

VIABILITY OF TALL BUILDINGS FOR 70 STOREYS IN AHMEDABAD

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ABSTRACT: viability of tall buildings in Ahmedabad (above 70 floors) incorporate and enlighten current real estate market trends and suggests crucial alternatives to make tall buildings above 70 floors viable in Ahmedabad. Key factors identified will help construction professionals and designers in terms of technical, economic and social aspects for making tall buildings above 70 stories viable in Ahmedabad. The research enfolds key factor like CGDCR norms, suggested technology, location assessment, social acceptance, operational issues, and broad financial feasibility.

Keywords: viability, tall buildings, 70 storeys, Ahmedabad

INTRODUCTION

Tall buildings, also known as "vertical City," consume the potential for urban decongestion. . The definition of a tall building is subjective considering factors like high relative to context, footprint/slenderness ratio. Building height (Architectural height) less than 300 M is considered a tall building, and between 300 M and 600 M, there are considered super tall buildings (Council for tall building and urban habitat, 2020).

Ahmedabad is currently India's most affordable market, with an affordability ratio of 24%, followed by Pune and Chennai, with affordability ratios of 26% for both cities (Knight Frank, 2020). To restrain the expansion of urban open space tall buildings is the likely option successfully adopted by tier 1 cities like Mumbai, Bangalore, Delhi etc., and it's time for Ahmedabad to learn and implement.

NEED

According to the 2011 census, the population of the Ahmedabad district is estimated to be 7.271 million, with an annual growth rate of approximately 2.05 percent. With exponential growth, Ahmedabad's population will reach 8.728 million by 2020 (AUDA, 2021), and the household to population ratio is 4.72, implying that the number of households expected in 2020 will be 1.85 million. (Guj RERA, 2019-2020)

Since Ahmedabad is India's first world heritage city (UNESCO, 2017) and India's third most livable city (Ministry of Housing and Urban Affairs, 2020), population growth in AMC limits is expected to be 15% by 2031 (expected need of housing for population 10 lakh); it is expected that Ahmedabad will require compact and efficient real estate. Since we are in the process of transitioning from horizontal to vertical development, it is critical to learn and access professionals involved to achieve collective progress for the real estate sector of tall buildings in Ahmedabad. The term "viability" refers to the ability to survive before any proposal's design and development process, and it is important to conduct thorough evaluations. Viability assesses the project's impact and its ability to satisfy user demands and make efficient use of resources. Since it is a new real estate sector for Ahmedabad and an unexplored part of the construction industry, the viability of tall buildings in Ahmedabad plays an important role in justifying fiscal, legal, operational, and other aspects.

OBJECTIVE

- To study the demand for residential and commercial properties in Ahmedabad.
- To investigate how the project's land cost and location affect its viability.
- To explore and comprehend the social and financial viability
- To evaluate likely change in construction costs of residential building as a structure's height rises.

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SCOPE OF THESIS

- The thesis identifies a land parcel for the case study and mapping it using Arc GIS following Gujarat government bylaws for tall buildings.
- The comprehensive study includes the following analysis of parameters:
 1. Location of the plot (Government of Gujarat Urban Development and Urban Housing Department, 2020)
 2. Design / Configuration of the project (Residential)
 3. Cost
 - Land cost (change in land cost as per location)
 - Construction cost (incremental computing cost due to rise in building height)
 - Approval cost (FSI / TDR premium)
 4. Operational / implementation challenges (Construction technology, firefighting facility by AMC, services etc.)
 5. Social acceptance for tall buildings in Ahmedabad.

AIM

The primary aim of this study is to determine the viability of tall buildings in Ahmedabad by emphasizing, identifying and evaluating key parameters such as land cost, construction cost/development cost, building bylaws, social acceptance, and overall financial viability. Are there any additional preparations or modifications that should be made to make it viable. To provide in-depth knowledge to stakeholders involved about change in the viability of the project as building high rises.

LIMITATION

- Considering tall structure to be residential.
- Built-up considered 25% of carpet area and ground floor coverage to be 45% of land area.

LITERATURE REVIEW

On 18th August, 2020 Gujarat government proposes the variation in CGDCR 2017 (part-III), declaring approval for a tall building above 100 meters with prescribed bylaws.

Tall buildings: According to a tall building and urban habitat, there is no absolute definition of what constitutes a "tall building". The definition is subjective, considering height relative to context, proportion and embracing technology relevant to tall buildings. (Council for tall building and urban habitat, 2020)

As per the current real estate trend and existing high-rise structures in Ahmedabad, structures above 100.00 Mtr and an aspect ratio of more than or equal to 9.00 are considered tall buildings.

Jantri: Land value certificate is another name for Jantri. The Jantri Rate is a predetermined rate set by the competent authority at a specific time. Jantri is a document issued by a

competent authority that specifies land and structures. Rates are adjusted and updated regularly, with necessary adjustments made as required. The land value on a Gujarat land certificate is based on the current market value in the area.

Sensitivity Analysis: Sensitivity analysis determines how the measure of worth – PW or AW or ROR alters variations in a particular parameter such as revenue or operating cost or salvage value. The measure of worth is compared with the basic criteria for the selection of the project. Sensitivity analysis is also a tool to provide feedback for taking an informed decision, and few scenarios must be considered.

- Decrease in net income by 10%.
- Increase in project cost by 10%.

Residual or development method: A hypothetical construction scheme is another name for this form. This approach calculates the potential increase in net income from a property if certain additions, alterations, or adjustments are made. The estimated cost of such improvements, alterations, or adjustments is calculated. The difference between the rise in capital value and the estimated cost of the additions is the property's future value. If the property is only open ground, an attempt is made to value it using figures based on the calculated financial results of hypothetical building construction on the considered land and its theoretical growth in the most profitable way.

This approach is useful for properties with construction or re-development potential, and it is used when a property's latent value can be increased by spending money on it.

The method can be expressed in simple equations as follows

$$A - B = C$$

A = Value of the completed development

B = Total spending on improvements, including developer profile

C = Value of the site or property in its current state.

Square meter method - in this method, the area of each floor of the proposed building is calculated in square meters. Then, Approximate

- **Cost of Proposed Building** = Total area of all floor x cost per Square meter of a similar existing building.

Quota sampling is a nonrandom sampling technique in which respondents are chosen based on predetermined characteristics. The total sample will have the same distribution of characteristics as the wider population. (Chinelo Blessing and Chioma Anyanmu, 2012)

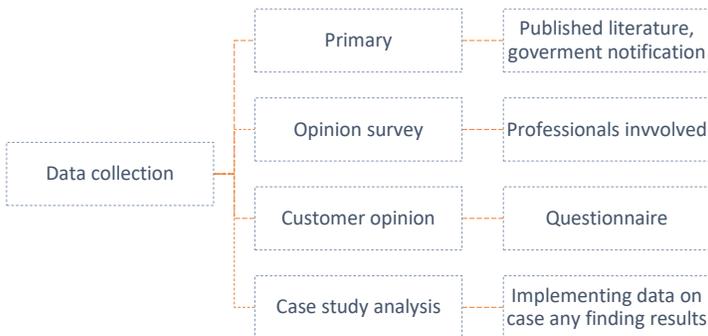
Profitability index is defined as:

$$\text{Profitability index} = \frac{\text{PV of future cash flow}}{\text{Initial Investment}}$$

Every project/investment with a profitability ratio of more than 1.00 is considered a viable project. (Cassimatis. P, 1988)

DATA COLLECTION

In a mixed-method study, qualitative and quantitative data are combined in a single framework. As compared to using a single research design, mixed methods research incorporates composite techniques that combine to optimize strengths and minimize weaknesses. This approach is primarily used in fields such as initiating, creating, designing, and extending interpolations. (Syed Muhammad Sajjad Kabir, 2016)



Stakeholder responses: For data collection from stakeholders in real estate industries, open-ended interviews were conducted, and google forms collected further responses. An open-ended interview is an interview in which

the interviewee is asked broad ended question/ basic question. In this interview, the answer cannot be a closing statement.

Ahmedabad based developer, contractors, Electrical consultant, MEP consultant, Firefighting Contractors, structural Consultant, Architects, Civil contractor, Plumbing contractor, government authorities, Firefighting authorities at AMC were approached for the interview, and their opinion on tall building viability in Ahmedabad was noted.

- Ahmedabad is a demand-driven market for residential units.
- The current real estate market demands yield for considering a residential building for the possibility of a tall building in Ahmedabad if there is any.
- The tall building of 70 storeys is likely to have three bhk luxury residential units as per the market analysis.
- Looking at the city's growth patterns and market demands, the location for such new configurations must be in western Ahmedabad in areas like Bodakdev, SG Highway, Sindhubhavan Marg, Bopal etc.
- As such a project must be in a posh neighbourhood, redevelopment strategies might also affect the project's viability.
- Unlike adopting other design learnings from metro cities like Mumbai and Delhi, the seismic zone may affect the construction cost of the overall building design.
- According to respondents, the AMC fire department is not well equipped or trained for 70 storied structures yet.
- From a developer's perspective, it is imperative to have an established reputation in the market as the tall building project is the upcoming sector of real estate markets in Ahmedabad and is also a key to gaining maximum customers' trust.
- Meanwhile, according to local design consultants, there will be approx. 10% increase in design factor of concrete and 15% increase in design factor of reinforcement at every ten floors interval.
- The incremental number of floors must access and understand social stigma like customer acceptance for a tall building. As per the survey conducted, 81.80% of the stakeholders think that customer acceptance is the biggest challenge, followed by technology adaptations and safety norms.
- According to the survey, 64% of Local contractors are not well equipped with the latest advanced technology, which is a must for any tall building construction.

- Contractors suggest that the type of contract must be shifted to 'with material contract' from labour contract, as it may create hurdles in the project timeline.
- The 70 storeys project should at least consist of 2.00 numbers of towers. Hence the land parcel shall be acquired accordingly.

Customer Responses: For the collection of data from the customer, google forms were circulated to understand social stigma, customer acceptance, to understand the willingness of the customer to pay a premium cost to get a view from a higher altitude, what type of project is expected (configuration, number of towers), preferable location, Source of income, yearly income, parking space expectation, willingness to pay higher unit price compared to the average price in that area. Responded target was here were between age group 20-70 years old.

Survey sample size (customer response): The focus on launching an affordable product remained strong as 75% of the launches occurred in the ticket sizes under INR 5 million. The INR 2.5 – 5 million ticket size saw 53% of the total launches in H1 2020. 16% of the units were launched in the INR 5 – 7.5 million ticket size while 3% between INR 7.5 – 10 million. (Knight Frank, 2020)

For any 3bhk in west Ahmedabad of 2025 Sq.Ft average price is 1.5 Cr. and as per RBI norm, the maximum loan amount for a home loan can be for a maximum of 65%.

SR.NO	DESCRIPTION	UNIT	VALUE
1	3bhk unit price	₹ Cr.	1.50
2	RBI norm for home loan maximum	%	65
3	Loan amount	Cr.	0.975
4	Loan tenure	Year	20
5	Interest rate per year	%	6.75
6	Loan EMI per month	₹.	73,755

Concluding that home loan will consume 50% of monthly income. Hence yearly income must be above ₹ 15 lac.

As per income tax department statistics, there are 2.82 million taxpayers with yearly incomes above 15 lakh in India with a population (Income Tax Department, 2018-2019) of approx. 1,366.42 million in the year 2019 (World Bank, 2019), hence assuming taxpayer to the population for

Ahmedabad having population 82.7 million (AUDA, 2021) will give 170.00 thousand number of eligible respondent.

Yaro Yamane Statistical Formula is adopted for finding the sample size of a finite population. This method is only applicable when the numerical strength of the population is known. The formula is:

$$n = N / [1 + N (e)^2]$$

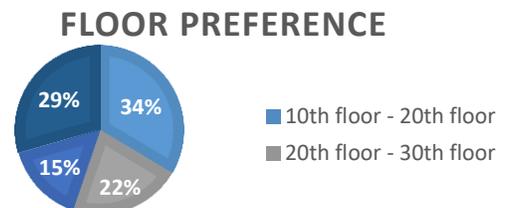
Where;

- n = the sample size
- N = the finite population
- e = the level of significance or limit of tolerable error
- 1 = unit or a constant

The number of responses required for customer opinion from 170676 population with confidence level 95% and margin of error to be 6.5% gives 236 respondent. So a total of 143 responses were collected through the survey. (Chinelo Blessing and Chioma Anyanmu, 2012)

Comprehensive learning outcome (customer): After all the responses received collective responses and mentioned below

- It is seen that 54% of respondents are willing to stay in bungalow rather than high-rise structure.
- Of all the respondents, 52% have the main source of income from the business, 42% have their primary source of income from the service sector.
- Considering social acceptance, only 29% of respondents are willing to buy property above 40 floors.



Bifurcation with respect to the age group willing to buy property is as mentioned below:

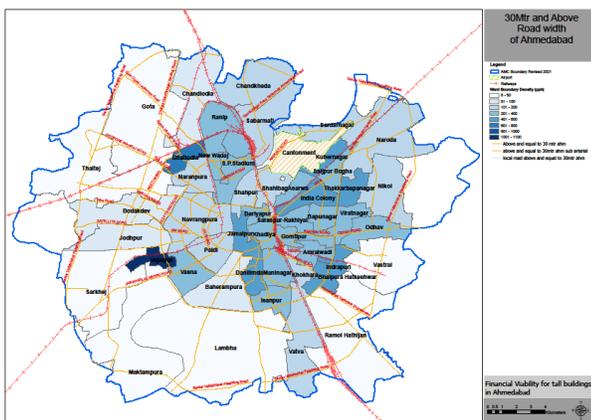
Sr. No	Age group	Floors			
		10-20	20-30	30-40	above 40
1	20-30	5	5	12	18
2	30-40	11	13	6	11
3	40-50	9	9	1	6

4	50-60	16	2	7	8
5	60-70	3	0	0	2

- Data presented shows that as the age group increase, the willingness to buy property at higher floor decreases.
- For any 70 storeys residential project in Ahmedabad, it has to be 3Bhk.
- The appropriate floor range from the survey is concluded to be 20-30 floors.
- From all the responses received, 57% of customers will prefer to buy a high-rise property between 10 - 20 storeys over buying in 70 storey structure at a 20% higher rate.
- As the current trend for extra premium cost for the view as number of floor increase, 55% respondent are not willing to pay extra premium cost.
- The number of towers and parking required for 70 storey building as per respondents are 2 Nos.
- As per the survey, 64% of respondents would like to buy property in the western and central areas of Ahmedabad.

DATA ANALYSIS

Road-mapping: As per the Tall building guideline provided by the Gujarat government, that tall building above 100.00 Mtr can only be constructed on land parcel having an abutting road width minimum of 30.00 Mtr (Government of Gujarat Urban development and Urban Housing Department, 2020)



As per road mapping, CGDCR norms for a tall building in Ahmedabad eligibility of land parcel include road width equal to or greater than 30.00 m, land parcel size minimum 2500.00 Sq.Mtr for tall building above 100.00 Mtr and up to 150.00 Mtr, 3500.00 Sq.Mtr above 150 Mtr were selected across Ahmedabad. As per stakeholder and customer

learning outcome, a feasible location for 70 storey structures is the west and central (riverfront) area of Ahmedabad. As per the customer survey, 64% of the respondent would like to buy property in western areas of Ahmedabad. For further case study, 5 land parcels are selected as per survey opinion, which is mentioned below.

Plot Identification	Area (Thd. Sq. Mtr)	Area (Lakh. Sq.ft)	Frontage (Mtr)	Location
Plot A	27.762	2.988	300.00	Riverfront
Plot B	3.621	0.390	80.00	Ashram road
Plot C	25.368	2.731	165.00	Iskcon mall
Plot D	5.587	0.602	97.00	SG highway
Plot E	13.660	1.471	160.00	Sindhu Bhavan Road

Assuming the project to be a 3Bhk luxury residential unit considering customer opinion of 140.00 Sq.Mtr each unit and 4 unit per floor. Hence per floor, FSI consumed will be 560.00 Sq.Mtr. Following plots are analyzed for further study.

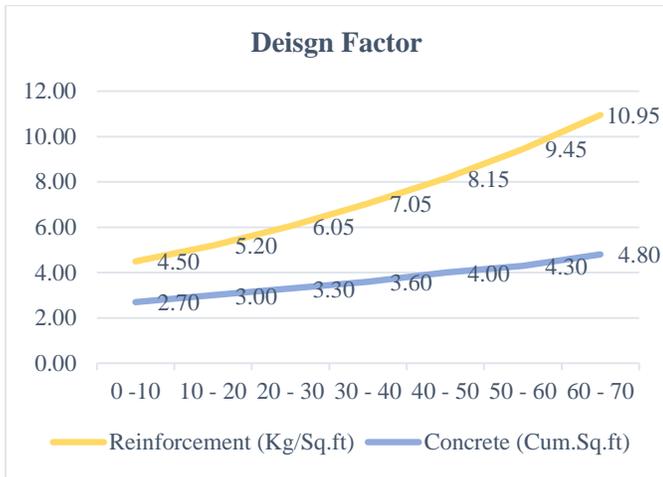
Area Computation: As per thumb rule market practice, Common area varies in every project within the range of 15-35% of carpet area between 10-70 floors. Hence 25% is considered here to bring everything in comparable bases.

AREA COMPUTATION		
Floor	Total built-up area	
Nos	Sq. Mtr	Sq.ft
10	7,000.00	75,347.30
20	14,000.00	1,50,694.60
30	21,000.00	2,26,041.90
40	28,000.00	3,01,389.20
50	35,000.00	3,76,736.50
60	42,000.00	4,52,083.80
70	49,000.00	5,27,431.10

Cost estimation: Cost estimation is done by comparing construction cost for likely change per Sq.mtr every ten consecutive floors. It is important to estimate the likely change in construction cost every ten floors as in Ahmedabad, and it is important to assess its new upcoming real estate sector. Resources can be managed.

Design factor: The design factor is part of unit square meter quantity estimation, which is used to estimate the quantity of reinforcement and concrete for any project once the quantum of work is derived after the preliminary design of the project is completed.

Below mentioned data is derived by incremental of 15% for reinforcement and 10 % for concrete every ten floors.

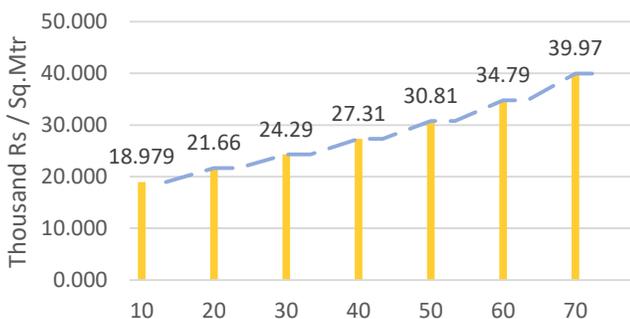


Design factor is approved by professional involved having a minimum of 15 years of experience in constructing a tall building.

For graphical representation, concrete's design factor is multiplied by 10.

Cost interpretation: As we can see, the exponential growth of construction costs every ten floors. There is an average ₹ 3485 increment in the unit price of construction cost every ten floors.

Construction Cost Vs Storeys



As per area computation considering 700.00 Sq.Mtr floor plate and FSI consumption plot A and C are only viable for further viability check.

Project cost estimation: project estimation is estimated considering factors such as average land cost, jantri Rate, construction cost per Sq mtr, premium FSI cost, carpet area, built-up area 25% of carpet area.

Plot C: Iskon Cross road

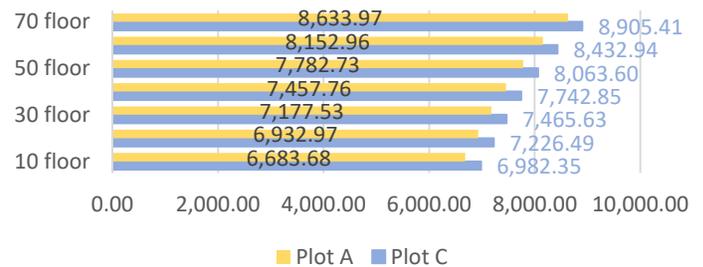
Land Cost: ₹ 910.12 Cr
FSI Premium Cost: 54.61
Builtup area: 1,71,240.68 Sq.mtr

Plot A: Riverfront Opp NID

Land Cost: ₹ 830.10 Cr
FSI Premium Cost: 162.41
Builtup area: 1,87,394.78 Sq.mtr

NO OF FLOOR Nos	TOTAL COST	
	Plot C ₹ /Sa.Mtr	Plot A ₹ /Sa.Mtr
10 floor	75,157.36	71,942.49
20 floor	77,785.26	74,625.79
30 floor	80,359.27	77,258.20
40 floor	83,343.28	80,274.53
50 floor	86,795.74	83,772.50
60 floor	90,771.36	87,757.64
70 floor	95,856.92	92,935.14

Per Sq.Mtr Cost Vs Storeys



Internal Rate of return (IRR): Internal Rate of return is important to check as the project might be viable in terms of profit, but considering the future value and bank interest might change the project viability.

Any project that has IRR below bank interest makes the project not viable. The current interest rate for FD is 5.50 (Reserve Bank of India, 2021). Hence project at plot A and plot C are not viable.

CURRENT MARKET TREND					
Sr.No	Storeys	Plot A		Plot C	
		Profit %	IRR	Profit %	IRR
1	10.00	25.58	4.66	-2.92	-0.59

2	20.00	21.07	3.90	-6.26	-1.28
3	30.00	16.94	3.18	-9.32	-1.93
4	40.00	12.55	2.39	-12.59	-2.65
5	50.00	7.85	1.52	-16.10	-3.44
6	60.00	2.95	0.58	-19.77	-4.30
7	70.00	-2.78	-0.56	-24.08	-5.36

To increase the IRR of both project, the selling price must be received to achieve the expected IRR for and developer, which is approx. 10.00. Hence to achieve the expected IRR selling price for 70 storeys project in Ahmedabad will be as mentioned below

CHANGE IN SELLING PRICE				
AVG. SELLING RATE	PLOT A		PLOT C	
	₹ / Sq.Mtr	₹ / Sq.Ft	₹ / Sq.Mtr	₹ / Sq. Ft
Current	1,13,000	10,500	91,500	8,500
Expected	1,88,400	17,500	1,99,200	18,500

CONCLUSIONS

From all the detailed research by considering factors like social acceptance, location viability, financial viability, Incremental cost as structure high rises, it is concluded that with the current real estate market scenario in terms of demand and supply 70 storeys residential structure is not viable.

Social Acceptance: Since Ahmedabad is concentrically spread out, customers prefer bungalows over apartments. 54% of respondent are willing to buy a bungalow, which implies the vertical growth would be a challenge for a tall building in Ahmedabad. The average selling price of a project rises as the number of storeys rises. 57% of customers would prefer to purchase property in a high-rise structure project with a floor between 10 and 20 storeys, which has a lower per-unit selling price.

Location viability: Concluding data collected from customer and stakeholders, it is likely to have such projects in the western (S.G highway, Ambli bopal, Science city) or central (Riverfront) area of Ahmedabad. Responses received from

customer 64 per cent of buyer would prefer to buy property in western Ahmedabad.

Financial Viability: For making 70 storeys residential project viable yielding approx. IRR 10.00 at plot A and Plot C, then selling price must be revised as mentioned below. There is approximately ₹ 21,900/ Sq. Mtr hike in construction cost between 10 and 70 storeys structure. According to current market trends, the location of both the case studies of 70 storeys residential type of project with the mentioned specification is not viable. IRR is negative at plots A and C, based on average selling prices at the Kochraj and SG highway, respectively.

Construction challenges: As per the survey, it is concluded that 64% of Ahmedabad-based contractors are not equipped with the technology that is required to construct tall structures (70 storeys). Technologies like Auto climbing system, safety screens/working platforms, Aluminium formwork are not introduced in Ahmedabad due to no change in traditional structure and methodology adopted for it. As the project construction timeline increase, which can be due to conventional methodologies, IRR/ profitability may decrease. As per the contractor opinion, it is necessary to implement a contract with material and labour to eliminate maximum mishap due to coordination.

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