiors are the major elements in refurbishment.
17. **Refurbishment Cost** – Investment cost to be estimated and compare this among the 3 Case buildings.
18. **Refurbishment Duration** – This should be defined in weeks and compared among the 3 Case Buildings.
19. **Reason for refurbishment** – Age of the building or client requirements.

6.3 COMPARATIVE ANALYSIS:

- Refurbishment is a common means of maintaining buildings in order to serve their users. For example, the maintenance of a campus building is important because they serve many students during their education and serve as a workplace for teachers and staff. Refurbishment is of many different types depending on many factors. Every building will have its own parameters for the reasons for refurbishment.



Fig 6.4 Conservation and Preservation



Fig 6.5 Upgrades and Improvements



Fig 6.6 Repurposing or Change of use

Table 6.12 Comparative Analysis

S.No.	Parameter for Comparison	Apollo First Med Hospitals, Kilpauk	Parsn Manere, T.Nagar	IIT Madras research Park, Kanagam, Taramani
1.	Building Type	Institutional	Residential cum Commercial Complex	Institutional
2.	Refurbishment Type	a) Upgrades and improvements b) Change of use	a) Upgrades b) Conservation	a) Upgrades And improvements
3.	Refurbishment Approach	Floor wise construction	Phase wise and Floors wise construction	Phase wise and construction
4.	Refurbishment Cost (Construction Phase)	Rs.34,61,160 (per floor)	Rs.1,34,17,680 (Electrical)	Rs.14,76,550 (E Block – Basement to 1 st Floor)
5.	Refurbishing Elements	Services and interior refurbishment	Electrical Refurbishment	Interior Refurbishment
6.	Reasons for refurbishment	Building age & Equipments corrosion	Outdated Electrical system	Equipments corrosion & Damaged interior components

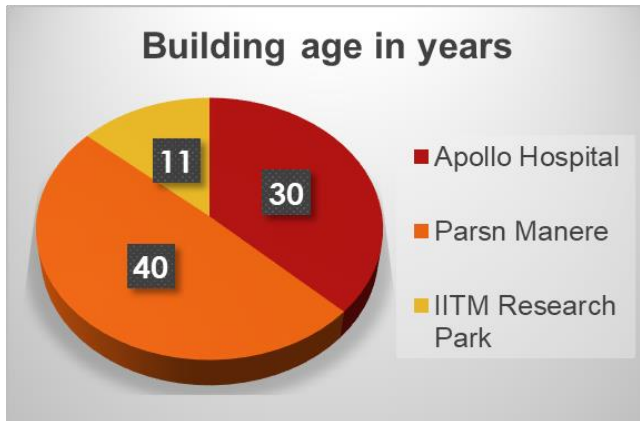


Fig 6.7 Present age of the structures to be refurbished

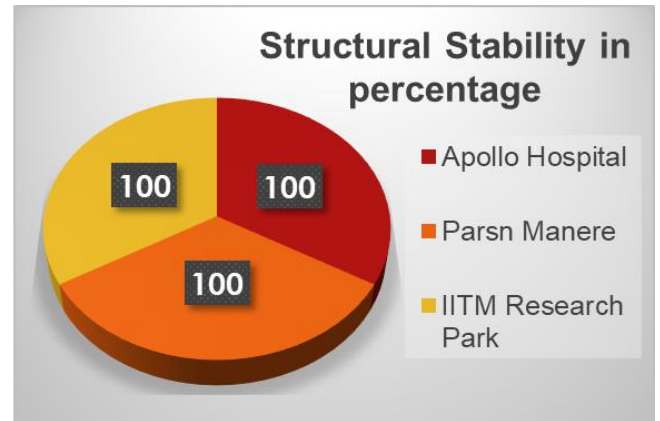


Fig 6.8 Structural Stability for the refurbishment work

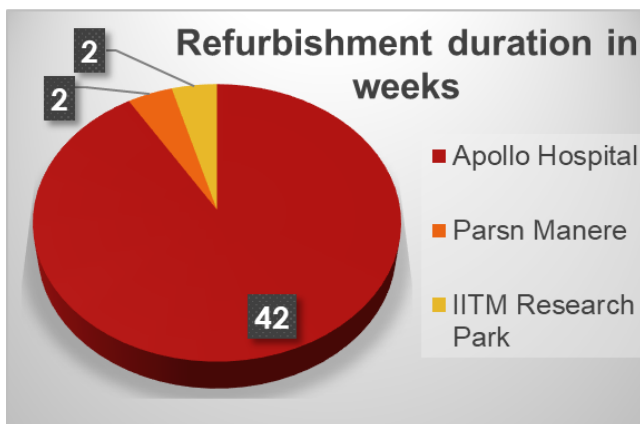


Fig 6.9 Refurbishment Duration in construction phase

Structural Inspection Levels

- Visual inspection
- Non-destructive Testing
- Classification building into a category

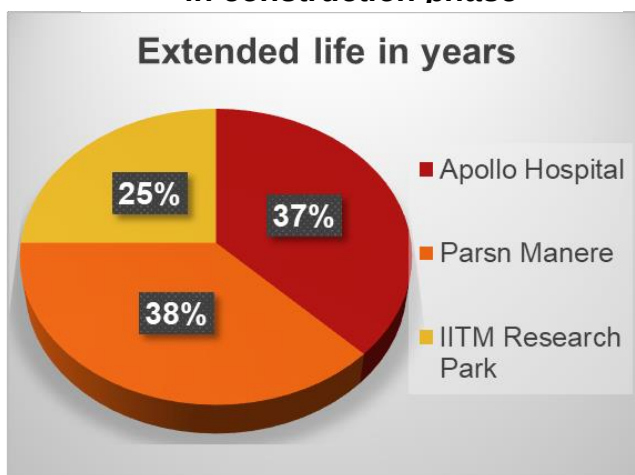


Fig 6.10 Extended life of the refurbished structures

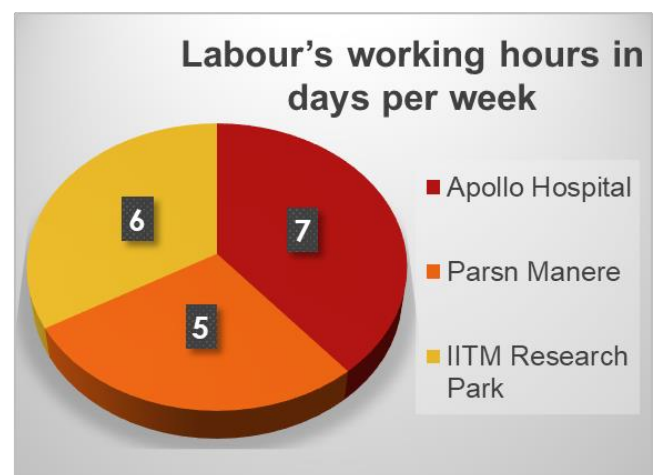


Fig 6.11 Labour's working hours for refurbishment work

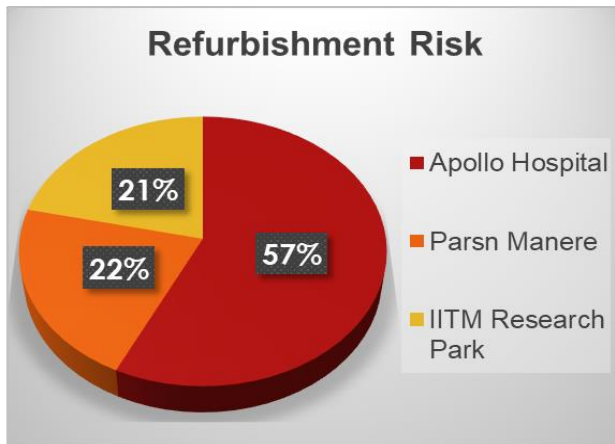


Fig 6.12 Percentage of risk caused due to refurbishment

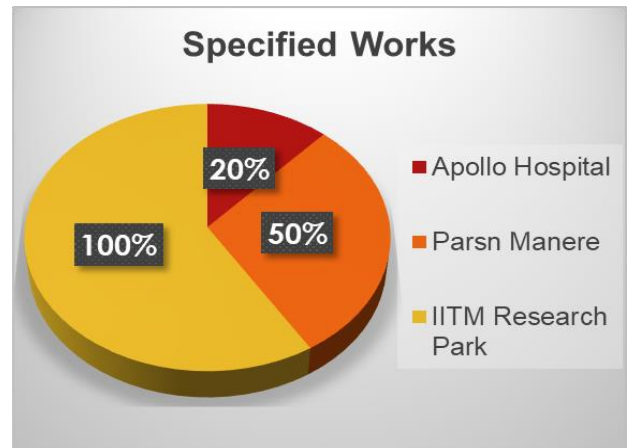


Fig 6.13 Refurbishment works in specified areas

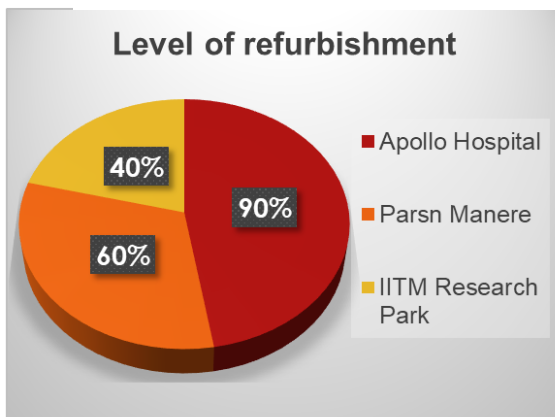


Fig 6.14 Levels of refurbishment done in these 3 case buildings

REFURBISHMENT LEVELS

- MAJOR: 80% - 100% of refurbishment works
- MEDIUM: 50% - 70% of refurbishment works
- MINOR: 10% - 40% of refurbishment works

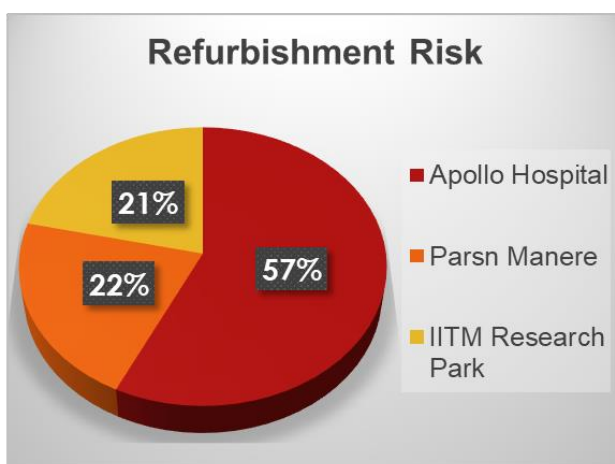


Fig 6.15 Upgradation of Components in the Case Buildings

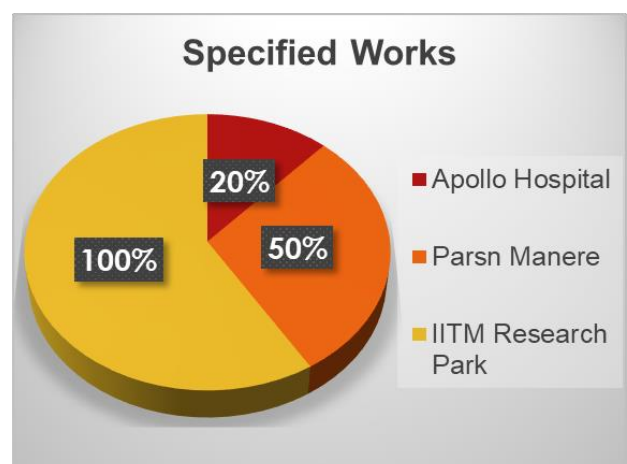


Fig 6.16 Building occupied during refurbishment work

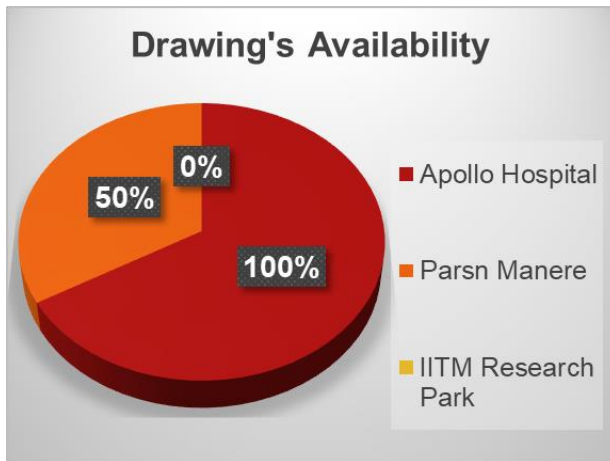


Fig 6.17 Building occupation during refurbishment process

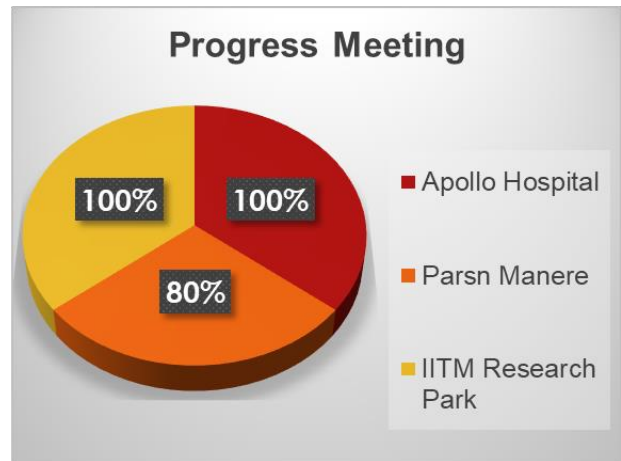


Fig 6.18 Project progress meeting during refurbishment



Fig 6.19 Meeting among the consultants involved in the project

6.4 RESULTS – PARAMETERS RANKING

Table 6.13 Parameters Ranking

S. No.	Parameters	Ranking	Remarks	
1.	Type of the building	Medium	Mostly considered	To propose the areas for refurbishment
2.	Refurbishment Type	Medium	Mostly Considered	To frame the refurbishment results
3.	Refurbishment Approach	High	Needs to be considered	To plan the construction schedule
4.	Refurbishment Cost	High	Needs to be considered	To withstand any form of project risk
5.	Reason for Refurbishment	High	Need to be Considered	To frame the objectives and aims for refurbishment
6.	Refurbishment Elements	Medium	Needs to be considered	This will lead to refurbishment type
7.	Building age	High	Needs to be considered	To freeze the refurbishment level
8.	Structural Stability	High	Needs to be considered	To identify the components that has to be enhanced
9.	Refurbishment duration	Medium	Mostly considered	Varied from building to building
10.	Extended Life in years	Low	May be considered	
11.	Labour's Working hours	High	Needs to be considered	To frame the project schedule
12.	Refurbishment risk	High	Needs to be considered	To know the emerging works
13.	Specified works	Low	May be considered	In case of minor refurbishment works

S. No.	Parameters	Ranking	Remarks	
14.	Level of refurbishment	Low	May be considered	To know the severity
15.	Components Upgradation	Low	May be considered	
16.	Occupants in the building	High	Needs to be considered	To schedule the refurbishment process accordingly
17.	Drawing availability	High	Need to be considered	Ease of preparing the refurbishment drawings
18.	Progress Meeting	Medium	Mostly considered	To maintain the work consistency or to improvise the efficiency of the work
19.	Consultant's Meeting	Medium	Mostly considered	To maintain the work consistency or to improvise the efficiency of the work

CHAPTER 7

SUMMARY AND CONCLUSION

7.1 SUMMARY – PARAMETERS GRADING IN GRAPH:

- Parameter is any characteristic that can help in defining or classifying a particular system.
- Refurbishing parameters are such elements that defines what are the important characteristics to be considered for a refurbishment project.
- Ranking based on their importance level has been graphed below.

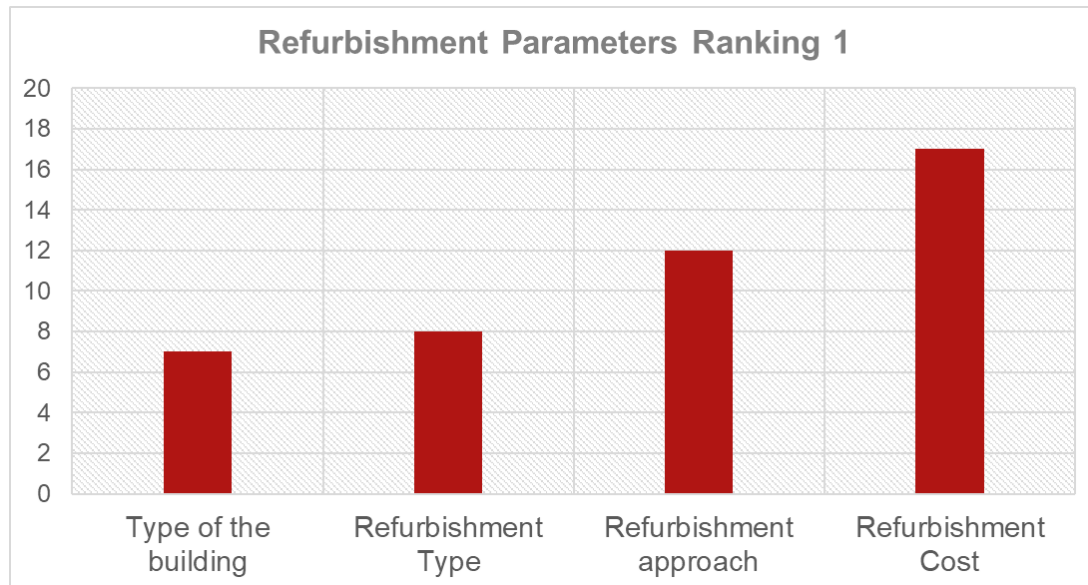


Fig 7.1 Refurbishment Ranking Parameters – 1

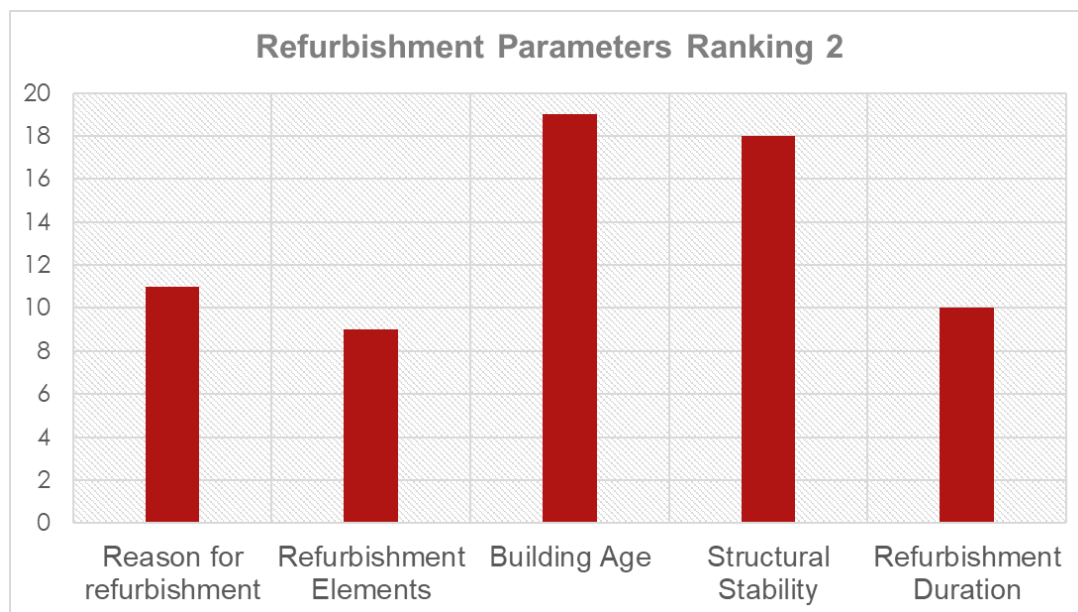


Fig 7.2 Refurbishment Ranking Parameters – 2

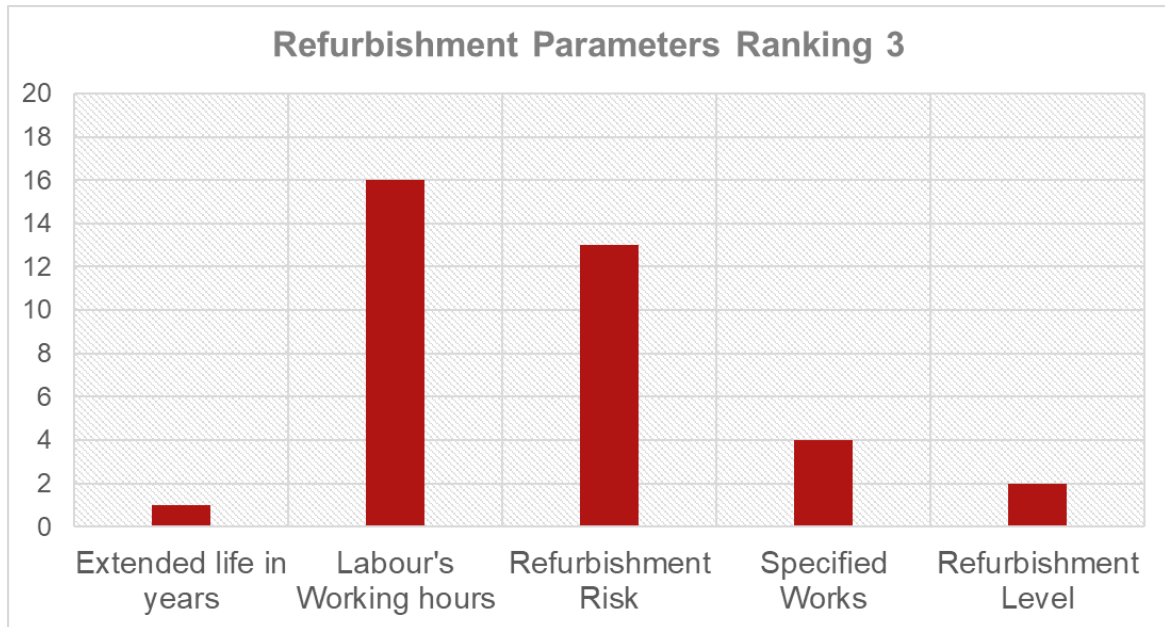


Fig 7.3 Refurbishment Ranking Parameters – 3

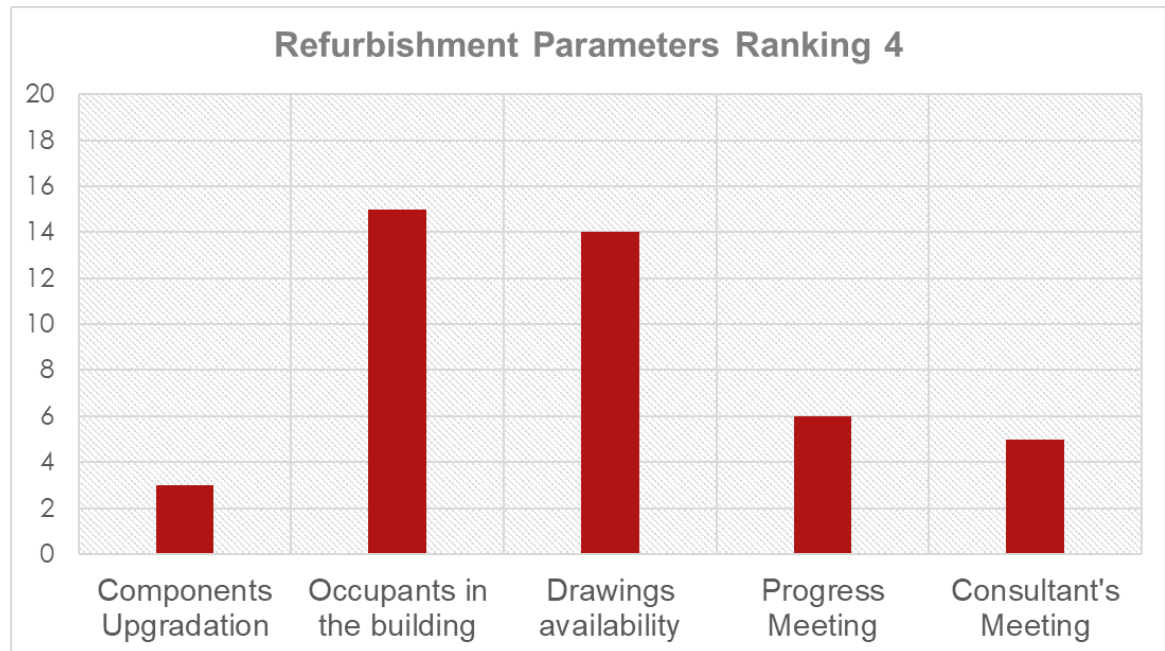


Fig 7.4 Refurbishment Ranking Parameters – 4

7.2 CONCLUSION:

As a question for the cost, schedule and parameters for refurbishment projects, this study presents refurbishment pre-construction process and construction process scheduling and cost estimations in perspective of long-term performance by considering the occupant convenience and quality improvement to the buildings.

All the 3 building's conditions were listed and the problems caused by the occupants and the structure itself was tabulated for which suitable solutions were also proposed.

Feasible solutions that was able to get applied on the structure were finalized.

Usually there are parameters, cost and scheduling pattern for any kind of new projects which is serving as reference for many new projects.

But this paper introduces parameters to be considered for a refurbishment project.

The method developed in this study helps the project managers and architects to plan the costing, scheduling and parameters for refurbishment projects.

This study is the main contribution in developing renovation scheduling strategies with quantitative information.

Not only the parameters but also the order of importance that has to be given and consider the highly ranked parameter the most for any refurbishment project.

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