



# **IMPACT OF METRO STATION IN ITS IMMEDIATE NEIGHBORHOOD – A CASE STUDY OF CHENNAI METRO RAIL CORRIDOR**

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## **ABSTRACT**

*Metro stations around the world have contributed to the development of the space surrounding the station. The intensity of development depends not only on the metro station but on lot of other parameters like availability of developable land, population density, existing intermodal connection, distance to the Central Business District (CBD), etc. Through literature the possible parameters which influence the development surrounding the metro station is identified and analysed to rank the stations of the Chennai metro rail 1st phase. This ranking will help to forecast the development which is likely to happen surrounding the metro station, helping the authorities in formulating suitable development regulations surrounding the station.*

**Keywords:** Impact study, metro station, parameters, Chennai Metro rail

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## **1. INTRODUCTION**

Transit system plays an important role in the development of a place. Especially Mass Rapid Transit systems are often related to better accessibility and infrastructure facilities which results in rapid developments surrounding the transit station. Government of India is emphasizing on the need to have mass rapid transit system in all major metros to strengthen the public transport systems, and many cities have started to develop their own metro rail corridors. These metro rails will definitely have an impact on the developments about to happen in the immediate vicinity of the stations. It is important to access the impact of these

metro stations so that necessary planning interventions can be done in advance to get benefit out of it.

The aim of this study is to identify the metro station which will have the most and the least impact on the developments in its influence zone. The objective is to identify the parameters through the literature which influences the development pattern surrounding the metro stations. The identified parameters are then classified into primary and secondary based on its importance and necessary weightages are attached to it. The stations are then analyzed based on the parameters to rank the station which will have the most and the least impact due to the functioning of the metro rail.

## **2. LITERATURE STUDY**

Cervero et al. (2011) finds that Transit system alone is likely to be a necessary, but by itself insufficient factor in intensifying land-use development and increasing land values surrounding the station. Coleman et al. (1993), says that market forces were found to be the most prominent factor in contributing to the development of the space surrounding the transit station, and in turn rail transit system encourages high density developments near the station which contributes to land use/land development decisions. He concludes that it is a cyclic process.

Hurst N (2011) finds change in land use especially the conversion of low density housing to denser use was observed only up to 90 feet from the station after LRT went into operation and Industrial properties within 1-mile distance from the stations were 10% more likely to experience land use change. Jun (2011), says that BRT service have contributed to the increase in development density in urban centers, attracting more firms from the suburbs, but has a limited effect on the redistribution of residential activities, implying a lower sensitivity towards residential locations due to the BRT-related accessibility improvements.

## **3. METHODOLOGY**

The parameters which impact the developments surrounding the metro stations are identified through literatures. The parameters are then classified into primary and secondary based on its importance and contribution towards developments surrounding the metro station. A weightage of twenty points is given to Primary parameters and ten points to secondary parameters. Influence zone surrounding the stations are analyzed through the identified parameters and ranked accordingly following a relative scale.

## **4. STUDY AREA – CHENNAI METRO RAIL CORRIDOR (1<sup>ST</sup> PHASE)**

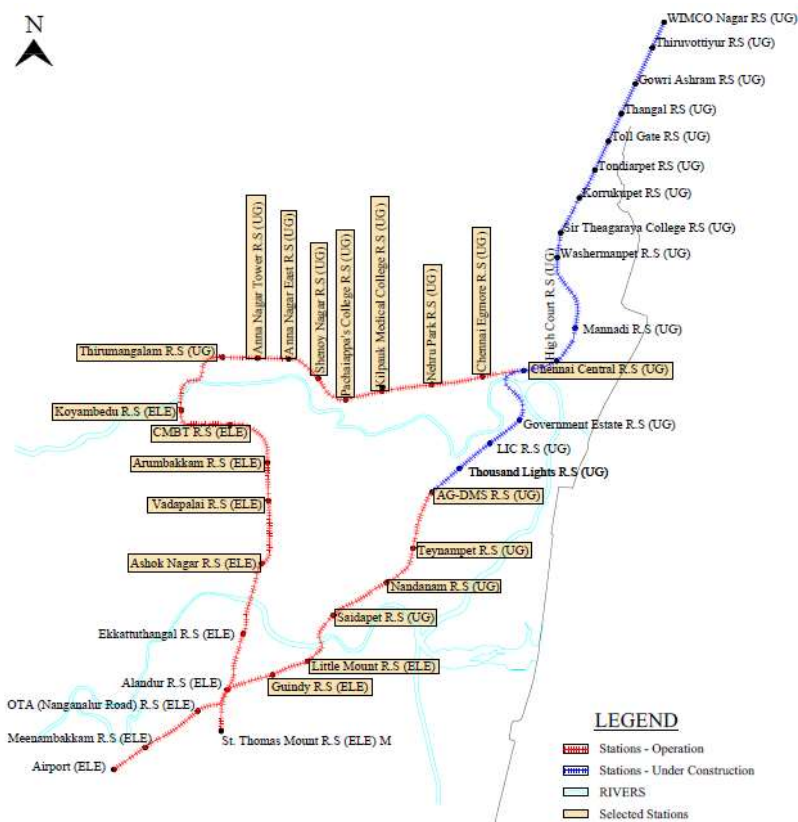
The 1<sup>st</sup> phase of Chennai Metro rail corridor consists of 33 stations covering a length of 45 Km. The stations which are located within the city limits, excluding cantonment area and which are under operation during the time of the study (October, 2018) were taken up for the analysis. (Refer Map: 1).

## **5. CONSOLIDATION OF PARAMETERS BASED ON THE LITERATURE**

The identified parameters and their source of secondary data are given in the table below.

**Table 1** Consolidation of Identified parameters which are taken for detailed study

| Sl. No | Identified parameters for detailed study | Source of Secondary Data                                        |
|--------|------------------------------------------|-----------------------------------------------------------------|
| 1      | Population Density                       | Greater Chennai Corporation Disaster Management Plan, 2017      |
| 2      | Land use                                 | Chennai Second Master Plan – Proposed Land use 2026             |
| 3      | Proximity of Transport Network           | Google Maps                                                     |
| 4      | Accessibility                            | Google Maps                                                     |
| 5      | Nearest to CBD                           | Google Maps                                                     |
| 6      | Social facilities                        | Google Maps                                                     |
| 7      | Land value                               | Property Websites like 99acres, Makaan, Magicbricks and Sulekha |
| 8      | Availability of land for development     | Google Maps                                                     |

**Map: 1** Chennai Metro Rail Corridor - Selected station for detailed study (20 Nos)

## 6. INFLUENCE ZONE

According to National Transit Oriented Development (TOD) Policy 2017, Government of India, the area in the immediate vicinity of the transit station, i.e. within a walking distance (10 – 12 Minutes), having high density compact development with mixed land use to support all basic needs of the residents is called the influence zone of a transit station / corridor. So a radius of 800m from the transit station is considered as the influence Zone of the metro station.



**Figure 1** Influence zone of a transit station

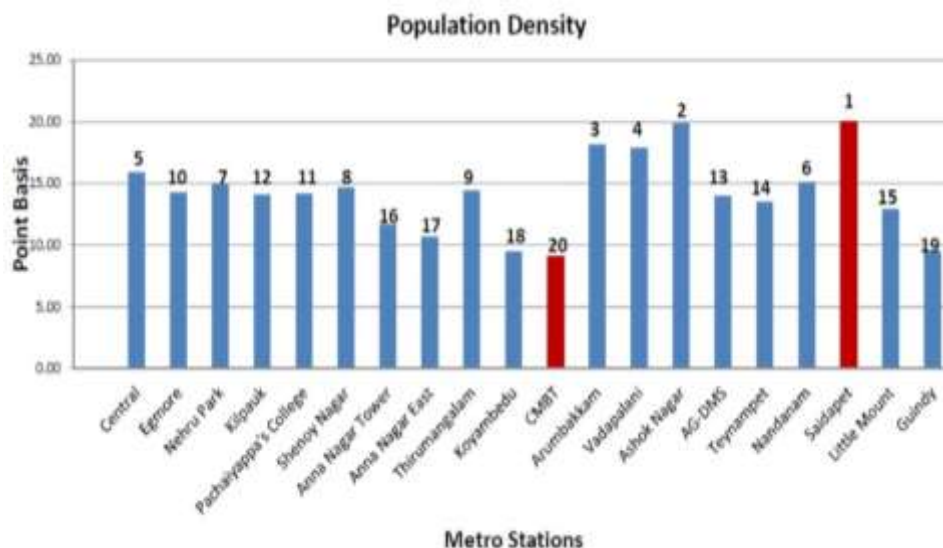
## 7. ANALYSIS

### 7.1 Population Density

Population density is the total number of people residing in a given area usually expressed as persons per square kilometer or per acre, etc. Demographic details are sourced from Greater Chennai City Corporation Disaster Management Plan, 2017, which has the detailed ward boundaries of the city with the population residing based on Census of India 2011 data. Population density is normalized and calculated as shown in table 2.

**Table 2** Population Density

| Station name                | Ward no. | Ward area (within 800 m radius) | Total Ward Area | population | Total population within 800 m radius |
|-----------------------------|----------|---------------------------------|-----------------|------------|--------------------------------------|
| Thriumangalam metro station | 90       | 0.46                            | 1.52            | 31408      | 9356                                 |
|                             | 99       | 1.19                            | 1.64            | 47653      | 34545                                |
|                             | 100      | 0.32                            | 3.16            | 40021      | 3994                                 |
|                             | 127      | 0.04                            | 3.90            | 49000      | 560                                  |
| Total                       |          | 2.01 Sq. Km                     |                 |            | 48455                                |

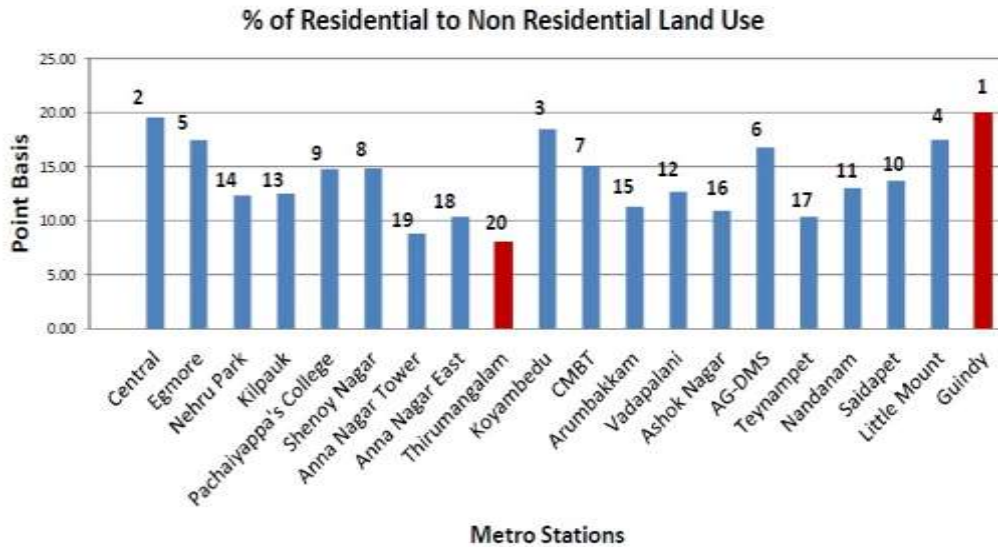


**Figure 2** Population Density of the Metro station

From fig: 2, it is found that the Saidapet station has the highest population residing within the influence zone and gets the maximum points.

## 7.2. Land use

Land use surrounding the metro station will impact the development pattern in that location. The percentage of non-residential land use to other land uses is considered to analyse the impact of land use, since, non-residential areas attract more transport trips than residential areas, which has a direct impact on the transit infrastructure.

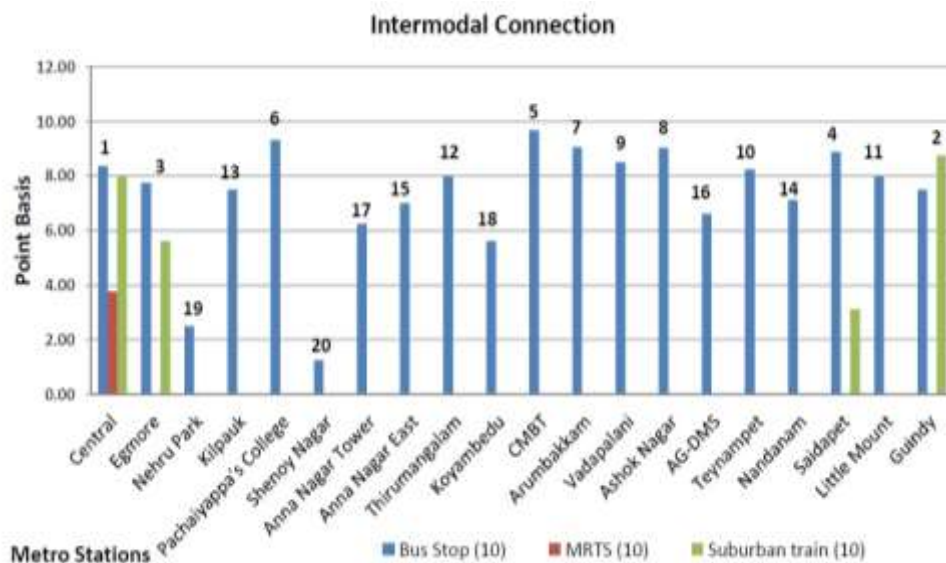


**Figure 3** Impact of Land use on the Metro stations

From fig: 3, it is observed that Guindy station has the lowest amount of residential land use and Thirumangalam station has the highest residential land use.

## 7.3. Proximity of Transport Network

Proximity to transport network influences travel patterns and major transport networks have always been a powerful influence on the pattern of developments near to it. The nearest bus stops, Mass Rapid Transit System (MRTS) and Suburban Rail network stations were considered and its distance from the metro stations is measured to understand the intermodal connectivity between the networks.



**Figure 4** Proximity to other Transport Networks from the metro stations

From the above figure it is seen that Central station, has all the other transport network connections very close to it, making it the busiest transit hubs of the city.

#### 7.4. Accessibility

Accessibility enhances the value of a space, and it's utility. The percentage of land devoted to road network will impact the on-street parking practices. Chennai roads have one or two parking lanes that typically represent 20-30% of their road width devoted to parking. Higher the percentage of road, greater the scope for on-street parking and accessibility of that space.

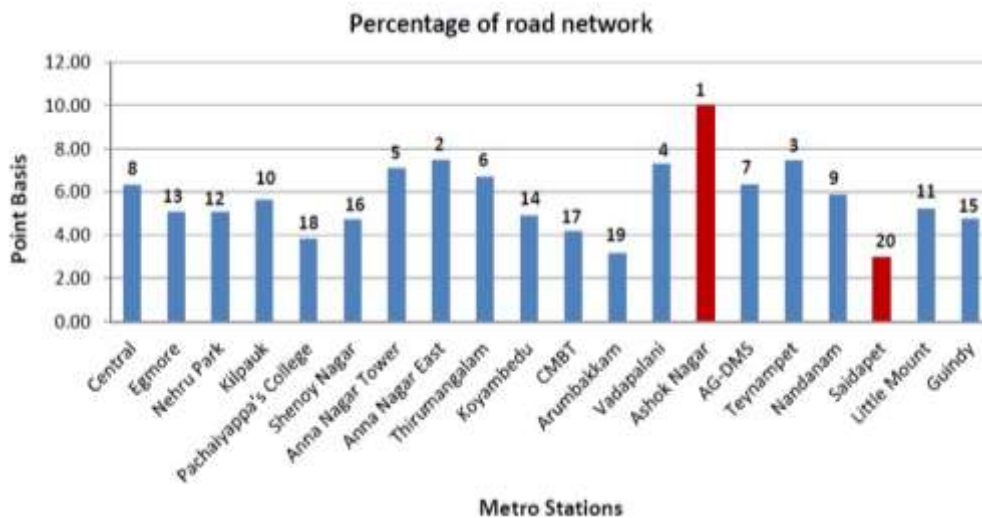


Figure 5 Percentage of road network around the metro stations

From the above figure it is seen that the space surrounding Ashok Nagar metro station has highest percentage of road network which results in more vehicular traffic and development.

#### 7.5. Nearness to CBD

As the distance from the Central Business District (CBD) increases, accessibility decreases which results in lower land cost and higher transportation costs. In Chennai, George Town is the Central Business District (CBD), and the distance of the metro stations from the CBD via road travel is measured. The more the distance, the less is the weightage on ten point bases.

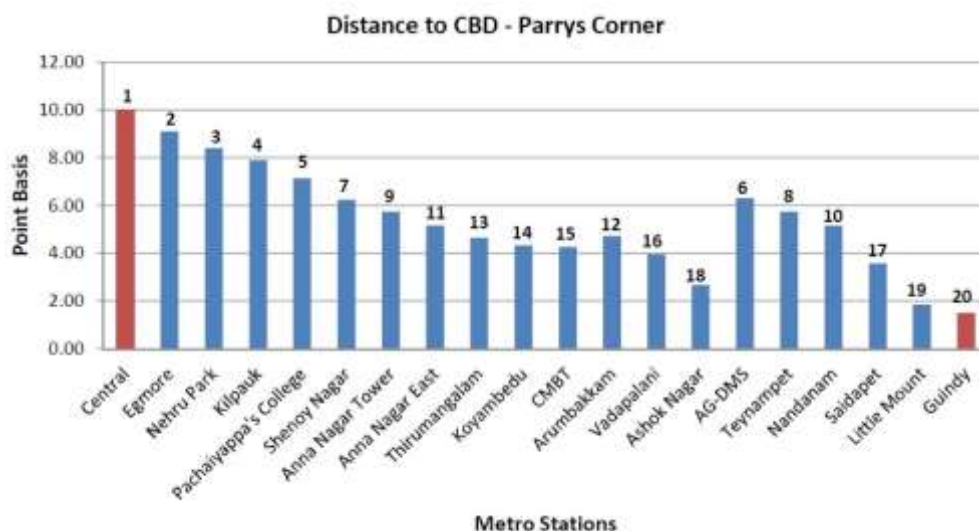


Figure 6 Distance to Central Business District from the metro stations

## 7.6. Social Infrastructure Facilities

Social infrastructure facilities available near the station have an impact with respect to the development pattern around the station. The social infrastructure facilities like Schools, College, Hospital (including health centres), Cinema Theatres and Shopping Mall were identified and added to find the influence of social infrastructure on the development pattern in that area. The weightage is based on number of such facilities.

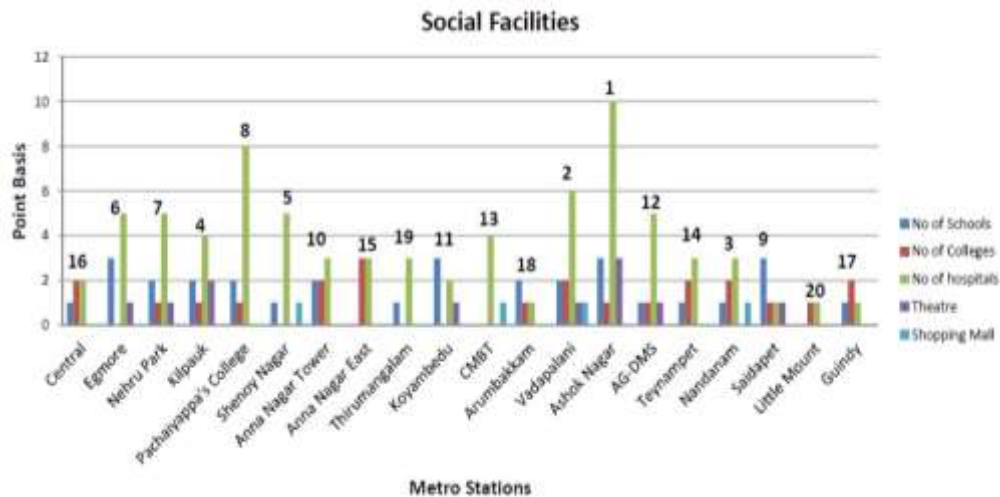


Figure 7 Social facilities surrounding the metro stations

## 7.7. Land Value

Metro rails generally affect the property values in its surrounding locations in a positive way. Residential property values were taken from different property websites and an average is arrived per square feet of residential property (Built up area in an apartment) in the influence zone. It is found that AG-DMS station has the highest value for residential properties per square feet and CMBT station has the lowest value. (Fig: 8)

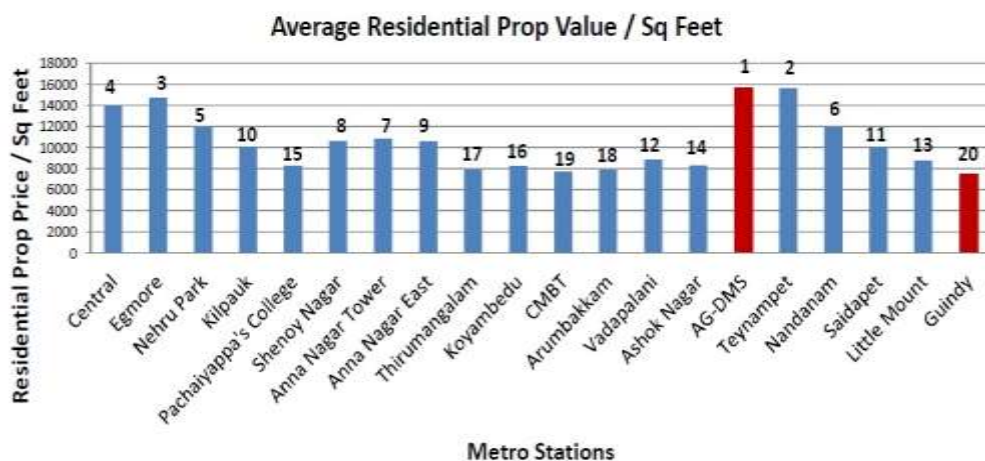
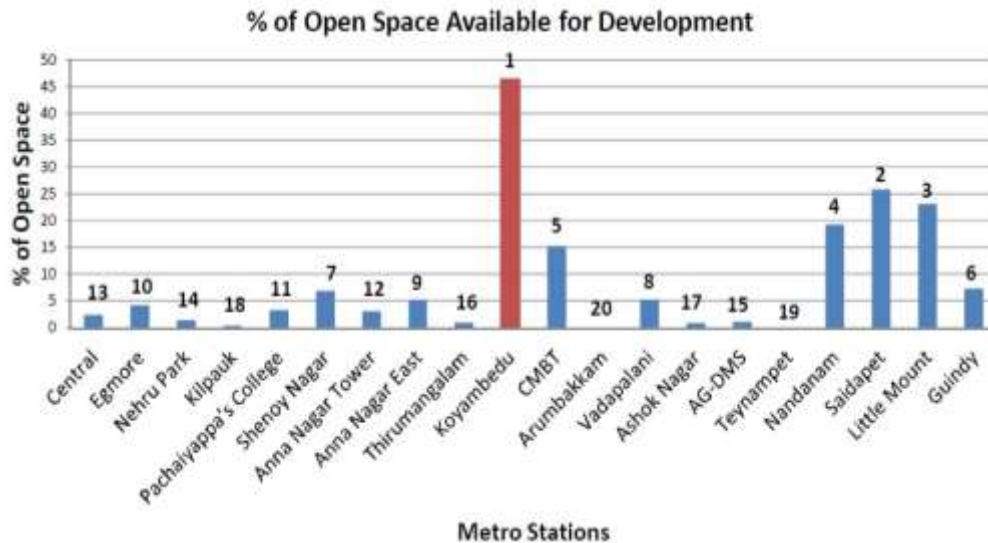


Figure 8 Average residential property values surrounding the metro stations

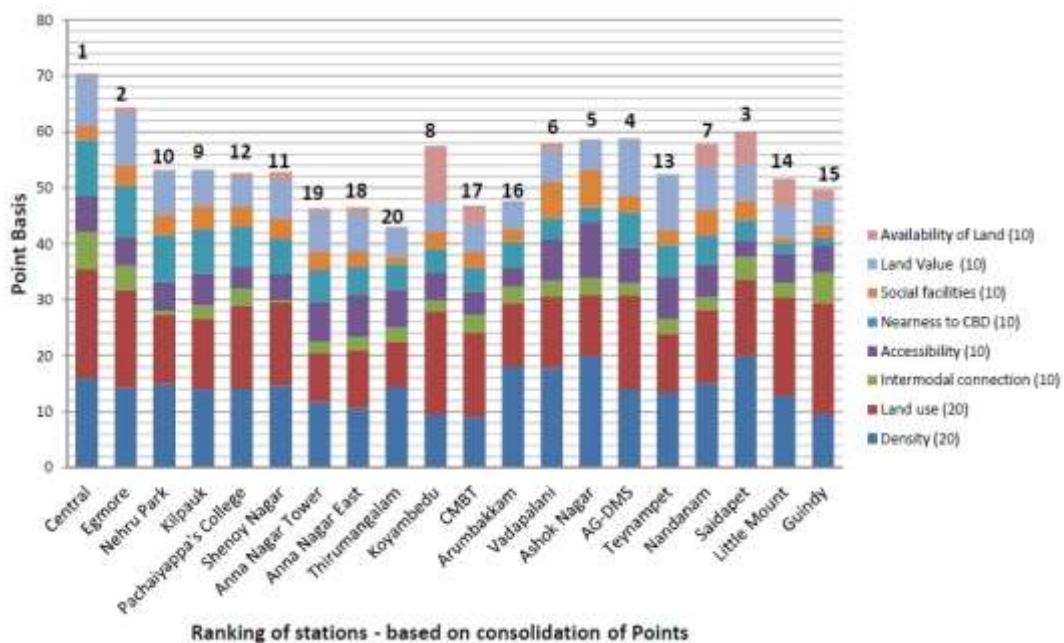
## 7.8. Availability of Land (Open Space) for Development



**Figure 9** Percentage of open space available for development surrounding the metro stations

Open space are the areas which will undergo transformation immediately due to the influence of the metro station. The open spaces i.e., the land available for immediate development surrounding the metro station within its influence zone is identified and calculated. From Fig: 9 it is found that Koyambedu station has more than 45 % of the land vacant, and Teynampet station has the least amount of land left for development.

## 8. CONSOLIDATION OF THE STUDY



**Figure 10** Consolidation of points for metro stations

Stations were ranked based on the above mentioned parameters. Central station has the highest possibility to undergo a developmental change and Thirumangalam station has the least. The final scores range between 43 to 70 points. Six stations gets below 50 points (least

impact), and 12 stations achieves between 50 to 60 points (Moderate impact) and only 2 stations gets more than 60 points (Highest impact).

## 9. CONCLUSION

This ranking system will help the authorities to predict the development pattern which is about to happen surrounding the metro station and utilize its impacts in a positive manner by suggesting necessary changes in development regulations like enhancing the FSI, providing higher incentives to certain specific land uses, provision of necessary physical and social infrastructure to support the such predicted developments, etc.

## 10. SCOPE FOR FURTHER RESEARCH

This research is limited to the chosen parameters, and there are many other parameters like the socio economic conditions of its residents which can be taken for further research to understand the impact of people on the developments surrounding the transit station. One station from each and every impact zone (Least, Moderate and Highest) can be taken up for further research to predict more precise developmental impacts surrounding the metro station.

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