

Feasibility Study for Proposed Project of Modernization, Augmentation and Retrofitting Of “Shanti One”

SANAL BHAGAT¹, ASHISH PRUTHVIRAJ WAGHMARE², DR. NAGESH SHELKE³

¹ M.E Scholar, Department of Civil Engineering, Dr. DYPSOET, Lohegaon, Pune.

² Guide & PG Coordinator, Department of Civil Engineering, Dr. DYPSOET, Lohegaon, Pune

³ Head of the department Dr. DYPSOET, Lohegaon, Pune.

Abstract- *A feasibility study is simply an assessment of the practicality of a proposed plan or project. As the name implies, these studies ask: "Is this project feasible? Do we have the people, tools, technology, and resources necessary for this project to succeed?" Also, "Will the project get us the return on investment (ROI) that we need and expect?"*

The goal of a feasibility study is to thoroughly understand all aspects of a project, concept, or plan; become aware of any potential problems that could occur while implementing the project; and determine if, after considering all significant factors, the project is viable—that is, worth undertaking.

The present project stage-II topic is related with studying the feasibility of a retrofitting project named as Shanti One situated in the heart of city on nagar highway near agha khan palace. The existing project was a mall building which is supposed to be converted into an IT park.

I. INTRODUCTION

A feasibility study is an analysis that takes all a project's relevant factors into account—including economic, technical, legal, and scheduling considerations—to ascertain the likelihood of completing the project successfully. Project managers use feasibility studies to discern the pros and cons of undertaking a project before they invest a lot of time and money into it. Feasibility studies also can provide a company's management with crucial information that could prevent the company from entering blindly into risky businesses.

A feasibility study includes an estimate of the level of expertise required for a project and who can provide it, quantitative and qualitative assessments of other

essential resources, identification of critical points, a general timetable, and a general cost estimate.

Whether a project is viable or not, i.e. whether it can generate an equal or a higher rate of return during its lifetime requires a thorough investigation of the investment per se as well as the level of current expenditure. The preliminary design is the simple description of the conceived idea with an indication of the main factors to be considered in the study.

II. PURPOSE

- Establish whether the project is viable.
- Help to identify feasible options.
- Assist in the development of other project documentation such as the business case, execution plan and strategic brief.
- Planning Permission.
- The likelihood that an environmental impact assessment will be required.
- Other legal/statutory approvals.
- Analysis of the budget relative to client requirements.
- Assessment of the potential to re-use existing facilities or doing nothing rather than building new facilities.
- Assessment of any site information provided by client.
- Considering different solution to accessing potential

III. IMPORTANCE OF FEASIBILITY STUDIES

Feasibility studies are important to business development. They can allow a business to address where and how it will operate; identify potential obstacles that may impede its operations and recognize

the amount of funding it will need to get the business up and running. Feasibility studies also can lead to marketing strategies that could help convince investors or banks that investing in a project or business is a wise choice.

The dynamic nature of today's business environment has led to an increase in the risks and uncertainties that are faced by organizations. The growth in the degree of awareness of the customers has led to a dramatic increase in competition as more and more companies are now trying to cater to the needs of these customers. It has become crucial for businesses to outshine competition in terms of provision of value to its clients. Survival in the marketplace has become difficult, however, entering it is an entirely different story. An absence of proper planning and forethought leads to the failure of entrants. Thus, to ensure profitability, it becomes essential to conduct some sort of analysis before plunging into the market. A proper example of this analysis is the feasibility study.

IV. OBJECTIVE

- To Study the technological support system required.
- To Analyze the effect of project on environment and its management.
- To Study the economic feasibility of the project.
- To Study the Market Feasibility.
- To Study the Impact of change cost on planned cost.

V. METHODOLOGY & CONCEPTUALISATION

The Figure represents the Framework for Feasibility Study

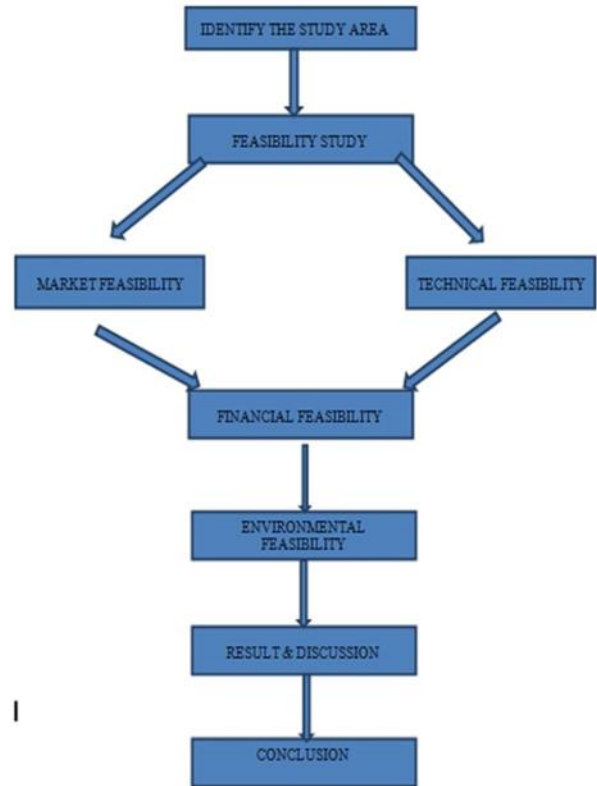


Figure 1 Methodology Flow Chart

The study area is located on nagar road highway, Kalyani nagar, which is located at 1km from Pune Airport and 6.5 km Pune railway station. Analyzing the factors of feasibility includes Market feasibility, Technical Feasibility, Financial Feasibility & Environmental Feasibility. Market feasibility is done by primarily by analyzing the proposed location. The market size is being analyzed. The competitors near by the proposed location are being identified and their amenities are found out. The target group definition for individual to purchase & rental yield is calculated. The technical feasibility is done by assessing the specifications by identifying brand products based on prices & quality. Financial feasibility is obtained from the gross profit achieved from the difference between the income & revenues. From the gross profit, the gross margin of the proposed project will be achieved. The proposed project will be rated from the LEED India Green Building Rating System and certified as a Green Building. This satisfies the environmental feasibility.

VI. DATA COLLECTION

MARKET FEASIBILITY

- **Position Definition** The project features 16 office spaces. The project will have all the luxury and modern amenities that one can expect in a modern luxury office space.
- **Project Positioning** The project is positioned as — **GRADE A IT PARK** catering to high network individuals, top executives of reputed corporate. The project will be luxury in price & also will have quality fitments & all smart features with all luxury facilities and social infrastructure. The project will be a huge **BRAND BUILDER** in IT companies.

- **Market Study**

Catchment Analysis – Catchment Analysis from User’s Perspective: The project is developed on an 6 grounds property located in Kalyani Nagar. The project location is in the heart of the city with reputed corporates, high end commercial developments, retail outputs & institutional developments. This area predominantly consists of upper & upper-middle income group residing. Development in the neighbor is a mixture of commercial, residential & retail use. Significant commercial developments have created huge need for office spaces in Kalyani Nagar. Commercial developments in the catchment include mostly high-end Software companies, Kpo, Bpo and IT companies. The supply of such spaces mainly lies in the location of that area. Several IT HUB of varying scales are under construction in Kalyani Nagar with major IT Companies including EON IT park, Barclays, Magarpatta City, Gega Space etc.,

Sr. No	Project	Unit Sizes	Unit Rate	Location
1	Eon IT Park	500 – 3000 Sq. Ft	28000/-	Kharadi
2	Magarpatta	500 – 3000 Sq. Ft	30000/-	Kharadi
3	Barclays	500 – 3000 Sq. Ft	29000/-	Kharadi
4	Gega Space	500 –	27000/-	Viman

		3000 Sq. Ft		Nagar
5	Shanti One	500 – 3000 Sq. Ft	25000/-	Kalyani Nagar
6	Cerebrum	500 – 3000 Sq. Ft	25000/-	Kalyani Nagar

Table 1 Market Study

VII. AMENITIES

The traditional and conventional style of office spaces in Pune have made it clear in the survey that basic amenities are only required for a successful project. Social infrastructures such as transport, parking facility, recreation area, lift etc. are some of the very important requirements. Other facilities such as power backup, security too is some of the important factors to be considered while designing the project. Amenities provided in this project are: Gym Clubhouse, Centralized HVAC system, Fire Fighting System, STP, Water Purifier SYSTEM, 12 Passenger lift, office automation, LED Lights in common area Roof Garden / Party Lawn, Cafeteria, Open Garden etc.

VIII. TECHNICAL FEASIBILITY

The technical feasibility is focused on gaining an understanding of the present technical resources of the organization and their applicability to the expected needs of the proposed system. To determine the structural soundness of the components as well as of the building, several technical studies and in-situ tests were conducted. In this effort, the foundation was investigated in detail, columns and beams were analyzed by various tests. To assess the quality and strength of R.C. members, rebound hammer tests, and to evaluate the quality and strength of certain R.C. members and masonry walls, ultrasonic pulse velocity tests were performed. Carbonation tests were also performed on concrete samples. After carrying out the detailed technical studies and in-situ tests, it was decided to adopt retrofitting measures for strengthening & alteration of building. Below are few techniques which were required for retrofitting.

IX. REINFORCEMENT SCANNING TECHNIQUE

PS 1000 reinforcement scanner is required for scanning of RCC members to find out exact position of bars which will help in design of base plate and connection details.



Figure 2 Image: Reinforcement scanning machine

- Ultrasonic test for welding:
DG SCAN DS-322 Ultrasonic scanner is required for scanning of Structural members to find out flaws and porosity of welding joints which will help to understand quality of welding done.



Figure 3 Image: - Ultrasonic testing Machine



- Die Penetration Test for welding



DeveloperSpray

Cleaner



- Application of die penetrant for flaw detection
Availability of all above agencies and their cost were verified and was considered in the estimation work. So, in every project it is very much essential to identify the technical requirements of the project and whether it is feasible to adopt those methods or not.

X. ECONOMIC FEASIBILITY

Particulars	Units
Average Unit Size	1920
Average Price/Sq. Ft	22000
Unit Price	4,22,40,000
Funding Details	Units
Own money (%)	20%
Own money (Rs.)	84,48,000
Bank loan (Rs.)	3,37,92,000
Emi Calculation	Units
Bank loan (Rs.)	3,37,92,000
Interest rate(p.a.)	10.50%
Loan Tenure (yrs.)	20
EMI(Rs.)	3,37,373
Eligibility Salary Calculation	Units
Banker's thumb rule (%)	40%
<u>Net salary per month (Rs.)</u>	<u>8,43,431</u>
Annual Salary (Rs.)	1,01,21,176
Rental Yield Calculation	Units
Office Unit price (Rs.)	4,22,40,000
Rent Per Month (Rs)	2,50,000
Annual Rent (Rs)	30,00,000
Return on investment (%)	7.1%
EMI out of pocket (Rs.)	87,373

Table 2 Economic Feasibility

XI. IMPACT ON PLANNED COST

After preparing change log we will get the cost of the changes occurred, after preparing the estimate & schedule we will get the planned cost, by using schedule and change log we can calculate the impact of change cost, analyze the changes occurred. Following formulas can be used to calculate impact, (Chan Chao)

1. Construction change % = $\frac{\text{Project construction change}}{\text{Project construction budget}} \times 100$

2. Total project change % = $\frac{\text{Total Project change}}{\text{Project budget}} \times 100$

3. Design change % = $\frac{\text{Project design change}}{\text{Project design budget}} \times 100$

4. Project cost overrun due to change % = $\frac{\text{Project expence due o change} - \text{Project budget}}{\text{Project budget}} \times 100$

5. Total project cost inefficiency % = $\frac{\text{Project expence} - \text{project budget} - \text{project change}}{\text{Project Change}} \times 100$

6. Design cost inefficiency % = $\frac{\text{Design expence} - \text{design budget} - \text{desogn change}}{\text{Design budget}} \times 100$

7. Construction cost inefficiency % = $\frac{\text{Construction expence} - \text{construction budget} - \text{construction change}}{\text{construction budget}} \times 100$

XII. SCOPEMODEL

R0					R1			
Sr. No	Nature of Work	Specifications	Quantity	Unit	Revised Specification	Revised Quantity	Unit	Total Quantity
1	Cutting	Demolition by diamond saw cutting in RCC column and staircases at given location as per architectural instruction including necessary tools and machineries, scaffolding watering, rates also included carting away the debris from site time to time or disposing the material as directed and specified by architect /client.	215	Cum	Demolition by diamond saw cutting in RCC Mullions at given location as per architectural instruction including necessary tools and machineries, scaffolding watering, rates also included carting away the debris from site time to time or disposing the material as directed and specified by architect /client.	9.704	Cum	224.704
		same as above item no 1 but wherever the areas demolition by diamond saw cutting is not feasible demolition by breaker or by other mechanical means as per architectural instruction including necessary tools and machineries, scaffolding watering, rates also included carting away the debris from site time to time or disposing the material as directed and specified by architect /client.	Rate only	Cum	same as above item no 1 but wherever the areas demolition by diamond saw cutting is not feasible demolition by breaker or by other mechanical means as per architectural instruction including necessary tools and machineries, scaffolding watering, rates also included carting away the debris from site time to time or disposing the material as directed and specified by architect /client.	18.54	Cum	18.54

Table 3 Scope Model

Scope model was made with the help of specification mention in contract document. Scope model was made in excel sheet in tabular form which includes detail

specification, quantity, unit, revised quantity and revised specification. To prepare this model detailed study of BOQ was done and whatever the changes

made in that specification was noted down during the internship period. These changes were considered as scope changes. The main purpose of the model was to keep the record of changes made in the scope of project. There were five changes occurred during the period of 152 days such as,

- A. Cancellation of cutting and construction of slab at staircase and lift area
 - B. Cutting of mullions
 - C. Cutting of beam column joint
 - D. Increased in cutting quantities
 - E. Extra measurements during execution for Cutting
- One example of scope model has mentioned in above table.

XIII. COST MODEL

Cost model was also developing to keep track on the cost of changes occurred. This model was made in excel sheet in tabular form which includes detailed specification, quantity, unit, price per unit, cost of item, revised specification, revised unit, revised cost and variance. To prepare cost model sanctioned BOQ between two parties (Client and Contractor) was followed after studying. List of changes was already made in scope model only the cost of that changes was found out in this model. To find the cost of item, detailed estimate of material required was calculated then the cost of each material was calculated and directly inserted into cost model.

These changes are explained in detailed and given below

- i. Cancellation of cutting and construction of slab at staircase and lift area -
This change is located at Service Lift Area, this change is occurred due to client's demand. That is why this change was considered as client change. This change costs 25548413.9 rupees only. Which includes the cost of back propping, staircase cutting, lift wall cutting, rafters anchor bolts, MS plate, GP Non shrink, Deck sheet, TMT bar, Concreting, fire proofing material and shuttering etc. the cost of these material was directly taken from contract document as mentioned above. This change has lowered the cost contract value by 2.55Cr due to cancellation of item. This value contributes 11.02% of considered case study cost. Cost of 152 days is 228068928 rupees only.

- ii. Cutting of mullions

This is located at Piazza Area out of all the areas. This change is occurred due to the architect as architect suggested to cut out that mullions for aesthetical view. Because of this reason this change is considered as architect change. This includes only cutting of the item, originally the quantity of diamond saw cutting was 215 cum, after this change it increased to 224.7 Cum. Cutting by breaker was also increased as not everywhere diamond saw cutting was feasible. This quantity is almost 18.54 cum. These both quantities increased in cutting cost 307725.72 rupees only which contributes 0.13% of considered cost.

- iii. Cutting of beam column joint

This change is located near New Lift Area, this change is considered as design change because at the time of construction this joint was found out to be a constraint in construction of further work. This change contributes 377920 rupees of the cost considered i.e. planned cost.

- iv. Increase in cutting quantities

This change is also considered as design change. This change had occurred as there was late delivery of cutting drawings from designer side. When the drawings were studied it was found that more cutting was needed. With the consent of the designer this cutting work was done. This item was not located at particular area; it is the sum up of different areas cutting work which cost 3929600 rupees only.

- v. Extra measurement

This change was considered as construction change. This work was not considered at the time of planning and during the execution it is found out some cutting was needed. That is why at such situation some extra cutting work was measured other than the planned work. This includes extra measurements in RCC wall cutting, Foam concrete cutting and diamond saw cutting. Foam concrete were used at multiplex its estimated quantity was less that the quantity was actually cut. This costs 1896021.76 rupees only.

XIV. CHANGE LOG

Change log was made to keep the record of changes occurred with their specification, cost, causes, implications etc. Different model such as scope model

cost model and change log were maintained which gave brief information changes for the life cycle of project.

R0						R1								
Sr. No	Nature of Work	Specifications	Quantity	Unit	Cost per Unit	Total Cost	Revised Specification	Revised Quantity	Unit	Total Quantity	Total Cost	Variance	Cause	Implications
1	Cutting	Demolition by diamond saw cutting in RCC column and staircases at given location as per architectural instruction including necessary tools and machineries, scaffolding watering, rates also included carting away the debris from site time to time or disposing the material as directed and specified by architect /client.	215	Cum	19648	4224320	Demolition by diamond saw cutting in RCC Mullions at given location as per architectural instruction including necessary tools and machineries, scaffolding watering, rates also included carting away the debris from site time to time or disposing the material as directed and specified by architect /client.	9.704	Cum	224.704	4414984.19	190664	The mullions were obstruction in the asthetical view.	To cut these mullions with consent of designer.
		same as above item no 1 but wherever the areas demolition by diamond saw cutting is not feasible demolition by breaker or by other mechanical means as per architectural instruction including necessary tools and machineries, scaffolding watering, rates also included carting away the debris from site time to time or disposing the material as directed and specified by architect /client.	Rate only	Cum	6314		same as above item no 1 but wherever the areas demolition by diamond saw cutting is not feasible demolition by breaker or by other mechanical means as per architectural instruction including necessary tools and machineries, scaffolding watering, rates also included carting away the debris from site time to time or disposing the material as directed and specified by architect /client.	18.54	Cum	18.54	117061.56	117062	same as mentioned above	same as mentioned above

Table 4 of Cost Model

XV. RESULTS & DISCUSSIONS

• OVERVIEW

The data was collected in the form of MS Project, scope model, cost model and change log etc. further analyzed for finding out the impact of the changes on planned cost.

• CATEGORIZATION OF CHANGES WITH PERCENTAGE

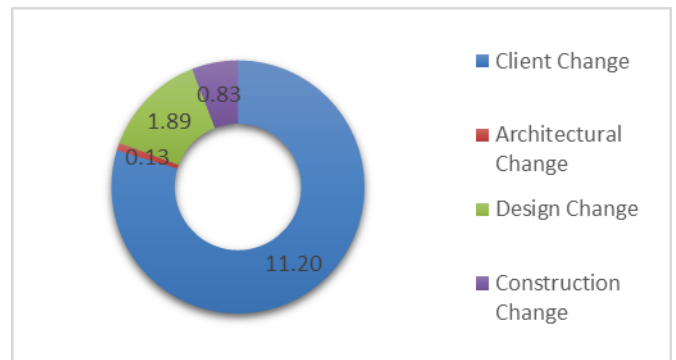


Figure 5 Type of change with percentage

Among all the categorization of reason of changes this particular site faces client change, architectural change, design change and construction change. This brownfield site had 14.06% changes in planned cost including all positive and negative changes. This pie chart gives the information about the amount of percentage contributed by the different types of changes. However the client change contributed

massively (11.20%) than other type of changes such as 0.13% architectural change, 1.89% design change, .83% construction change.

• POSITIVE AND NEGATIVE CHANGES

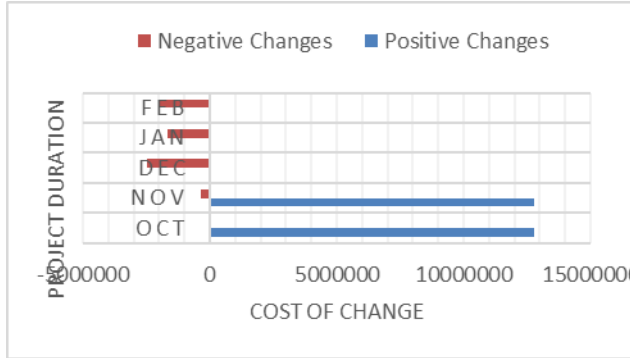


Figure 6 Positive and Negative changes along with project duration

Changes that increases the planned and working cost is considered as negative change and changes that decreases the planned and working cost is considered as positive change. Figure above shows that the cost of positive changes is much greater than the negative changes. It also shows that number of positive changes at initial time is less than the number of negative changes towards the progress of project. In this case study the total cost of positive changes is rupees 2.55cr and negative changes is rupees 65.11lacs only. This figure results that the cost and number of positive and negative changes are not constant.

XVI. IMPACT OF CHANGES

• Total Impact of Change Cost

Project Time	Change Cost per Month	Planned Cost Per Month	Total Planned Cost	Changed % Cost in Planned Cost per Month	Changed % Cost in planned Cost
Oct	12774206.95	39952034.35	228068928.6	31.97	5.60
Nov	13152126.95	64585067.21		20.36	5.77
Dec	2469244.16	47364605.89		5.21	1.08
Jan	1686297.6	48347745.22		3.49	0.74
Feb	1977805.752	27819475.97		7.11	0.87

Table 5 Impact of Change Cost

Table above gives the information about percentage of changed cost that influenced the planned cost. Total impact of changed cost is 14.06% and it was found by the following formula suggested by Chao Chen, 2015

Step 1-

$$\text{Total project change \%} = \frac{\text{Total Project change}}{\text{Project budget}} \times 100$$

x 100

Step 2-

$$\text{Project cost overrun due to change \%} = \frac{\text{Project expense due to change} - \text{Project budget}}{\text{Project budget}} \times 100$$

Where,

$$\text{Project expense due to change} = \text{Increased cost of project due to total cost of changes} - \text{Project budget} = \text{Planned cost of project}$$

Step 3-

$$\text{Project cost overrun due to change \%} = \frac{228068929 - 234580196}{228068929} \times 100 = 2.85\%$$

Cost overrun due to changes is 2.85%

Following bar chart illustrates the percentage change in budgeted/planned cost of the month. Another bar on side in each respective month gives impact of change on total budgeted cost of project. It is evident from the chart that the significant changes on cost were experienced in the initial stages of project. But as the project proceeded further these changes diminished. The bar chart also signifies that the changes are unpredictable and not constant.

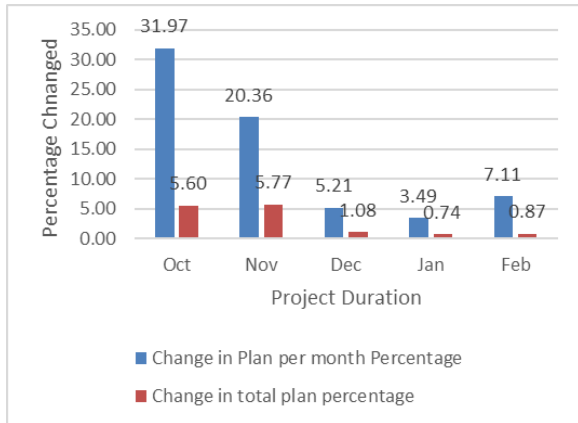


Figure 7 Bar chart of planned changed cost percentage per month

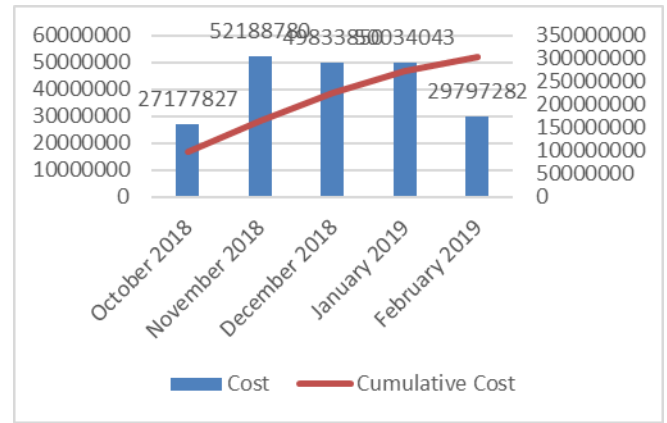


Figure 9 Cash flow with Changed Cost

• Change cost impact on planned cost

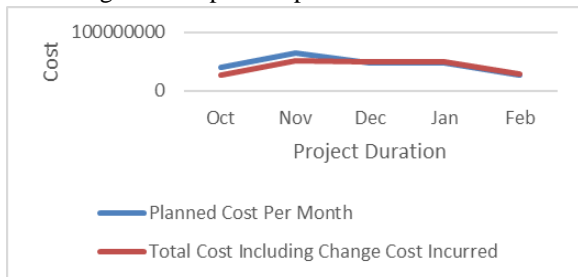


Figure 8 Impact of changed cost on planned cost

Above area chart shows impact of change cost on planned cost. Planned cost was decreased as the change was positive and planned cost was increased as change was negative. It means nature (positive, negative) of change is inversely proportional to the budget of project. Planned cost was increased by 2.85% and decreased by 11.20%. Graph also shows the fluctuations in planned cost due to change cost along with the project duration.

• Cash flow after change cost

Below bar chart shows the cash flow after changes adding changes into it. Y-axis shows cost and cumulative cost. Cash flow divides whole budget into per month budget that means it gives per month planned cost. Given bar chart shows cash flow with the changed cost.

• Market Feasibility

Project Location	Kalyani Nagar
Land Location	located on nagar road highway, Kalyani nagar, which is located at 1km from Pune Airport and 6.5 km Pune railway station
Competitors	Eon It Park, Magarpatta It Park, Barclays, Gega Space, Cerebrum
Amenities	Gym Clubhouse, Centralized HVAC system, Fire Fighting System, STP, Water Purifier SYSTEM, 12 Passenger lift, office automation, LED Lights in common area Roof Garden / Party Lawn, Cafeteria, Open Garden etc.
Target Group	IT Companies, Corporate Companies, Investors.
Average Unit Size (Sq. Ft)	500 -3000 Sqft

Table 6 Market Feasibility

CONCLUSION

The proposed project was found to be feasible by the market, technical, financial, environmental feasibility. The market feasibility done in the proposed site in Kalyani Nagar is found feasible by location. The various amenities make the project Grade A. The technical feasibility is feasible by using the specified technological methods suggested. The financial feasibility infers, 34% of gross profit is achieved to the construction company, making it feasible. The proposed project will be verified through the LEED India NC criteria for environmental feasibility. Thus, this building will be rated as —certified green building —and also environmentally suitable project. The proposed project will be profitable provided the execution of the project does not exceed the timeline, minimum wastage of resources, no compromise in quality & minimal cost escalation.

As per the study of impact of change cost on planned cost it is found that positive changes decrease planned cost whereas negative changes increase the planned cost. Impact of change cost percentage is not constant throughout the project each types of change have different impact on overall project cost. Cost increased due to changes is 2.85% of the planned cost. Calculated percentage for the cost increased seems small as compare to total project cost, but it is significant.

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