



Effects of Metro Project near Residential area

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Abstract: The availability and affordability of housing play a vital role in meeting the fundamental needs of society. Even the slightest change in the surrounding environment can have an impact on housing prices. Numerous factors contribute to this variation. Among them, one crucial factor is the accessibility benefits offered by the surrounding area, which is essential as people need to commute regularly to meet their personal requirements. In the major cities of India, the most versatile transportation option for daily commuting is the Metro Rail Transit System. Over the past few decades, Gujarat has experienced significant urban development, thanks to improvements in road and highway infrastructure and the introduction of the Metro Rail System as a new mode of public transportation. The main objective of this study is to analyze the influence of the metro rail transit system on the prices of residential properties situated in proximity to metro stations. Numerous factors associated with properties located near metro stations have the potential to affect property values positively or negatively. Therefore, this research aims to identify and rank these attributes, and subsequently develop a model that can forecast property prices based on the selected attributes for properties near metro stations. The forecasting of property prices around metro stations in this study was conducted using the Hedonic Price Method, trend analysis, and a questionnaire survey. The findings indicate that the price of a property situated near a metro station is influenced by several attributes, which have been identified and ranked in this study. Additionally, it was observed that the impact of the metro system is more significant in low-income areas compared to high-income areas. Moreover, as the distance between the property and the metro station increases, the value of the property tends to vary.

Index Terms - Effects of Metro Project, impact Residential area

1.INTRODUCTION

India, the world's second most densely populated country with an estimated population of approximately 1.35 billion, faces the need for a transportation system capable of accommodating a large number of people. To meet this demand, there is a requirement for the development of an efficient public transportation system that offers fast and convenient travel options, while also being environmentally friendly and promoting economic growth. In the modern era, a reliable, safe, trustworthy, and comfortable public transportation system is considered an essential aspect of a good quality of life. The Mass Rapid Transit System (MRTS), commonly known as the Metro Rail, is the solution that fulfills these criteria. Metro railways are considered as contemporary, automated, electrically-powered, and eco-friendly means of urban transportation with a high capacity for carrying passengers.

They operate at high speeds on dedicated tracks that are separate from other roads or pedestrian pathways. Metro rail networks are constructed either underground, at road level, or on elevated rails above the ground. These networks consist of designated lines connecting various stations, and they utilize electric multiple units that run on rail tracks. To enhance overall mobility and provide last-mile connectivity, metro rail systems are often integrated with other modes of public transportation, such as local buses, rickshaws, and auto-rickshaws. By implementing a well-planned and efficient Metro Rail system, India can address its transportation challenges and provide its citizens with a reliable, convenient, and sustainable mode of public transport. (Geetesh Malhotra, 2020) Such a system not only improves connectivity but also contributes to a cleaner environment, better mobility options, and the overall growth of the economy.

2.OBJECTIVE

To determine the impact of Metro Rail Transit System on the value of Residential properties at Thaltej metro Station to Gujarat university metro station to find 0.5 to 1.5km properties price From the Hedonic Price Model analysis, the Collected data differentiate in the Three categories based on the size of the house and income of the house like,

Low Income Group (LIG)

Medium Income Group (MIG)

High Income Group (HIG)

To identify and choose the attributes that impacts the value of residential properties along the metro stretch.

3.NEED OF STUDY

The current body of literature predominantly draws from international contexts and may not be directly applicable to Indian cities characterized by significant subway traffic and high population density. Public transportation plays a crucial role in Indian metropolitan areas, and passengers in these areas may exhibit heightened sensitivity to even minor fluctuations in transportation services.

4.SCOPE OF WORK

(Elangovan et al., 2018)The improvement of the country's economy and the expansion of the working population have led to an increased demand for efficient urban transit systems. In this regard, metro rails have emerged as a secure and reliable mode of transportation. With the growing trend of urbanization and the need for faster and interconnected travel, metro rails play a pivotal role in driving a progressive economy.

As the country's economy flourishes and more people join the workforce, the demand for convenient transportation options escalates. Metro rails provide a safe and efficient solution by offering a dedicated infrastructure that is separate from road traffic.

This not only reduces the congestion on the roads but also ensures a reliable and punctual commute for urban dwellers.

5.. Research gap

The research gap in the metro rail project refers to areas or aspects of the project where further investigation or study is needed. It signifies the lack of comprehensive understanding or knowledge in certain key areas related to the metro rail system. The identification of a research gap is essential as it helps to determine the scope for further research, analysis, and improvement in various aspects of the metro rail project. By identifying these gaps, stakeholders can focus on addressing the specific areas that require attention, ultimately enhancing the effectiveness and efficiency of the project. Closing the research gap in a metro rail project involves conducting thorough studies and analyses in areas such as: Cost-Benefit Analysis: There may be a need for further research to evaluate the economic viability and long-term benefits of the metro rail project. This includes assessing the return on investment, the potential for revenue generation, and the overall impact on the local economy. Environmental Impact Assessment: Evaluating the environmental consequences of the metro rail project is crucial. Additional research may be needed to understand and mitigate potential environmental risks, such as noise pollution, air quality, and disruption to ecosystems. Social Impact Assessment: Understanding the social implications of the metro rail system is essential for ensuring its acceptance and integration within the community. Further research can help identify the potential effects on neighborhoods, local businesses, and social dynamics, enabling appropriate measures to be taken to minimize negative impacts and maximize positive outcomes.

2.1 Research Methodology

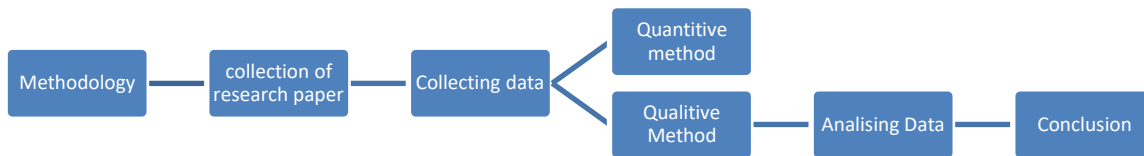


Figure 1 Plan of methodology

2.2 Literature Review

(Tian, 2006) The study conducted in Guangzhou, China, investigates the impacts of two transport projects on residential property values. Although I don't have access to the specific details of the study, generally, transport projects in urban areas can influence property values through multiple factors. Improved accessibility resulting from upgraded transport infrastructure, such as subway lines or highways, can enhance connectivity and reduce travel times, making properties near these facilities more desirable and consequently increasing their value. The convenience provided by efficient transportation options can further contribute to the attractiveness of neighborhoods, positively impacting property values. Additionally, transport projects often stimulate transit-oriented development, leading to the creation of mixed-use neighborhoods around transport nodes, attracting businesses and amenities that increase property values. The presence of well-planned and executed transport projects can also improve the overall image and desirability of an area, driving up property values. It is essential to consider project specifics, local market conditions, and contextual factors when assessing the impacts on residential property values. The Guangzhou study likely provides a more comprehensive analysis of these factors and their influence on the observed property value changes in the city.

(Agostini & Palmucci, 2008) "The Anticipated Capitalization Effect of a New Metro Line on Housing Prices" is a study that explores how the introduction of a new metro line impacts housing prices. The study likely investigates the expectation that the future benefits associated with the metro line will be reflected in current property prices, known as the anticipated capitalization effect. Factors such as improved accessibility and connectivity, reduced travel time, convenience, transit-oriented development, and positive market perception are likely considered. Properties located near metro stations or along the route may experience increased desirability and subsequently higher housing prices due to the anticipated benefits of the metro line. However, the specific impacts can vary depending on local market conditions, the scale of the metro project, and other contextual factors. The study aims to provide a comprehensive understanding of the anticipated capitalization effect on housing prices in relation to the specific metro line under investigation.

(Pagliara & Papa, 2011) The analysis focuses on the impacts of investments in urban rail systems on property values and residents' location choices. Urban rail investments, such as subway or light rail networks, have wide-ranging effects on cities. They enhance accessibility and connectivity, making areas near rail stations more desirable and leading to increased property values. Residents benefit from time and cost savings associated with efficient transportation, which can influence their decision to live near rail lines. Investments in urban rail often stimulate transit-oriented development, creating vibrant neighborhoods around stations and further

driving up property values. Changes in land use and zoning regulations near rail stations can also contribute to increased property values through higher-density developments. Additionally, the positive image and improved perception of cities with well-functioning urban rail systems attract real estate investors and homebuyers, fostering increased demand and higher property values. The specific impacts of urban rail investments depend on various factors, such as the scale of the investment, effectiveness of the rail system, local market conditions, and city-specific characteristics. In-depth analysis within the context of the study would provide a more comprehensive understanding of the effects on property values and residents' location decisions.

(Pilaka & Nallathiga, 2015) The technical analysis of the Hyderabad Metro Rail Project provides a comprehensive evaluation of its technical aspects. It examines the infrastructure, rolling stock, signaling systems, track design, power supply, and communication systems of the metro system. The analysis focuses on assessing the system's efficiency, reliability, and safety, considering factors such as operational performance, passenger capacity, and adherence to engineering standards. It also investigates the construction methods used, evaluating their effectiveness, quality control measures, and adherence to project timelines. The analysis aims to identify areas for improvement and provide recommendations to optimize the technical aspects of the project, ensuring a seamless and efficient transportation experience for the residents of Hyderabad. Detailed findings and specific recommendations can be obtained by referring to the original research, official reports, or technical documentation related to the Hyderabad Metro Rail Project.

(Mohammad et al., 2015) "The effect of the Dubai Metro on the value of residential and commercial properties" is a study that examines the impact of the Dubai Metro, a prominent transportation system in Dubai, on property values in the city. The study likely investigates how the presence of the metro system has influenced the value of residential and commercial properties located near metro stations or along the metro routes. Factors such as improved accessibility and connectivity, time and cost savings in commuting, transit-oriented development, and the positive market perception of the metro system may contribute to changes in property values. By conducting a detailed analysis of local market conditions, the effectiveness of the metro system, and other relevant factors, the study aims to provide insights into the specific effects of the Dubai Metro on property values in both the residential and commercial real estate sectors of the city.

(Elangovan et al., 2018) The study conducted on the Chennai Metro Rail Limited (CMRL) routing system examines its current effects on Chennai and explores its potential for future growth. Although I don't have access to the specific details of the study, it likely analyzes the impact of the CMRL routes on transportation, urban development, and economic growth. The study examines how the existing CMRL routes have influenced connectivity, accessibility, and changes in land use and property values in the areas served by the metro. Additionally, the study may assess the feasibility and potential impacts of expanding the CMRL network to cover more areas of Chennai, considering factors like population growth, urban expansion, and transportation demands. Through quantitative and qualitative analysis, the study aims to provide insights and recommendations for optimizing the CMRL routing system, guiding future expansion plans, and maximizing its positive effects on Chennai's development and quality of life. For specific findings and details, referring to the original research or official reports on the CMRL and its impact would be necessary.

(Sharma, 2018) The Bangalore Metro, a rapid transit system in Bangalore, has the potential to influence land values in emerging cities. Urban rail projects like the Bangalore Metro can increase land values through improved accessibility, reduced congestion, development opportunities, transit-oriented development, and positive market perception. Areas near metro stations or along the metro routes often experience a greater value uplift, as the convenience and connectivity offered by the metro make them desirable for residential and commercial purposes. Additionally, the construction of the metro can attract economic development and stimulate real estate investments. However, the specific impact on land values in Bangalore would require a detailed analysis based on local data and studies.

(Chen et al., 2019) "The impact on neighborhood residential property valuations of a newly proposed public transport project: The Sydney Northwest Metro case study" focuses on analyzing how the Sydney Northwest Metro, a newly proposed public transport project, would affect residential property valuations in the surrounding neighborhoods. Although I don't have access to the specific details of the study, the general theme can be summarized.

(Geetesh Malhotra, 2020) The impact of a metro rail transit system on residential properties is a topic of study and analysis. The introduction or expansion of a metro rail system brings increased accessibility to various parts of the city, benefiting properties near

metro stations or along the route. Improved accessibility often leads to higher desirability and property values. Additionally, a well-functioning metro system reduces commuting time, attracting residents seeking convenience and efficiency. Transit-oriented development, where mixed-use communities are built around transit stations, can further enhance property values by providing access to amenities and services. The construction of a metro system can also influence development patterns, concentrating businesses and services near stations and increasing property values in those areas. The positive perception and image associated with a reliable public transportation system can also impact property values. However, the specific impacts depend on factors like the metro system's characteristics, local real estate market conditions, and the overall urban context. Detailed analysis and location-specific studies are necessary to gain a precise understanding of how a metro rail transit system affects residential properties.

(Prasad et al., 2022) The study on the response of urban real estate values in anticipation of the Washington Metro examines the impact of the metro system on property values in the surrounding areas. It analyzes how the announcement and development of the Washington Metro have influenced real estate values, considering factors such as improved transportation infrastructure, enhanced connectivity, and accessibility. The study likely employs methodologies like hedonic pricing models or regression analysis to quantify the effects of the metro system on property values, taking into account variables such as proximity to metro stations, changes in land use, and market dynamics. The findings aim to provide valuable insights for policymakers, urban planners, and real estate stakeholders, assisting in decision-making processes related to urban development, transit-oriented planning, and the potential economic benefits associated with similar urban transit projects. By understanding the response of urban real estate values in anticipation of the Washington Metro, the study contributes to the knowledge of the relationship between transportation infrastructure and property markets, informing future urban planning strategies and development initiatives.

2.3 Data Collection

Data will be gathered through two distinct methods: Quantitative Research and Qualitative Research. The collection process will involve the use of questionnaire survey forms or personal interviews conducted with value engineers and other relevant experts on the subject matter. Additionally, data will be obtained from comprehensive case studies.

- Where will the data be collected?
- How will the data be collected?
- What will be the sample size for data collection?

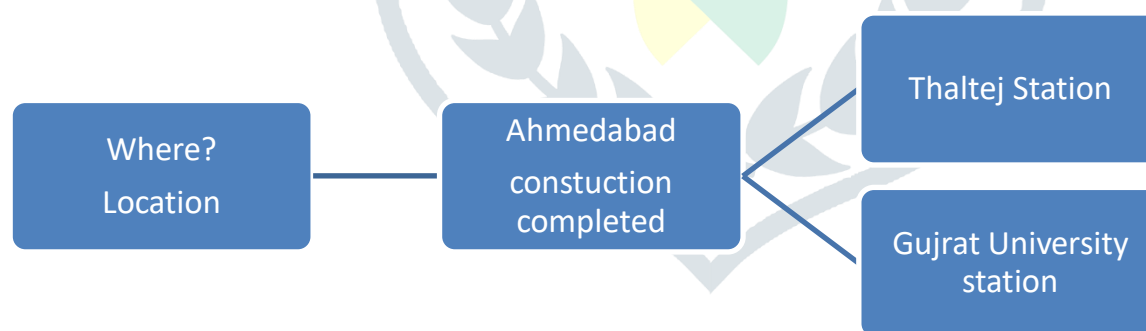


Figure 2 Data collection process

2.4 Questioner design

Strongly agree	Agree	Neutral	Disagree	Strongly disagree
5	4	3	2	1

Table 1 Measure Scale

3.1 Data Analysis

Data analysis plays a pivotal role in any research, as it involves the comprehensive examination and summarization of collected data. Through the use of analytical and logical reasoning, data analysis aims to interpret the gathered data in order to identify patterns, relationships, or trends. This crucial process enables researchers to derive meaningful insights and draw conclusions based on the analyzed information.



Figure 3 Process of Data analysis

The Collected data any differentiate in the Three categories based on the size of the house and income of the house like,

- Low Income Group (LIG)
- Medium Income Group (MIG)
- High Income Group (HIG)

And also differentiate into the distance from the metro station like,

- 0.0-0.5 km
- 0.5-1.0 km
- 1.0-1.5 km.

3.2 Data Analysis by RII

The Relative Importance Index (RII) is utilized to assess the relative significance of quality factors in a study. The Likert scale points, ranging from 1 to 5, represent the weighting (W) assigned by respondents to each factor. The RII is calculated using the following equation to determine the relative importance of each factor.

$$\text{Relative Importance Index} = \frac{5n_5 + 4n_4 + 3n_3 + 2n_2 + 1n_1}{A * N}$$

Equation 1 Relative Importance Index Method

Where,

n_5 = Number of respondents for strongly affected

n_4 = Number of respondents for affected

n_3 = Number of respondents for neutral

n_2 = Number of respondents for not affected

n_1 = Number of respondents for strongly not affected

A = Highest weightage

N = Total No of respondent

From this method show the result below which attributes mostly affected the property value and their importance factor

3.3 Factors and Responses

No.	Questions	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1	Property size	15	14	8	5	4
2	Distance from metro station	10	8	5	4	4
3	Criminal activities around metro	20	25	4	4	3
4	Accessibility improvements due to metro	18	21	8	9	5
5	Nuisance due to metro	30	33	2	3	3
6	Traffic congestion around metro	45	25	5	8	6
7	Parking facility by metro	50	35	5	7	8
8	Developments in neighborhood due to metro	25	25	8	6	3
9	Location	40	45	5	8	5
10	Facilities by the municipal corporation	20	15	7	5	4
11	Last mile connectivity from metro	52	45	4	5	4
12	Distance from school	25	42	6	4	7
13	Distance from grocery store	26	25	3	4	9
14	Distance from recreational area	29	24	2	6	5

Table 2 Data collected from questioner

3.4 Factor RII Rank

Table 11 Relative Importance Index of Different Attributes

Attributes	Importance Index
Property Size	0.96
Distance from metro station	0.92
Criminal Activities around metro	0.91

Accessibility Improvements due to metro	0.91
Nuisance due to metro	0.90
Traffic Congestion around metro	0.89
Parking Facility by Metro	0.87
Developments in neighborhood due to metro	0.87
Location	0.87
Facilities by the municipal corporation	0.84
Last mile connectivity from Metro	0.84
Distance from School	0.82
Distance from Grocery Store	0.80
Distance from Recreational area	0.75

Table 3 Result of RII method

3.5 Closing Summary of Data Analysis

Average Price Fluctuation in Ahmedabad City

In Ahmedabad			
Distance from the Metro Station	Group	Price Fluctuation before to after announcement of metro Project	Price Fluctuation after announcement of metro Project to completion of Project
0.0-0.5 km	LIG	2.59% ↓	1.85% ↓
	MIG	1.10% ↓	1.85% ↓
	HIG	3.69% ↓	1.27% ↓
0.5-1.0 km	LIG	8.79% ↑	3.14% ↑
	MIG	6.59% ↑	3.97% ↑
	HIG	5.32% ↑	2.56% ↑
1.0-1.5 km	LIG	2.67% ↑	1.59% ↑
	MIG	2.08% ↑	1.18% ↑

Table 4 Average Price Fluctuation in Ahmedabad City

In closing summary of Ahmedabad city data there was price decrease in radius of 0.0-0.5 km and after that 0.5-1.5 km price of properties are increased and in the third radius price will increase but not as much like in second radius prices are increased in Gujrat university metro station & Thaltej metro station There are average percentage of decrease and increase with respectively 1-2% ↓, 8-9% ↑, 3-4% ↑.

4. Conclusion

4.1 General Conclusion

The price of a residential property near a metro stretch is influenced by several factors. These include the proximity of the property to the metro station, the distance from recent developments in the neighborhood triggered by the metro, the overall area of the property, the presence of an interchange station, last-mile connectivity options, accessibility upgrades facilitated by the metro, as well as any nuisances associated with the metro, such as criminal activity, traffic congestion, and availability of parking facilities. All these factors contribute to determining the value and desirability of residential properties located near a metro stretch. RII method are calculate following equation to determine the relative importance of each factor. Attribute mostly affected property value size top 5 Attributes

Property Size (0.96), Distance from metro station (0.92), Criminal Activities around metro (0.91), Accessibility Improvements due to metro (0.91), Nuisance due to metro (0.90).

Through the price trend analysis by Hedonic Price Model analysis, it is determined that there was price decrease in the radius of 0.0 to 0.5km. Therefore, maximum price increase in the property was seen which comes under the radius of 0.5 to 1.0km in the areas like Gujarat University Metro Station and Thaltej Metro Station. As there was slight price hike in the price of the property that comes under the radius of 1.0 to 1.5km.

4.2 Future Scope

India, being a developing country, is set to witness significant growth in upcoming years, with numerous metro projects planned and implemented in various cities. This study holds great value in determining property values and assists individuals in making informed investment decisions in the real estate sector. Additionally, the findings of this study can be valuable for government authorities in determining the strategic placement of metro stations, thereby fostering development and improvement in the respective areas.

5. Acknowledgment

The seminar brings about dramatic changes in the traditional lookout of science & technology. It has widened our vision, opened newer avenues, and lightened the dark obscure facts of the mysterious universe. Behind every success, there are lot many efforts, but efforts are fruitful due to hands making the passage smoother. I express my deep sense of gratitude for hands, people extended to me during my work. I would like to thank my Guide **PROF. ANKIT S. PATEL**, Professor of Civil Department & PG CO-ORDINATOR of M. Tech. (CEM), UVPCE, for his moral support, constant unceasing encouragement, critical evaluation, suggestion, constant untiring guidance and affection throughout this project. With reverence and gratitude, I would like to thank **PROF. JAYRAJ V. SOLANKI**, Professor of Civil Department & PG Head of M. Tech. (CEM), UVPCE who has provided me the necessary knowledge and guidance for enabling this project work successfully at regular interval. Further, I would like to thank my friends who have encouraged me over the course of this project and stood by me and provided all the necessary help to complete my work. Finally, I want to thank my family. My parents, especially, have been a source of strength and support for me. They continually push me to think critically and never settle for anything less than my best. They kept me focused, on track and fed in the final stretch of my project. For their continual support, I am forever grateful.

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