Metro Rail Transit System Impacts On Land-use And Land Values In Bangalore, India

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Metro Rail Transit System Impacts On Land-use And Land Values In Bangalore, India

- Background and Need of the Study
- Concept Formation
- Literature Review
- Study Area Characteristics
- Analysis Framework
- Analysis
- Conclusions

Study Background & Need of the Study

Study Background

- The **public transportation** system does much more than merely carrying its citizens from one place to another **- it plays a vital role in encouraging and controlling urban growth.**
- Transport infrastructure projects embrace **direct as well as indirect benefits**.
- The direct user benefits such as **reduced travel time**, but also indirect benefits such as **land value increase, land use densification** etc.
- The benefits of transportation investments get **capitalized in real estate market** in the **short-term** while **land-use adjustments occur over longer term**.
- This potential to produce **economic benefits** has become important in decision-making process of the transport investment.

Need of the Study

- Accessibility benefits **by improvement in public transport impetus to development** and hence should be taken as **an opportunity** to develop the city.
- This study tries to build a relation among **accessibility benefits, impact on proximate land use and land value gains.**
- The value appreciation **varies from place to place** influenced by various parameters. The study identifies **parameters that influence the scale of increment** in land values.

Research Question:

What is the relationship between accessibility benefits, land use, built form densification and land value increments?

Hypothesis:

Accessibility improvement leads to gain in the proximate land values.

Aim:

The aim of the study is to ***assess the impacts of accessibility improvement on proximate land use and land values***. The study also investigates the potential to capture value appreciation by Value Capture Mechanism.

Objectives:

1. To assess land use changes and land value increment along the metro corridor at different points of time (i.e. Initial speculation period, Project formulation, During construction, Post completion).
2. To investigate Potential of value capture.

Scope & Limitation :

1. The study is be limited to the delineated study area. The land value has been assessed through market guidance value gazettes and also by direct interaction with developers, real estate agents.
2. Value appreciation has been captured through change in accessibility, change in ownership patterns, land consolidations, number of transactions, distance from CBD's etc.

Concept Formation

Land Value

The market price is the price at which the actual transaction takes place.

Registration value is the price at which the sale is registered.

The guidance value is the published value below which the transaction cannot take place.

Land use Changes

Land use changes can be defined as increase in **land use mix at various scales**, including mixing within a building, along a street and within a neighborhood/ area.

Built Form Densification

Changes in **Building heights, ability to use higher FSI**

Database

- Market Guidance Value Gazettes for the time period 1998- 2013
- Survey of real estate brokers, property agents to identify real market values

- 1998 Land use based on CDP and other literature
- Existing Land use Plan(2004); RMP-2015
- Land use details based on Property Tax Database 2007 and 2011 (BBMP)
- For 2014 Land use Primary Survey
- New Proposed development since 2004 (BBMP)

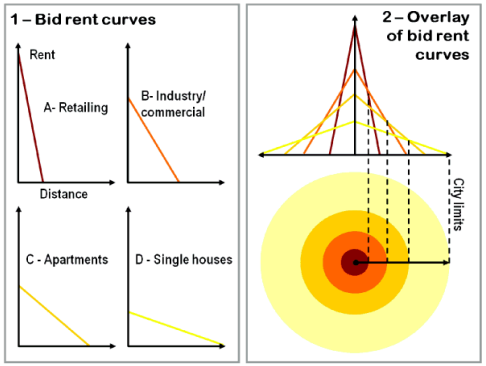
- 2007 Heights based on Property Tax Database 2007 (BBMP)
- For 2014 Building Heights Primary Survey

Literature Review

Land Value : Theories, Determinants and Techniques

- The land value is guided by the economic principle of the **highest & best use which produces the highest net return over a period of time**.
- The **property value** of a plot includes, value of its **land**, structural specifications and other contextual attributes (land use, location etc.).
- As **construction cost** of different components is **uniform** depending upon the quality, hence property value is a direct function of Land Value.

Theories
1. Land & its prices
2. Land rent theory
3. Land rent & land Use
4. Micro economic theories: a. Alonso's model b. Wingo's model



Determinants of Land Value
1. Physical attributes of property
2. Neighborhood attributes
3. Availability of infrastructure
4. Nature of development
5. Proportion of road width in context to land use and building heights
6. Locational attributes and Transport Linkages
7. Economic factors
8. Supply and demand factors
9. Legal/ Government forces
10. Potential of future development
11. Social factors

Techniques to calculate land value change
1. Accessibility and Proximity levels
2. Market activity & Business competitiveness Surveys
3. Qualitative analysis
4. Descriptive statistics
5. Regression analysis
6. Hedonic pricing
7. Transactional analysis
8. Projected rate able values
9. Geographically weighted regression
10. GIS mapping techniques a) Inverse distance weighting (IDW) b) Kriging

Techniques to calculate Land Value Change

1. Accessibility and Proximity levels	Travel time thresholds with the use of a distance decay function is used to calculate for the improvement in the accessibility levels in terms of reduction in the travel time.
2. Market Activity & Business Competitiveness Surveys	Assesses the market trends through business interviews, discussions with developers/ builders/regulatory agency, FGD's.
3. Qualitative analysis	Analysis such as environmental quality audits and other analyses provide complementary information.
4. Descriptive Statistics	Various factors are cross tabulated with measures of change in travel and modal split (e.g. a correlation analysis).
5. Regression analysis	Quantifies or establish a relationship among different sets of data.
6. Hedonic pricing	assumes that the overall transaction prices are combination of different attributes, thus can be decomposed into components.
7. Transactional analysis	Monitors changes in land values from actual transactions & requires time-series analysis of land values.
8. Projected rate able values	Determines the way the market is likely to move in terms of yields, occupancy rates and the demand for different type of spaces.
9. GIS mapping techniques	Create maps representing the level of accessibility both before and after the introduction of the public transport facility and calculates the relative change in accessibility and its impact on land values.
a. Inverse Distance Weighting	The principle underlying all surface interpolation methodologies is that entities that are found to be close together in geographical space are likely to be similar.
b. Kriging	the imputation function uses sample points to influence those in nearby locations rather than having a fixed mathematical function to determine values.

Techniques used to Evaluate Impacts

Source	System details		Methods used in studies									
	Location	Mode	Accessibility & Proximity	Surveys	Qualitative Analysis	Descriptive Statistics	Regression	Hedonic Pricing	Transactional Analysis	Growth Assessment	Projected Rateable Values	GIS Mapping Techniques
Cervero & Duncan (2002)	Santa Clara	LRT	✓	✓	✓	✓	✓	✓				
Hillier Parker (2002)	London Crossrail	Rail	✓	✓	✓			✓		✓	✓	
Chesterton (2002)	London JLE	Metro	✓	✓	✓	✓			✓			
Pharoah (2002)	London JLE	Metro	✓	✓	✓							
Hennebury (2002)	Sheffield Supertram	LRT	✓					✓				
RICS (2004)	Croydon	Tram	✓	✓	✓			✓	✓			✓
Cervero & Kang (2011)	Seoul	BRTS	✓	✓	✓		✓	✓			✓	✓
PWC (2013)	Delhi	Metro	✓	✓	✓							
This Research	Bangalore	Metro	✓	✓					✓			✓

The Concept of Accessibility

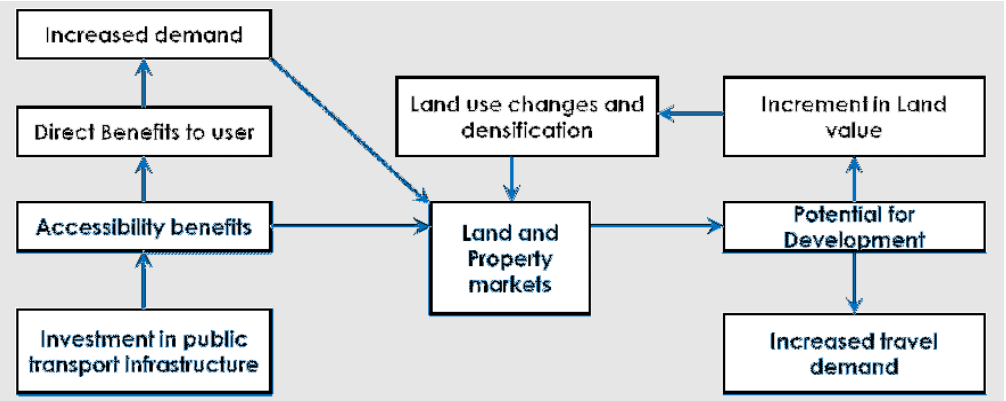
What is accessibility?

- Accessibility is **degree to which desired destinations are served**. It is measured in terms of the availability of and proximity of primary destinations to transportation services (Towns, 1996).
- Accessibility is referred to the **ease in accessing transport infrastructure facilities** or the impact on travel times from origin to other destinations (Thakur, 2009)
- It is the extent to which **land-use and transport systems enable individuals to reach activities** or **destinations by means of a (combination of) transport mode(s)** (Geurs and Wee, 2004).

Relationship

- Landuse and transportation interactions are a **dynamic process that includes spatial and temporal changes.**
- Development of transportation **improves accessibility,** thus it **stimulates changes in land use pattern** (Aravantinos, 2000 and Zhao et al., 2003) and **escalate land values**.

Schema of structural relationship between transport investment and Land value



- The **firms** adjust their locations to take advantage of the improved accessibility. While **households** also adjust location to maximize opportunities of employment, to reduce commuting cost etc.

Adapted based on: RICS, D. f. (2002). *Land value and public transport* .

Categorization of Transport Impacts & Its Threshold

Impact	Benefits
1. Mobility and Access Impacts	Transit use in terms of level of use- such transit ridership, modal split; **Travel time savings**, **Service availability, Service reliability**, Service quality and Congestion reduction.
2. Economic & Financial Impacts	Relative higher productivity and saving across the system, **user cost savings**. Induce **Direct as well as Indirect Benefits**. Indirect benefits include increment in land prices
3. Environmental and Energy Impacts	Induce benefits such as **reduced consumption** of energy, reduced emissions and reduced exposure to noises.
4. Safety and Security Impacts	Benefits are related **to rider and non-rider safety, security** and health as exposure to physical harm from transit operations reduces and security in public places increases.
5. Social Equity Impacts	The benefits including **wider and focused operations** of transit services, system configuration with respect to target population concentration etc.
6. Intangible Impacts and Factors	Individual and community are benefited by improvement in **quality of life** standard, sustainable development and personal well-being.

Threshold

- Within **close proximity** to stations, **impact is higher on commercial property values** than on residential values, but the effect is reversed as distance from the station increases.
- **The land prices are higher if land parcel is located within walking distance but not directly next to** the station.
- Empirical studies conclude that the **majority of the benefits extend** till a buffer of **1000m**.

Value Capture and Its importance

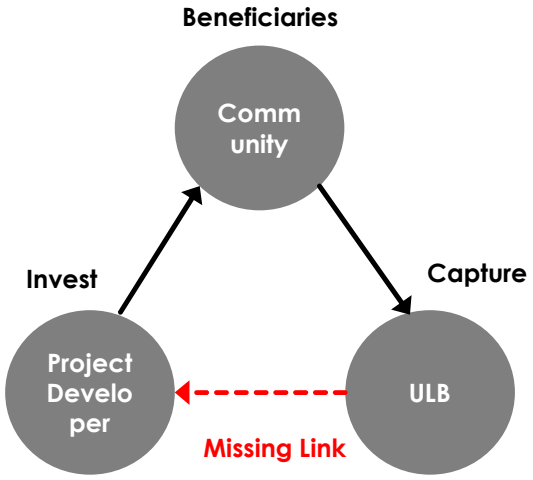
What is Value Capture?

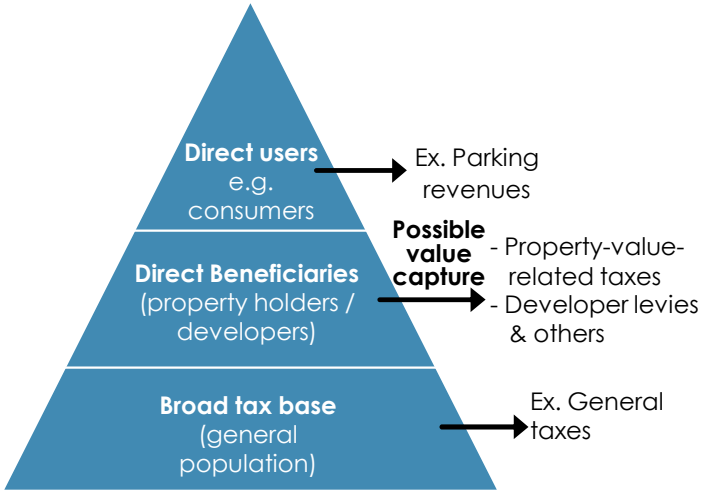
Value capture refers to a type of innovative public financing in which, increases in private land values generated by a new public investment are all or in part "captured" through a land related tax or any other innovative mechanism, to pay for that investment or other public projects. (The Lincoln Institute of Land Policy, USA, www.lincolninst.edu)c

Why Value Capture is important?

- Public transport increases the quality of a city's transport system and adds significant value to proximate land.
- The increase in the land values is reflected in the area served, especially around the stations.
- Uplift is more in case of rail-based systems due to long term surety of development investment.
- The value capture mechanisms can be used to monetize the additional land value that, in turn, can be used to defray the cost of providing transport infrastructure.

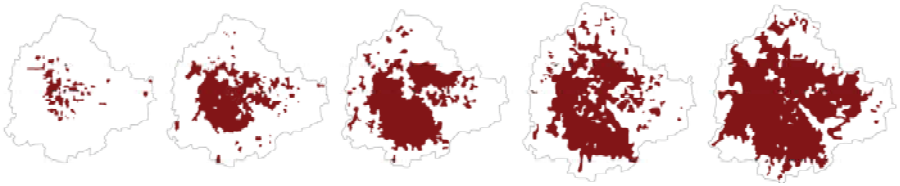
ISSUES	TOOLS



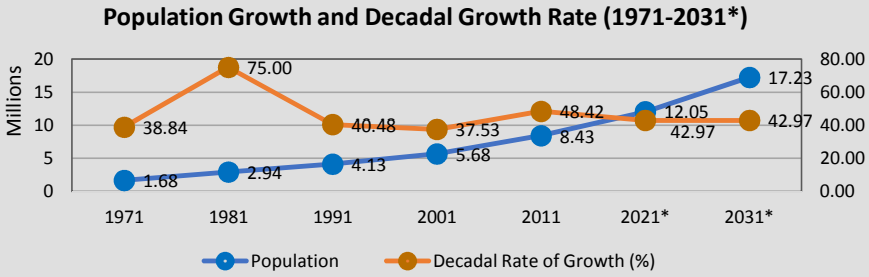


Study Area Characteristics

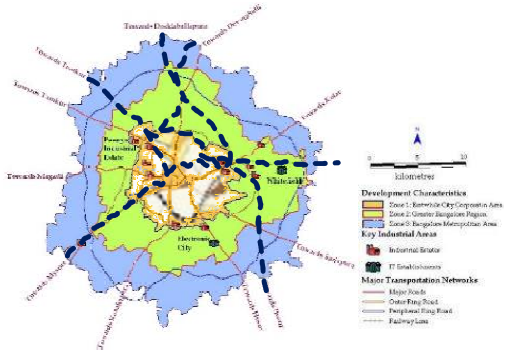
BANGALORE: City Context



Built up Growth Trends



Population Density



- Bangalore city has experienced a tremendous sprawl in the city area. The city size has grown from **160 sq.km.(1991) to 741 sq.km (2011).**
- With more than **8.4 million inhabitants and 11,876 people/ sq. km.**, Bangalore comprises one of the world densest urbanized areas in the world.
- City is key contributor in the state economy. The annual growth are about: 3% for the population; 6% for employment; and 9% for the incomes.
- Bangalore has a strong and balanced economy, with stimulated by light and heavy engineering (automobiles, earthmoving, and aeronautics), textiles, and high technology (IT, ITeS, Biotech, R&D).
- **Vehicle ownership has grown from 58 to 503 per 1000 population from 1981 to 2013.**
- The WPR has changed from 45% (25.5 Lakhs) in 2001 to 43.7% (36.3 Lakhs) in 2011.

Bangalore Metro: PHASE 1

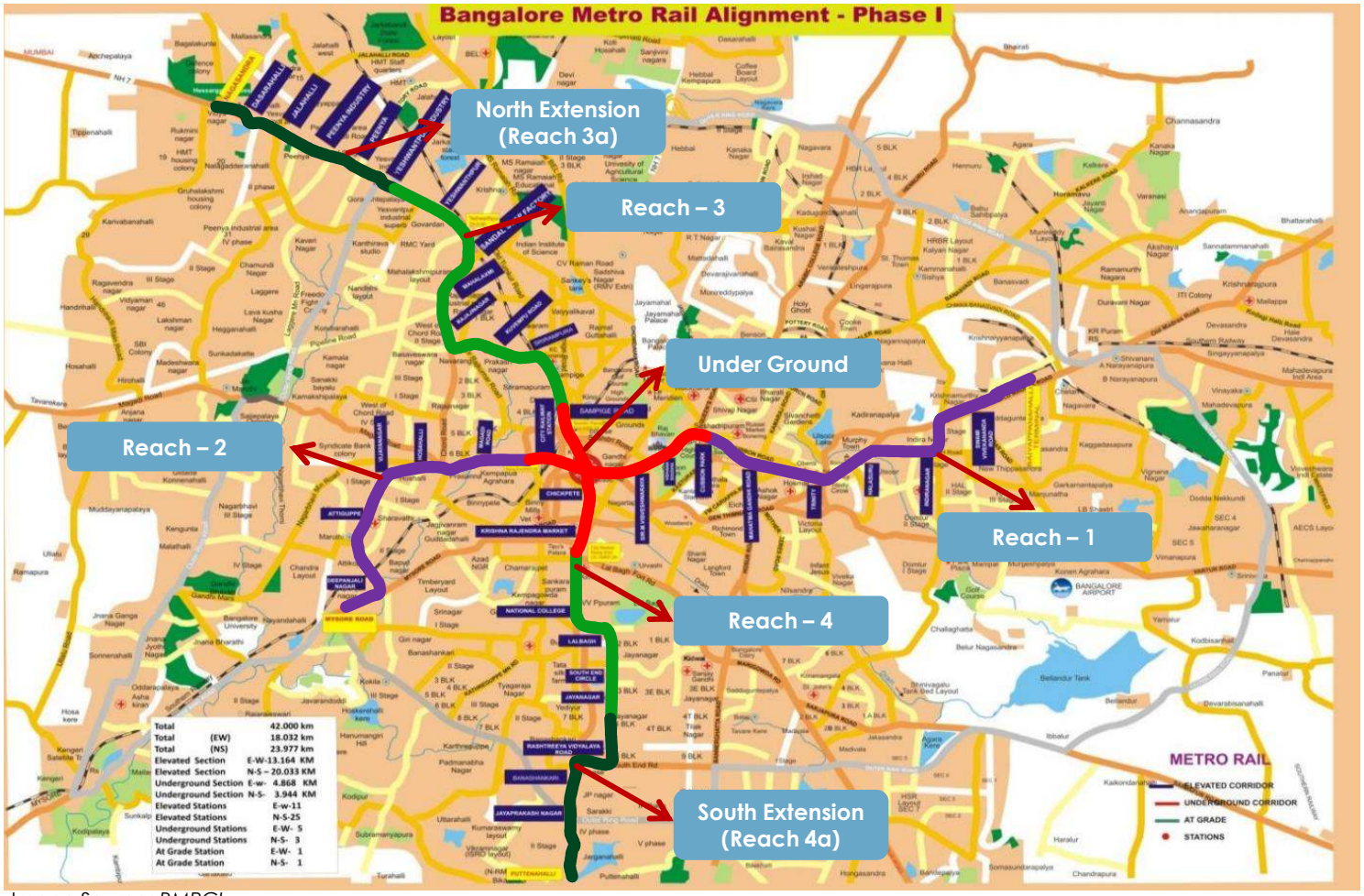


Image Source: *BMRCL*

Metro Operational: Operational Corridor

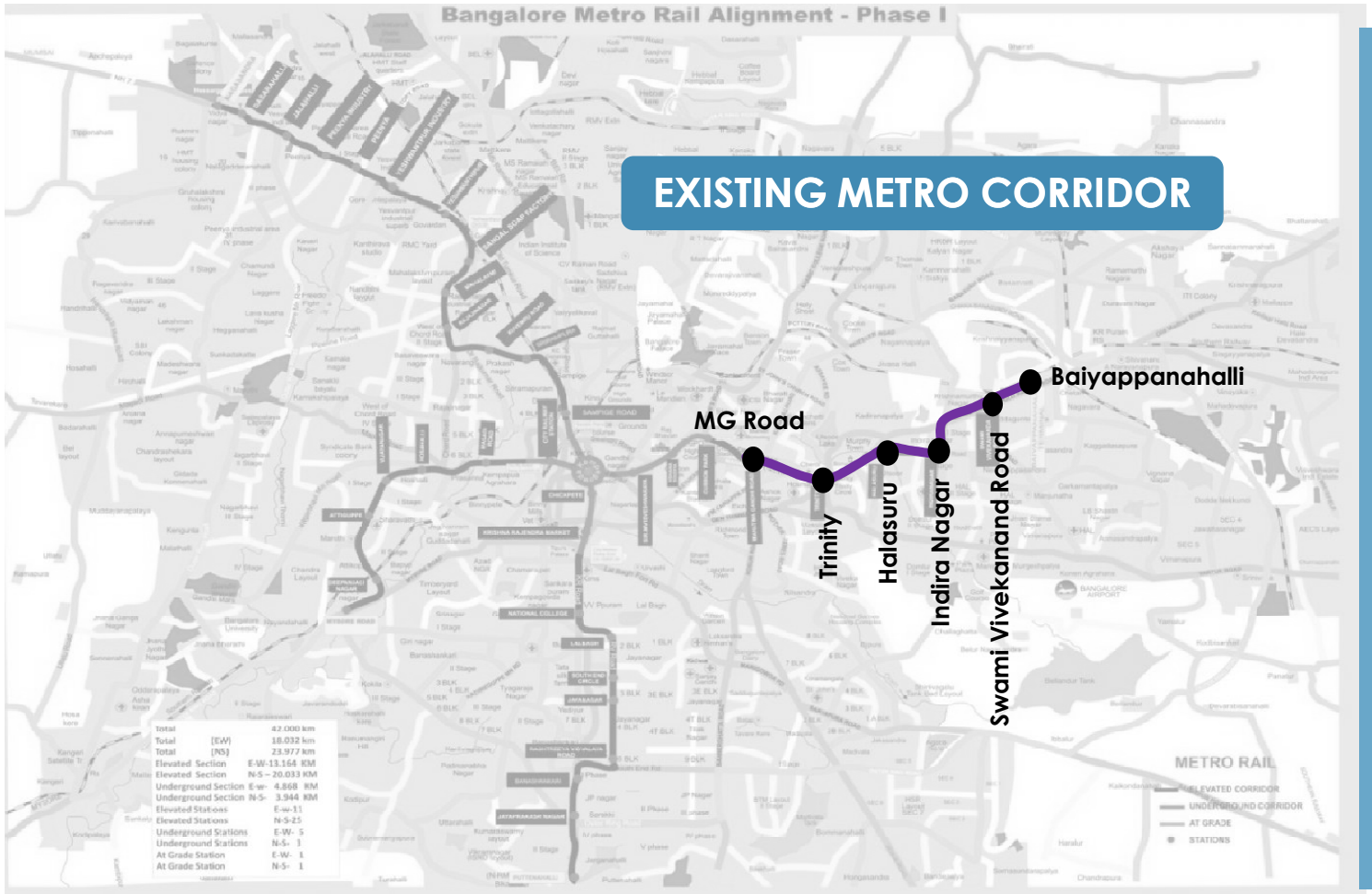
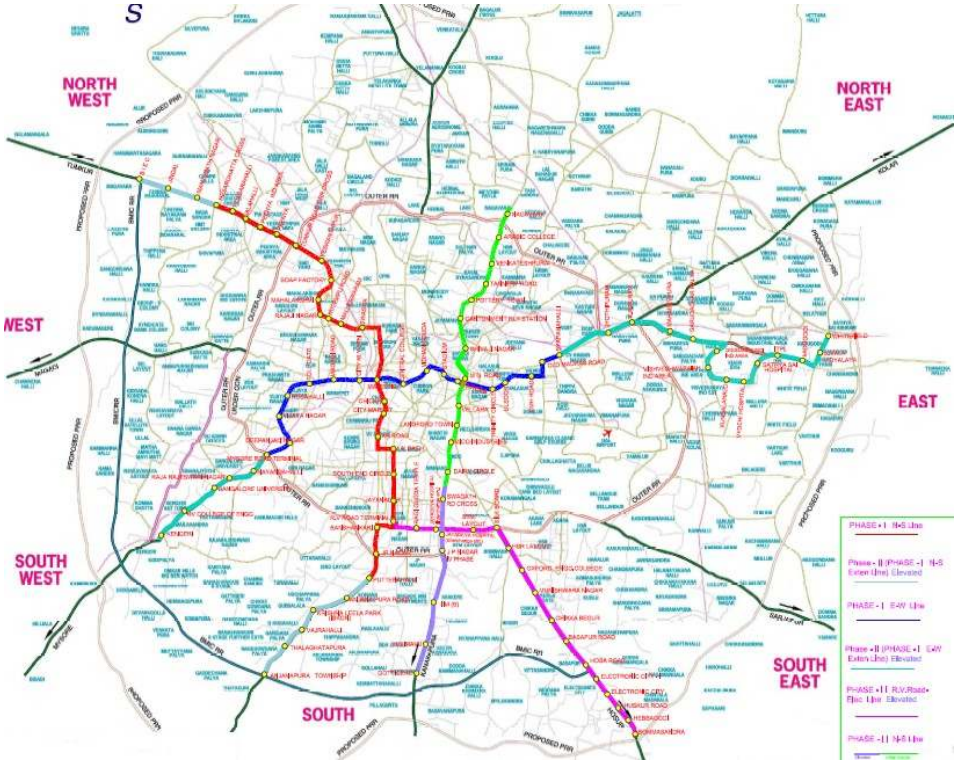


Image Source: *BMRCL*

Length of operational metro:

6.7 Km.

Bangalore Metro: Introduction



Phase	Line	Elevated Length (km)	Under ground Length (km)	Total Length (km)	Stations
Phase 1		**33.42**	**8.88**	**42.30**	**41**
	Purple Line	13.22	4.88	18.10	17
	Green Line	20.20	4	24.20	24
Phase 2		**58.31**	**13.79**	**72.1**	**61**
	N-S Extension	6.29	0	6.29	5
	E-W Extension	25.74	0	25.74	22
	Red	7.46	13.79	21.25	18
	Yellow	18.82	0	18.82	16

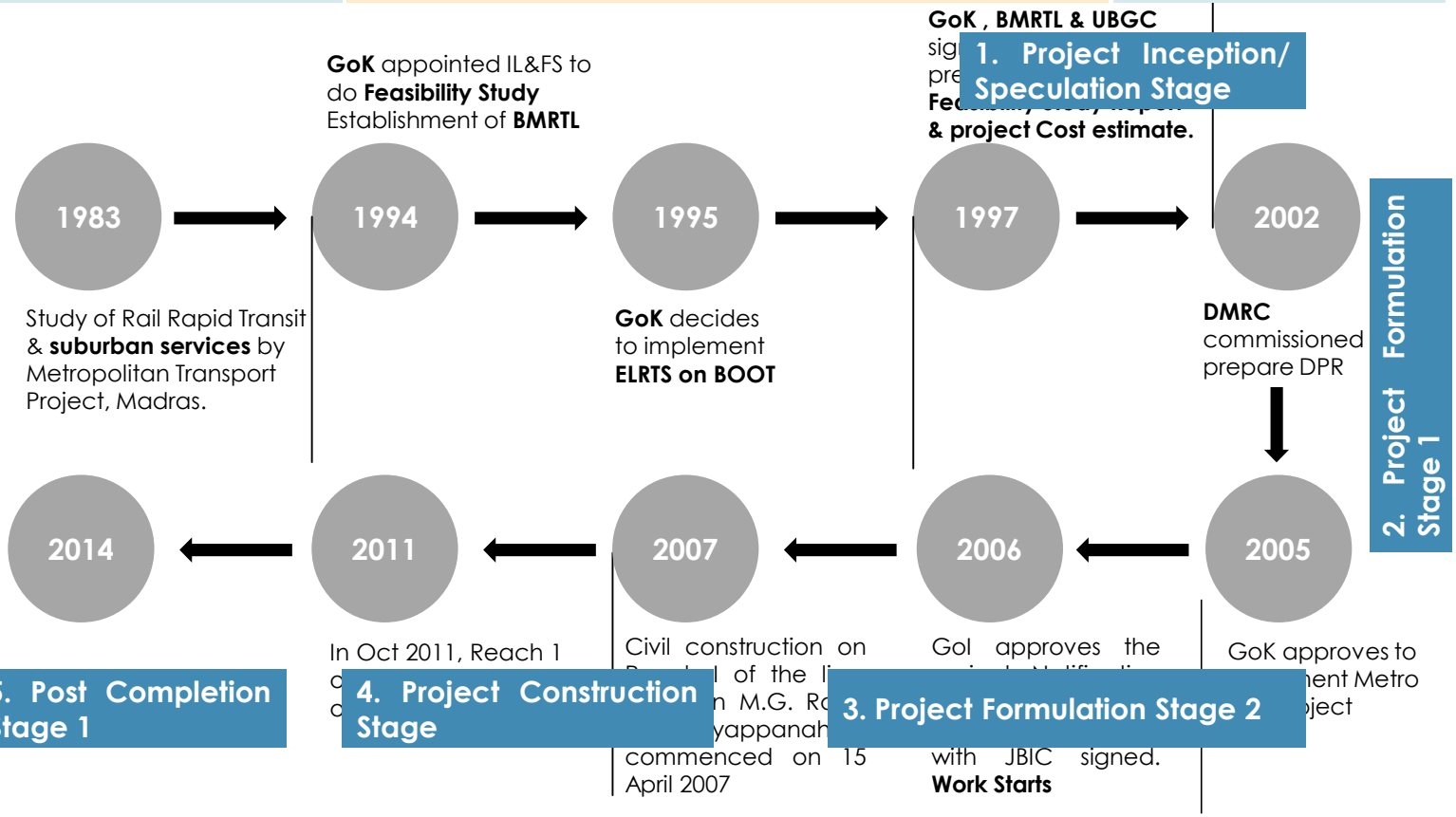
Image Source: *BMRCL*

Bangalore Metro: How it has been initiated?

Narrow Roads with heavy traffic and no scope of expansion

City faced problems like low travel speed, congestion, high accidental rate and increased pollution level

Need has been felt for an efficient rail- based system



1. Project inception/speculation Stage (1998-2002)
2. Project formulation/development stage 1 (2003-2005)
3. Project formulation/development stage 2 (2005-2007)
4. Project construction stage (2007- 2011)
5. Post-completion stage 1 (2011- 2013)

- **BMRTL** – Bangalore Mass Rapid Transit Limited
- **ELRTS** - Elevated Light Rail Transit System
- **UBGC** - UB Group Consortium
- **JBIC** - Japan Bank for International Cooperation

Analysis Framework

Investment in major transport projects such as Metro Rail system **leads to change in land use, change in land value and in built form densification.**

- Changes in Land use
- Impact on Land Values
- Built form Densification

How are these impacts influenced by land ownership?

What is the spatial reach and consistency of these impacts?

When do these changes occur in a project cycle? During which period are these impacts prominent?

Variables

- Influence of Land owner-ship
- As a function of distance from station
- As a function of time

Land ownership/ Land use profile: Private land
Public/Semi Public
Restricted (Defence)

Influences as a function of Distance from Metro Station divided in a buffer of 150m, 250m, 500m and 1000m.

Project Cycle:

1. Project inception/speculation Stage (1998- 2002)
2. Project formulation/development stage 1 (2003- 2005)
3. Project formulation/development stage 2 (2005- 2007)
4. Project construction stage (2007- 2011)
5. Post-completion stage 1 (2011- 2013)

Analysis

Analysis has been carried out at 2 Levels:

1) For all Six Stations

2) Detail Study for MG Road Station

Analysis

For all Six Stations

1. **Land use profile: Development precincts**
2. **Impact on Land use**
   a) Land use changes over a Period of Time

3. **Impact on Land Value**
   a) Land Value Increment as a function of time
   b) Land values as a function of distance from metro station
   c) Land value increment and population density

Detail Study for 3 Stations

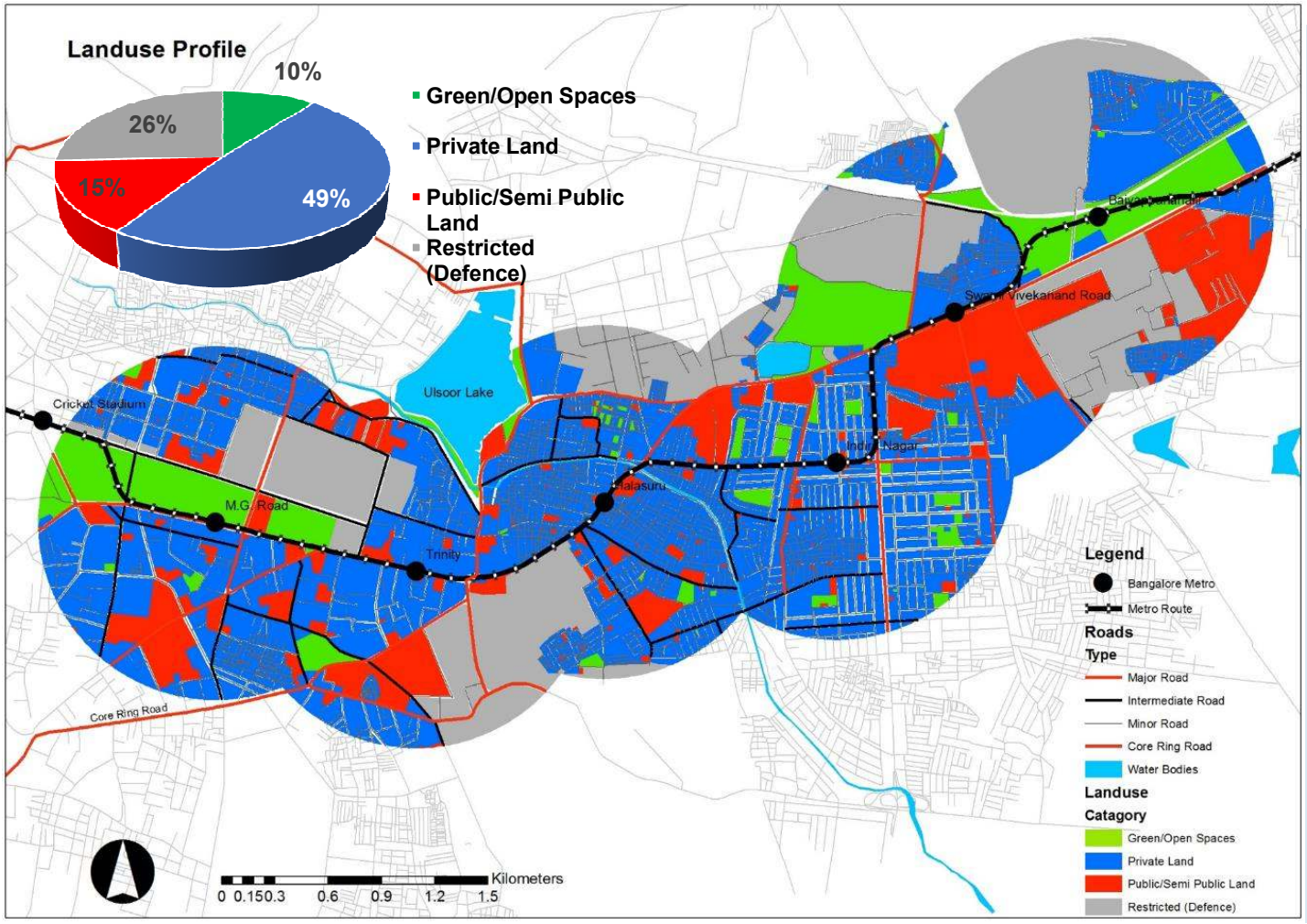
1. **Land use profile: Development precincts**
2. **Impact on Land use**
   a) Land use changes over a Period of Time
   b) Land use Conversion
   c) Plot amalgamation/ Land Consolidation

3. **Land use changes: Vertical Densification**

4. **Impact on Land Value**
   a) Land Value Increment as a function of time (Including Deviation factor)
   b) Land values as a function of distance from metro station

Analysis: For all Six Stations

Land use profile: Development precincts



- Bangalore metro Reach 1 corridor has been aligned to serve high population density areas of the city.
- A **large extent of the area** is dedicated to the **Pubilc/Semi public uses and Defence uses, which restricts development oppertunities.**
- As **only private land** is available for development, only this has been used for further analysis purpose.

Impact on Land use: Land use Changes

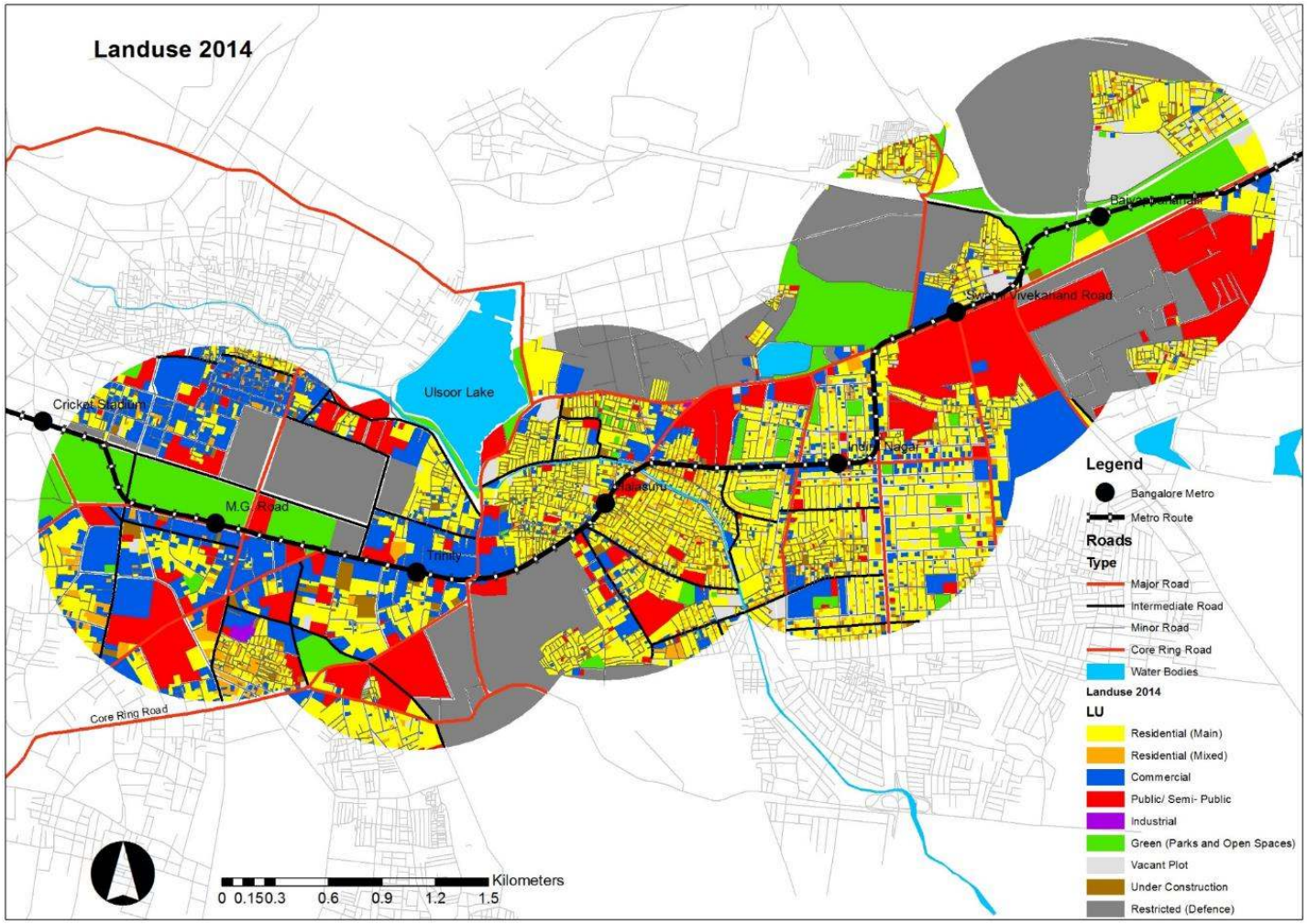


Image Source: *BBMP Property Tax Database and Primary Survey*

What are Land use changes?

- Land use changes can be defined **as increase in land use mix**, which refers to allocating different land uses close together.
- **Transformation** from residential and mixed use as well **can be anticipated due to increased demand.**

Land use changes over a Period of Time

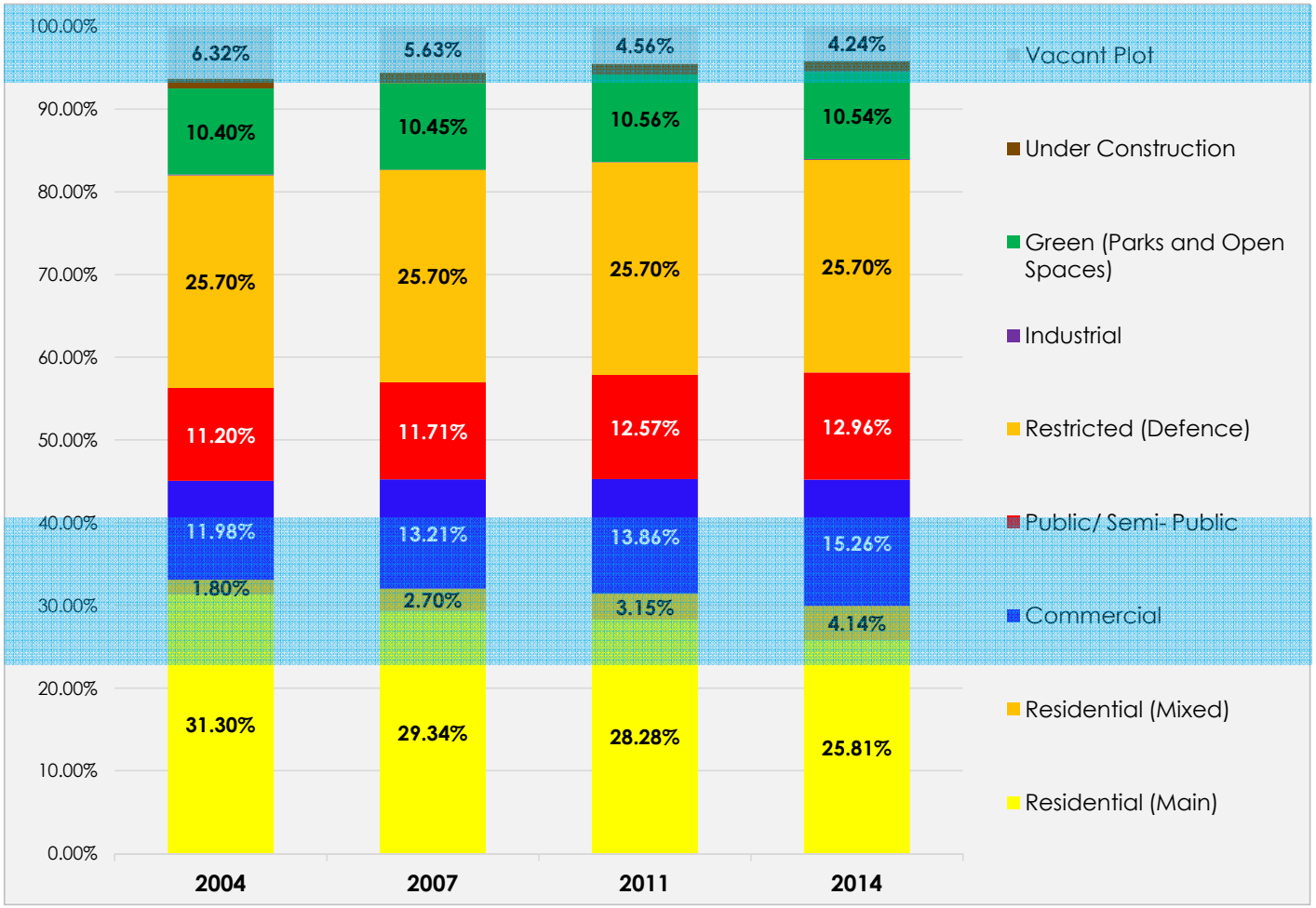


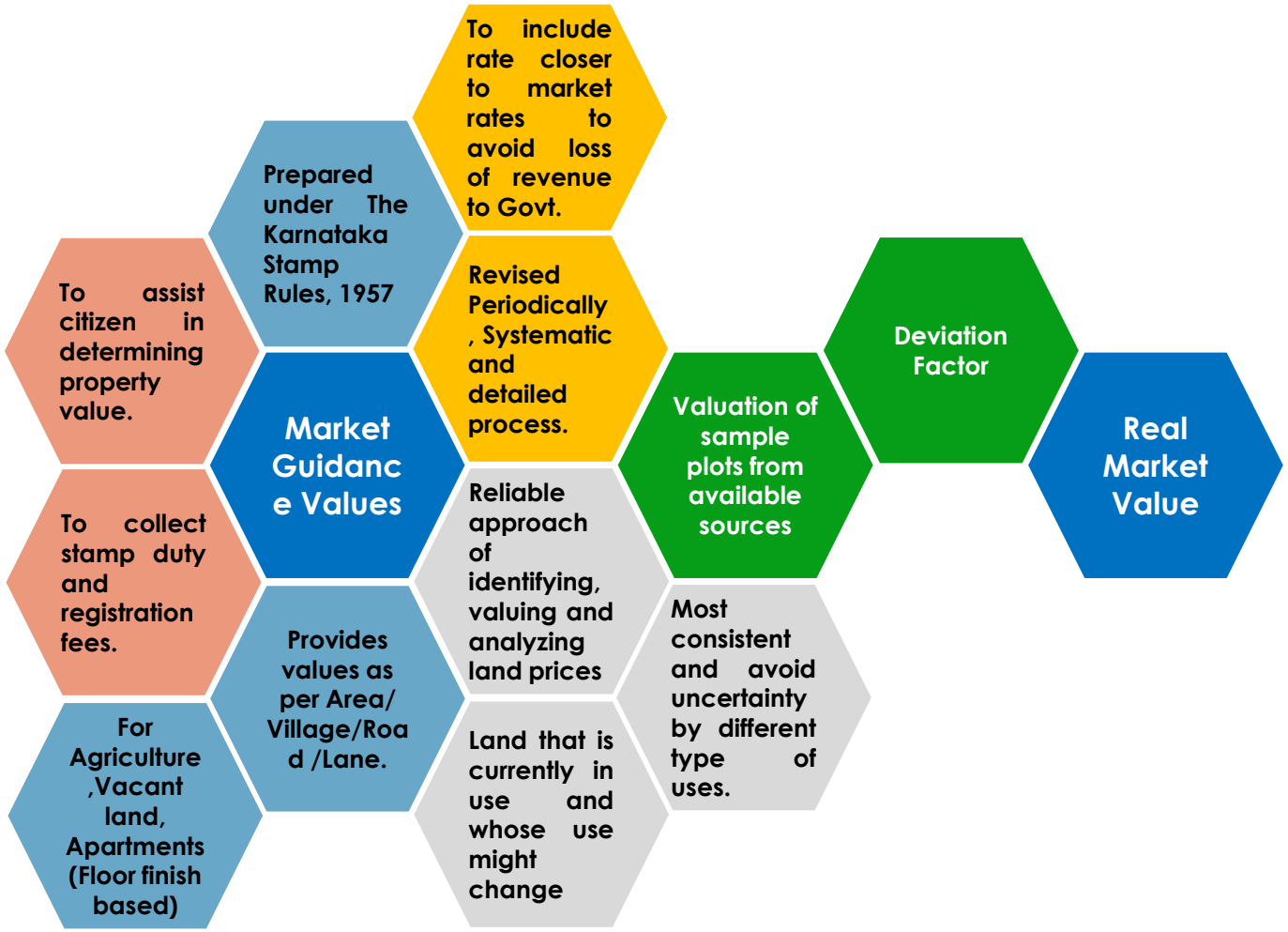
Image Source: *RMP-2015, BBMP Property Tax Database and Primary Survey*

- **Major** land use impact have started **after a period of time.**
- Considerable increase in **demand** of retail and office spaces around the existing metro stations

Land Use Changes

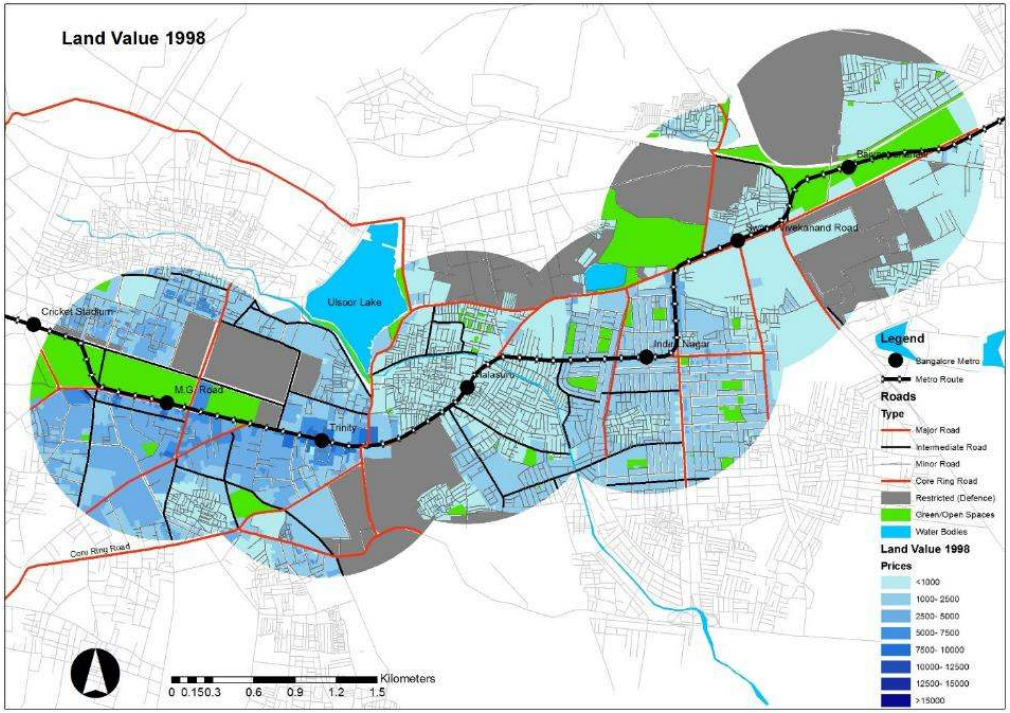
- Conversion of; **residential to apartments,** mixed use and residential **or mixed to commercial and** new development on open/ vacant land.

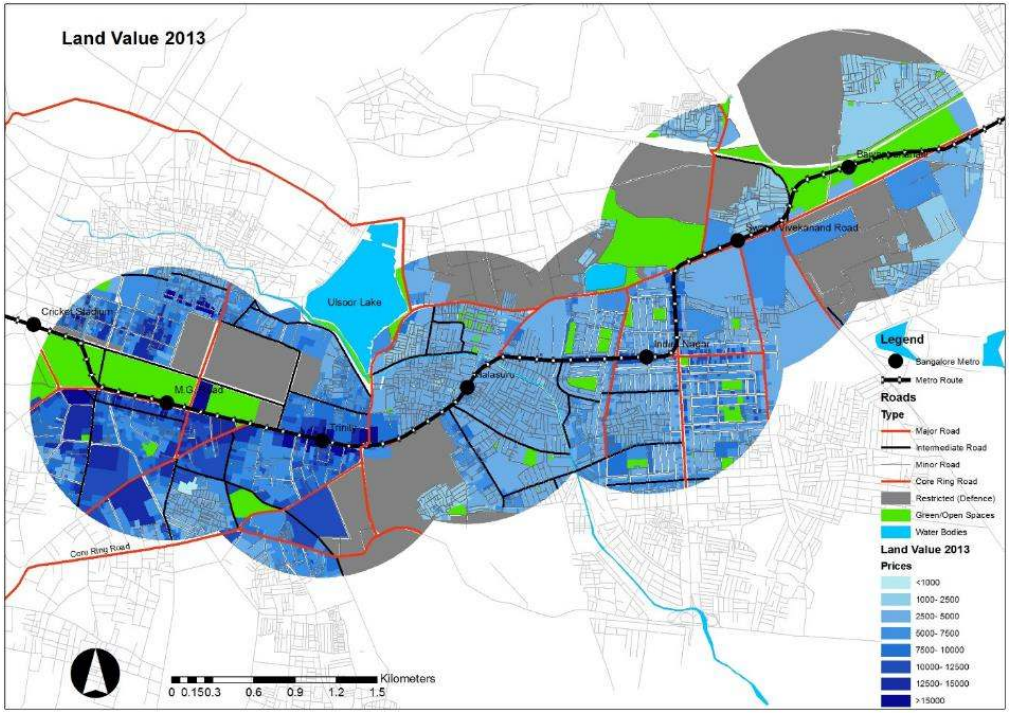
Market Guidance Values: As A Reliable Source



- For analysis Market **Guidance value** has been used, which is further ratified with r**eal market prices.**

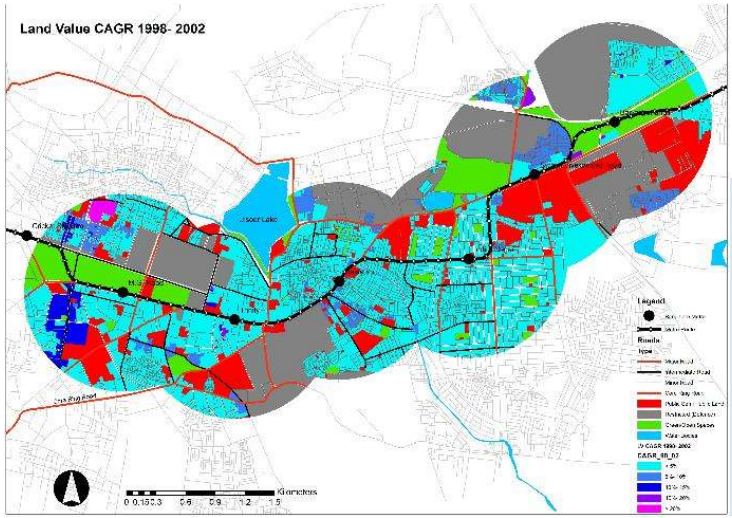
Land Value Increment as a Function of Time



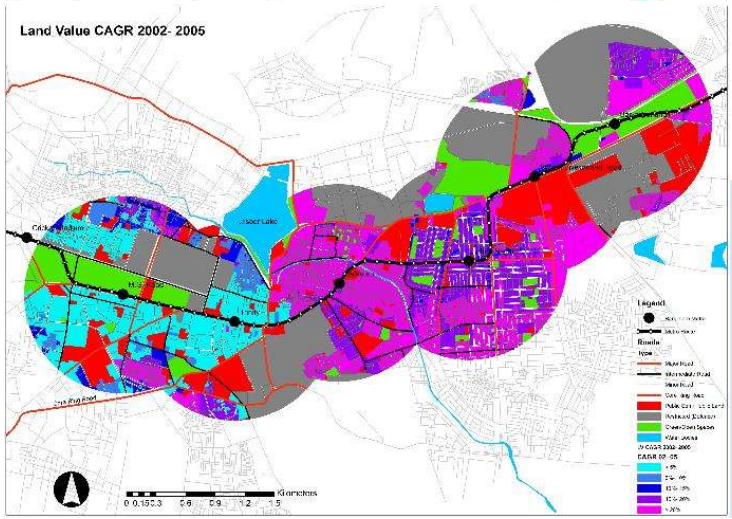


- A **significant growth** in land values have been observed over the period of time 1998- 2013.
- Land value price escalations are very **area specific**.

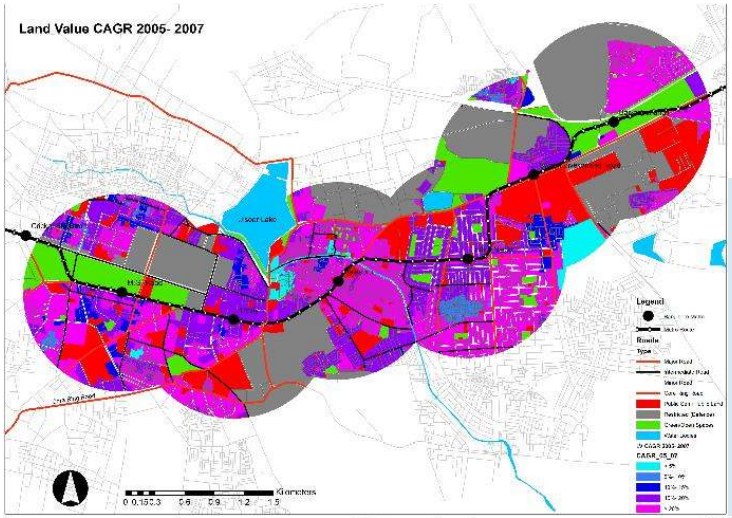
Land Value Increment as a Function of Time



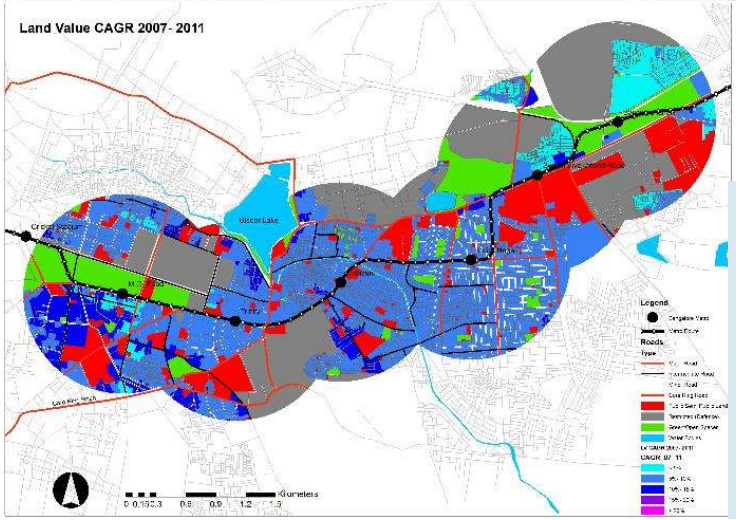
1. **Project Inception Stage(1998-2002)**
   - CAGR in land prices is only 1%- 2%.



2. **Project formulation/ development stage i (2002-2005)**
   - CAGR of 24%-26% has been observed.

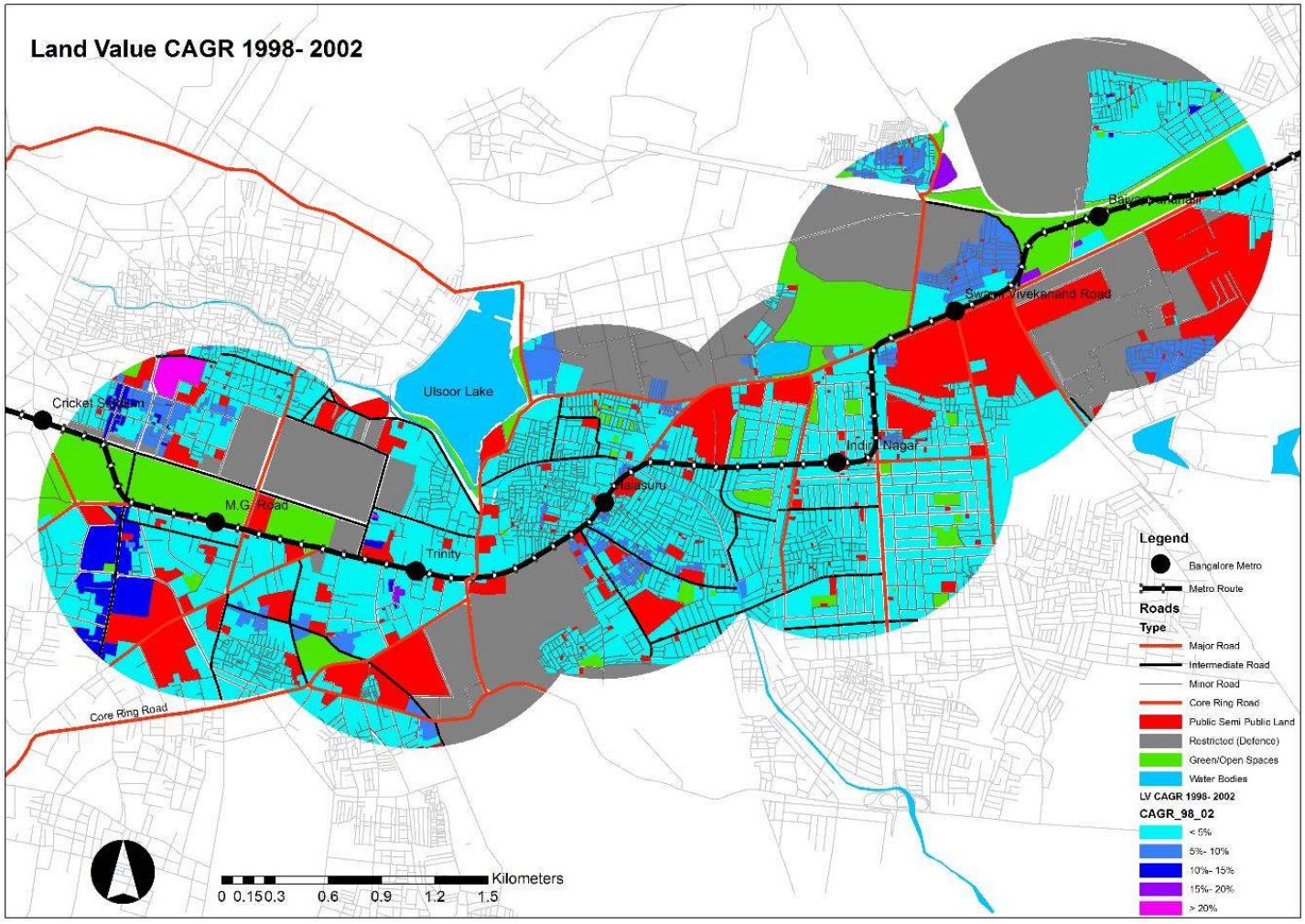


3. **Project formulation/ development stage ii (2005- 2007)**
   - CAGR of 20%-21% has been observed. (HIGHEST)



4. **Project construction stage (2007-2011)**
   - CAGR of 7.5%- 8% has been observed.

Land Value Increment as a Function of Time 1. Project Inception Stage

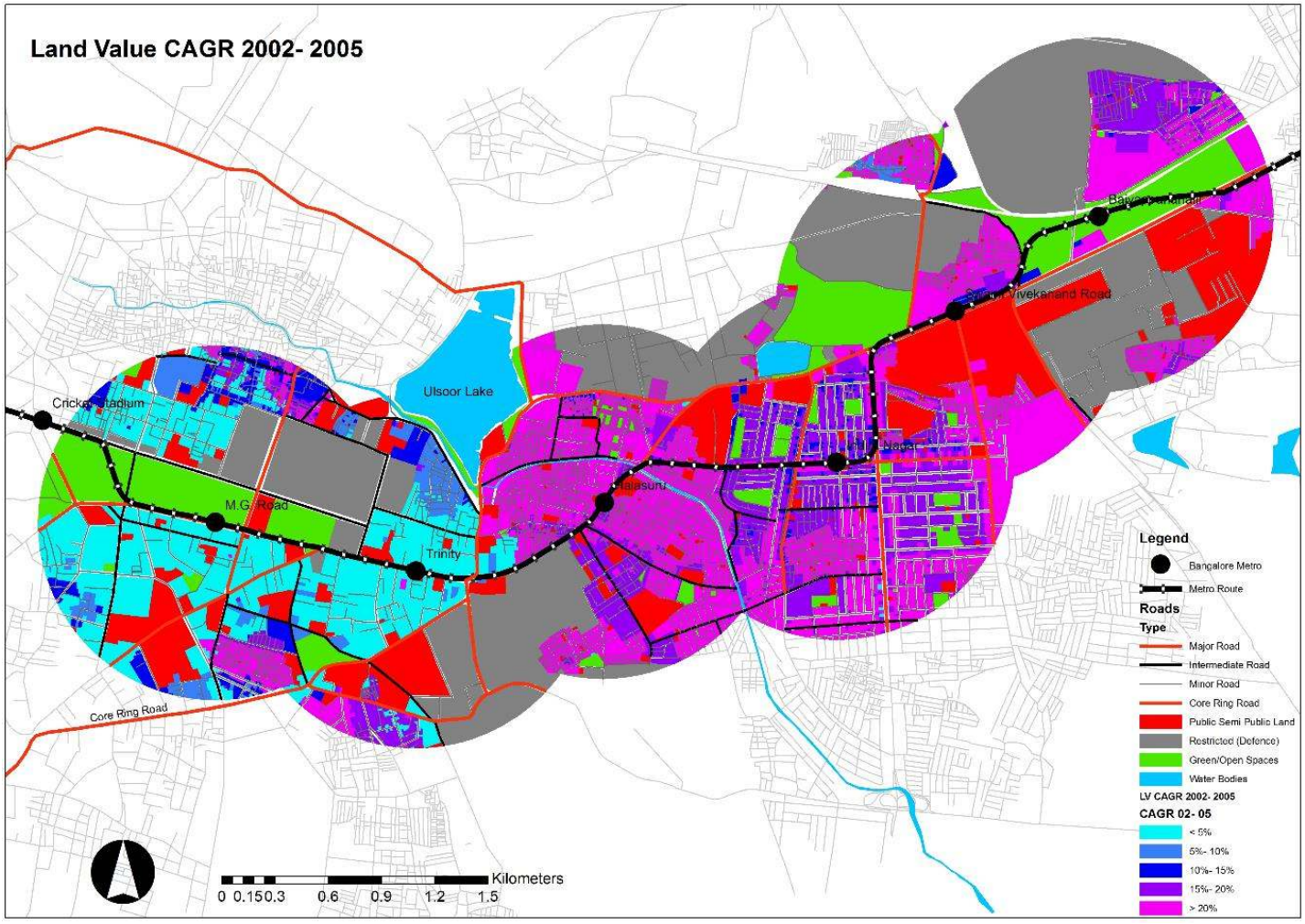


- MG Road- Baiyappanhalli, has a significance in city since the past, it has always been a most important **commercial area**.

1. Project inception/ speculation Stage (1998-2002)

- ELRTS project didn't take off due to various reasons and speculation about the METRO have risen.
- In 2002, DMRC was commissioned to prepare DPR.
- There has not been an evident growth in land prices.
- CAGR in land prices is only 1%- 2%.

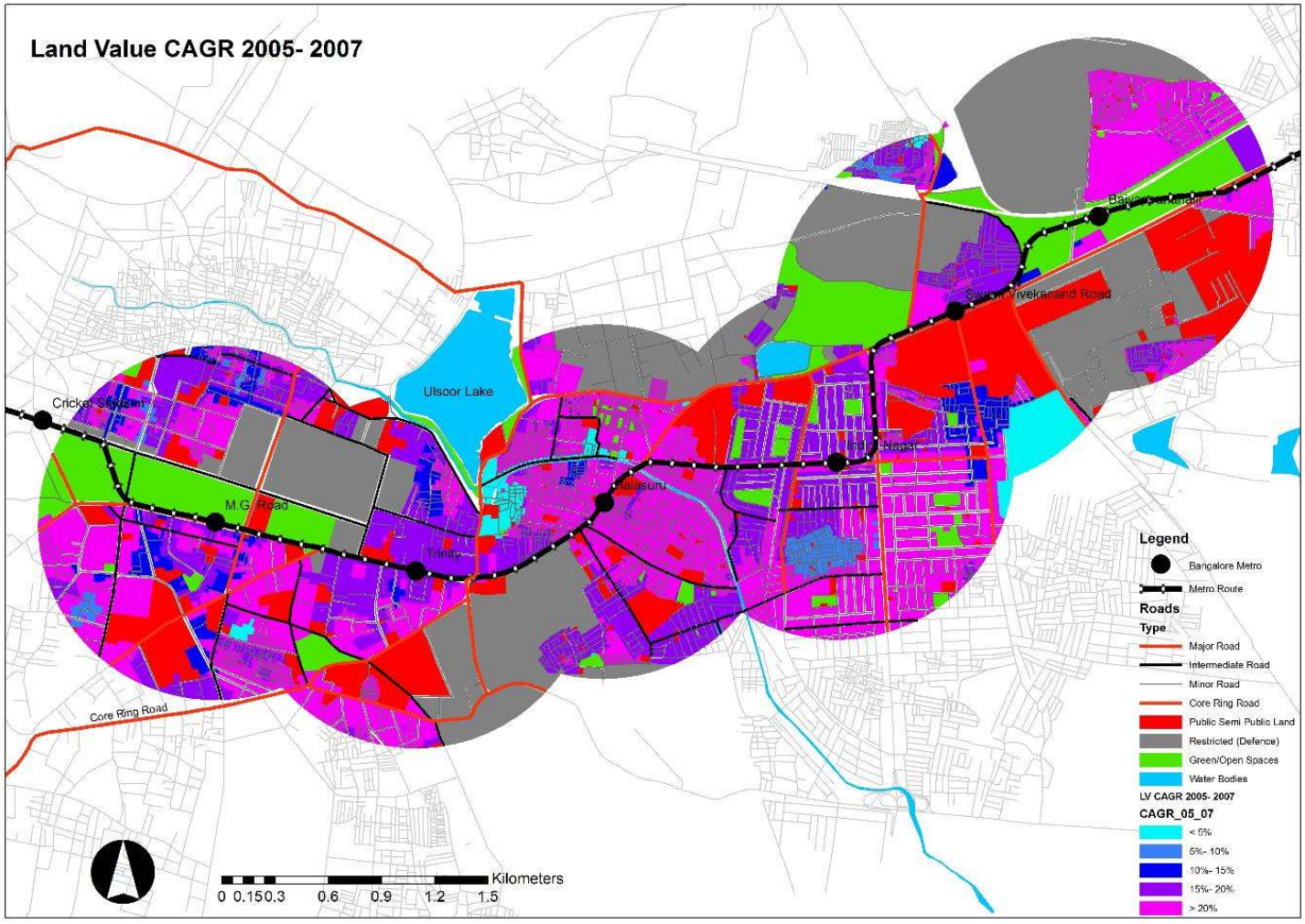
Land Value Increment as a Function of Time 2. Project Formulation Stage i



2. Project formulation/ development stage i (2002-2005)

- Metro project was approved by Govt. of Karnataka in 2005.
- CAGR of 24%- 26% has been observed.
- Residential properties have obtained a higher growth in land prices when matched to commercial properties.
- Increment is higher near Halasuru, Indiranagar station.

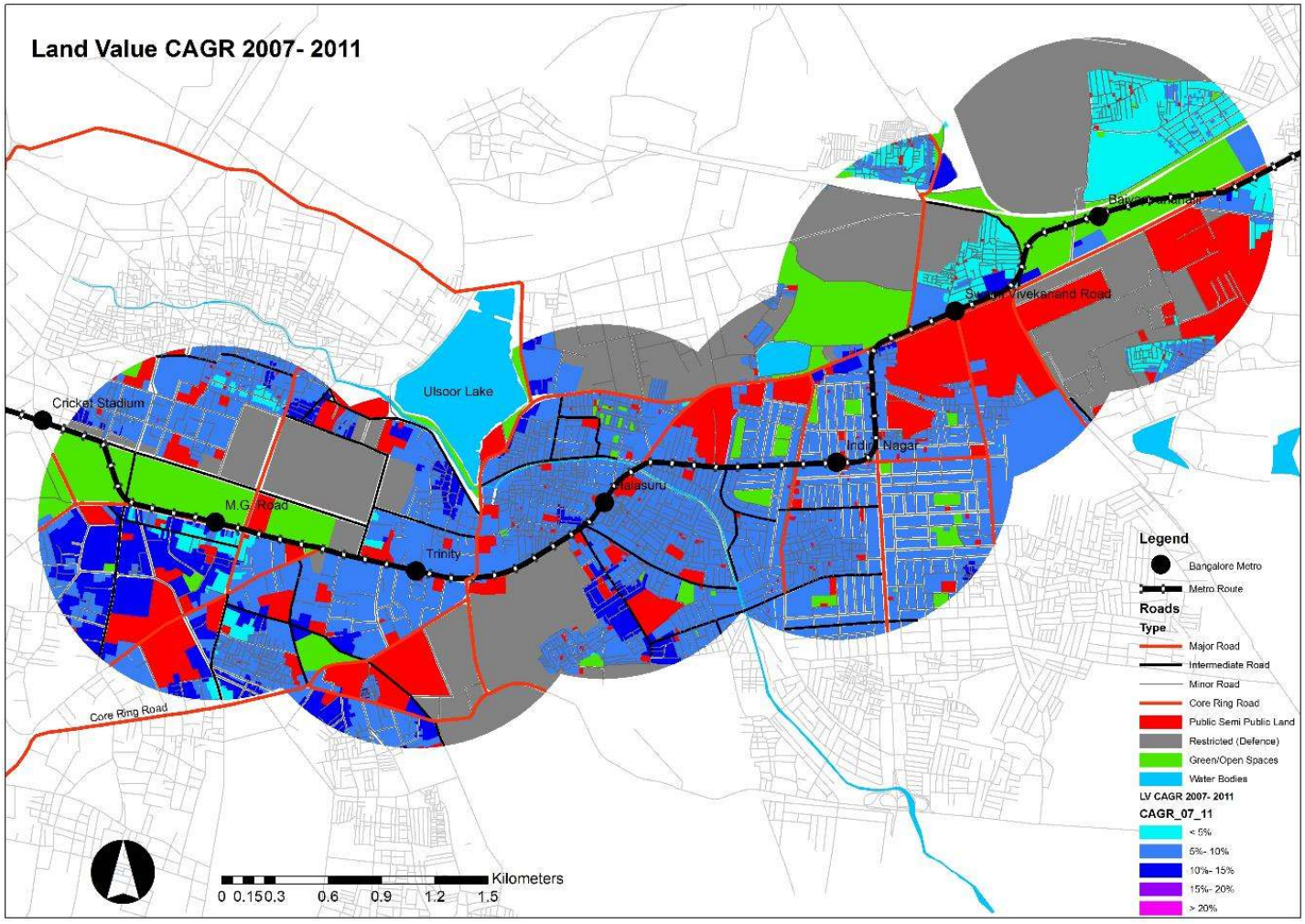
Land Value Increment as a Function of Time 3. Project Formulation Stage ii



3. Project formulation/ development stage ii (2005-2007)

- Civil construction of Metro started in 2007.
- During this period the land value has determined with the highest growth.
- CAGR of 20%- 21% has been observed.
- Growth has been seen in both commercial and residential properties.
- MG Road & Trinity has also determined significant growth in prices.

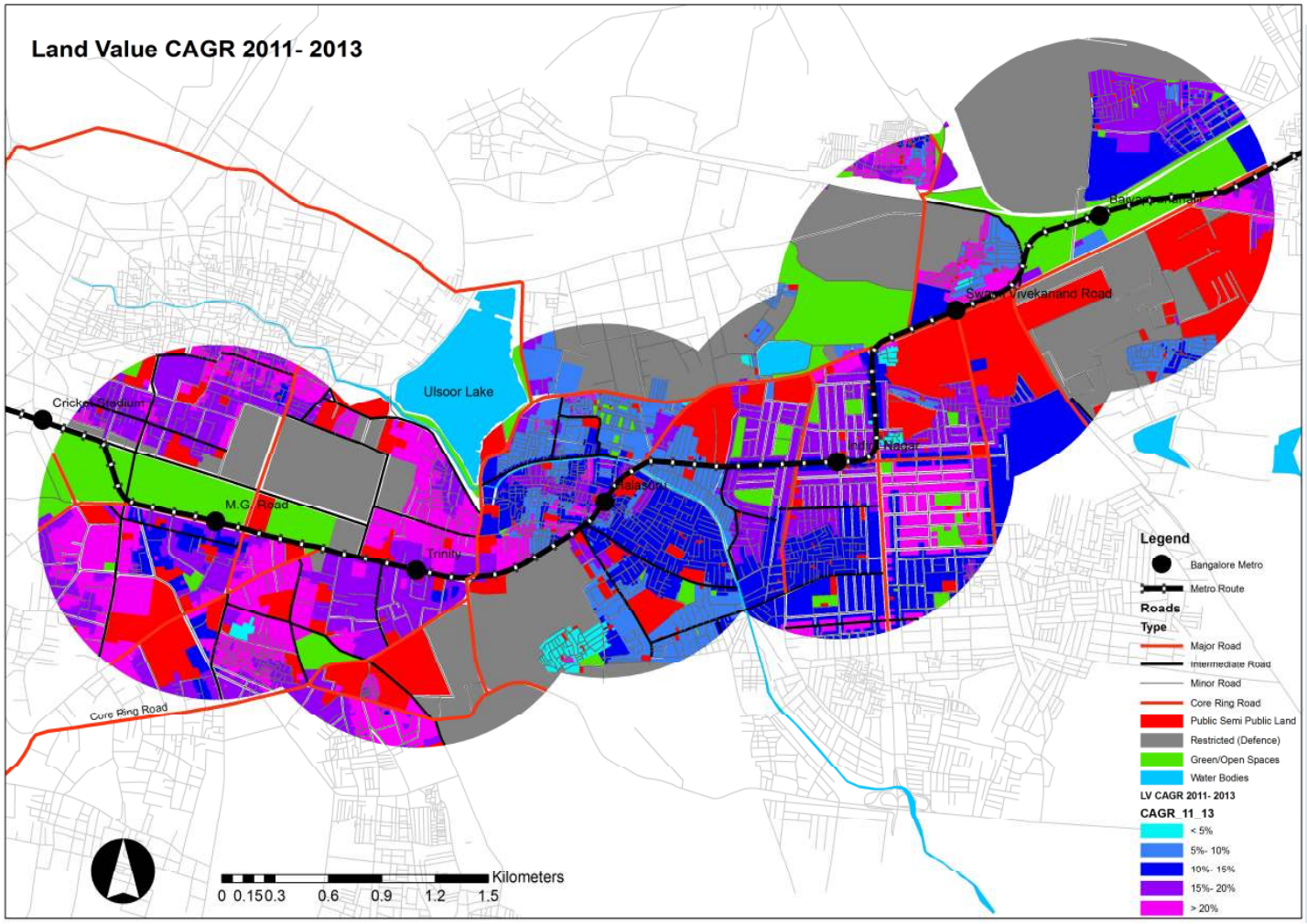
Land Value Increment as a Function of Time 4. Project Construction Stage



4. Project construction stage (2007- 2011)

- In Oct 2011, Metro has been opened to public.
- Areas abutting to MG Road and Trinity, have the highest rise due to increased demand of commercial spaces.
- Rise is significant even if plots are located at a distance from metro.
- CAGR of 7.5%- 8% has been observed.
- The area, closely located to metro station has witnessed an escalation of around 11%- 13%.

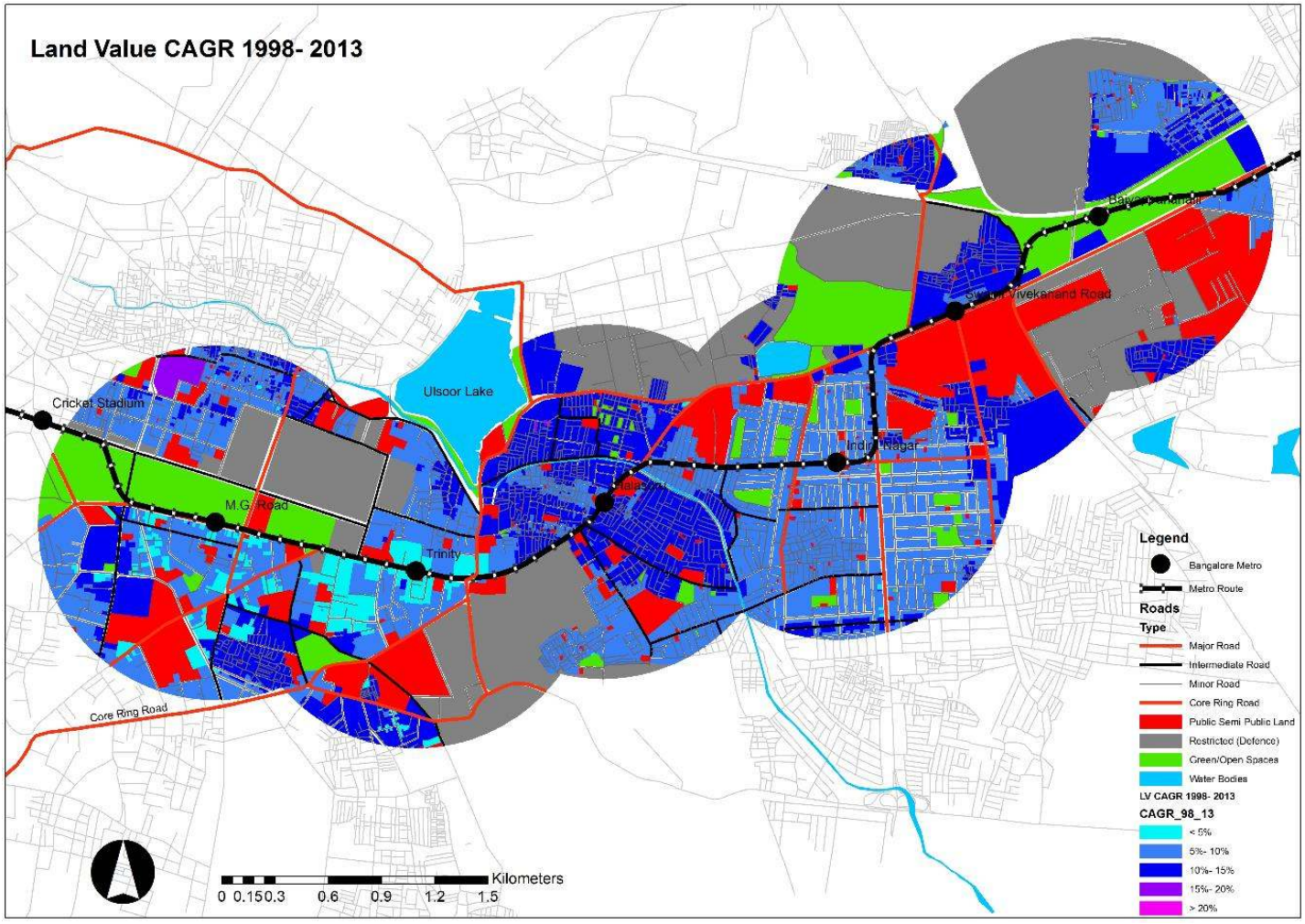
Land Value Increment as a Function of Time 5. Post Completion Stage i



5. Post completion stage i (2011- 2013)

- Areas abutting to MG Road and Trinity, have the highest rise due to increased demand of commercial spaces.
- CAGR of **14%- 16%** has been observed.
- Highest increment has been perceived in areas around Trinity Metro station.
- The areas within a buffer of 1000m had a higher growth in Land Prices due to locational advantage.

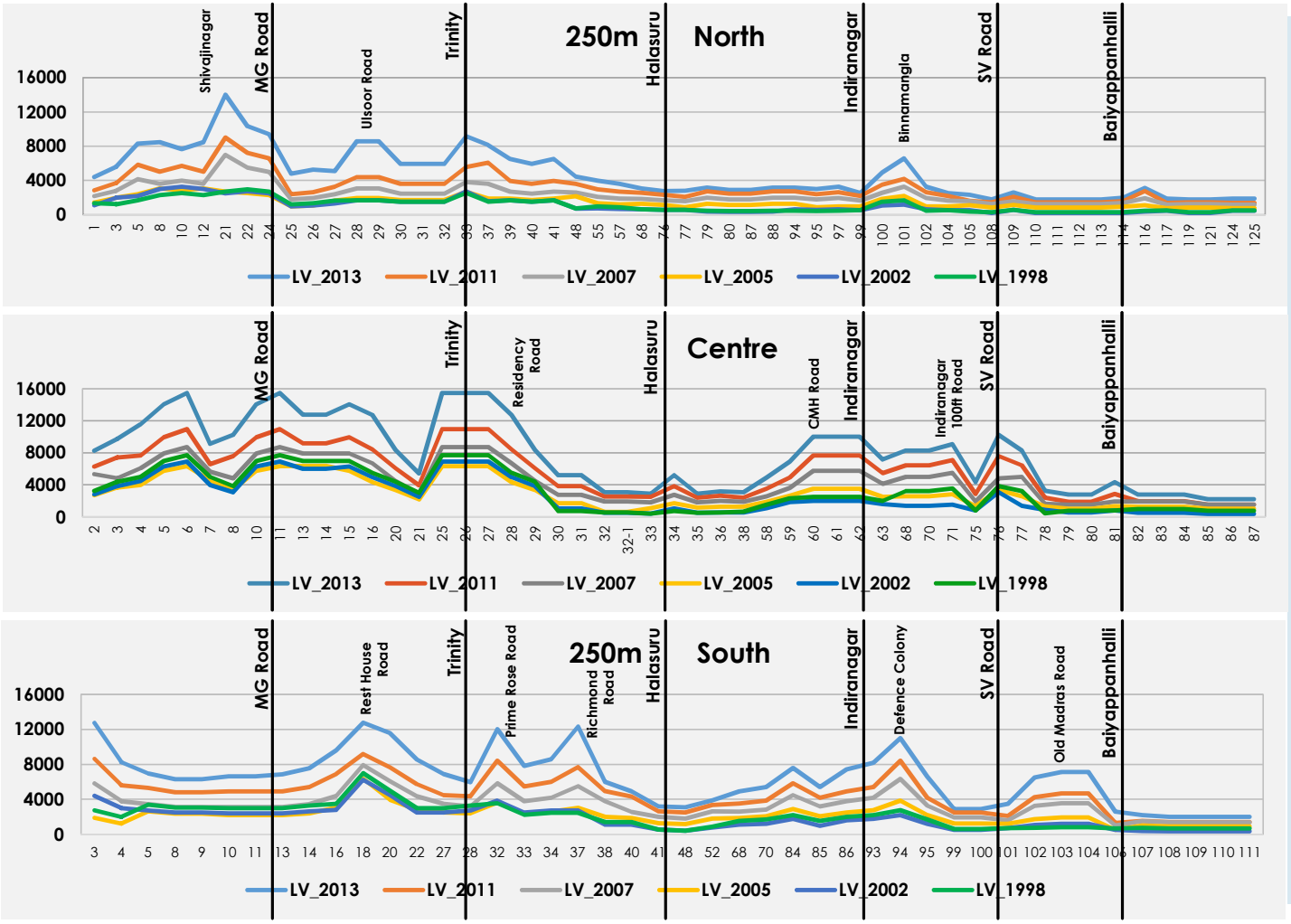
Land Value Increment as a Function of Time; Full Time Period



Full Time Period (1998- 2013)

- Land values have escalated with **a steep increase** during the whole period.
- CAGR of **9%- 11%** has been observed.
- Highest increment has been perceived in areas around **Halasuru** Metro station.
- Areas closer to MG Road and Trinity station, have grown at **relatively lower rate** due to **pre-existed higher prices**.
- **Absolute increment is highest near MG Road Station.**

Land Values as a Function of Distance from Metro

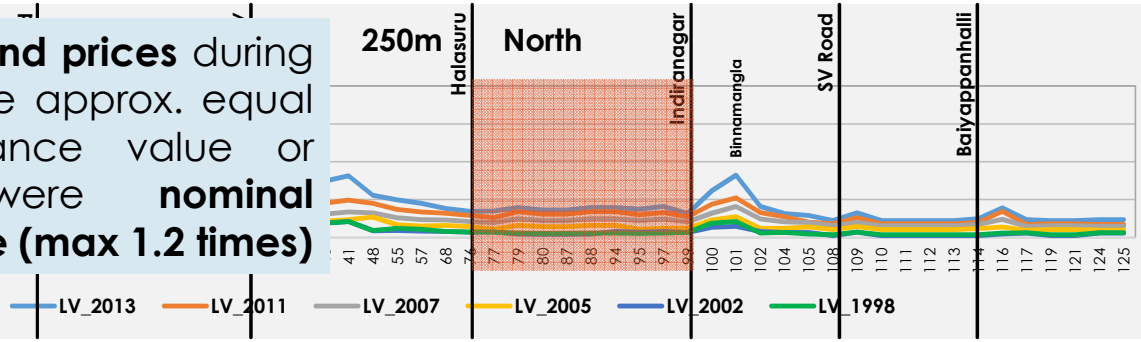


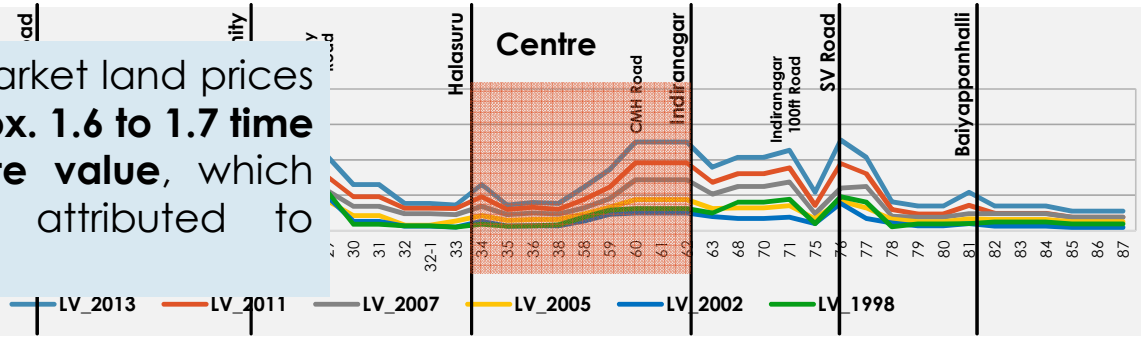
- Land values are **inversely** related to the distance of land parcels from the metro station.
- Small increment in proximate areas of MG Road and Trinity due to already **saturated** Land prices in these areas.
- **Ordinarily, land values decreases as we drift away from metro.**
- **Higher on Southern side**
- Metro has exerted influence up to a buffer of 1 km radius with **maximum influence in within 500m.**

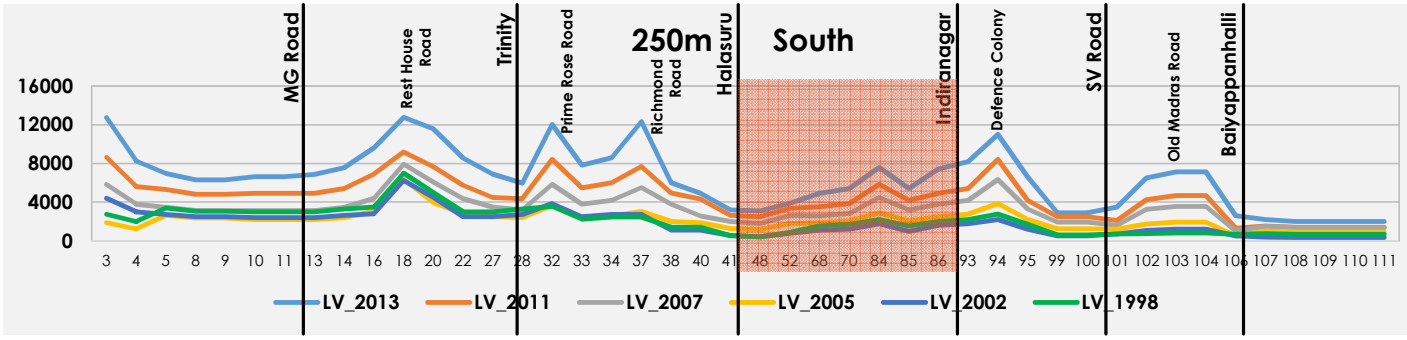
Land Values as a Function of Distance from Metro

- **Market land prices** during **2002** were approx. equal to guidance value or there were **nominal difference (max 1.2 times)**

- Today, Market land prices are **approx. 1.6 to 1.7 time of Gazette value**, which can be attributed to Metro.





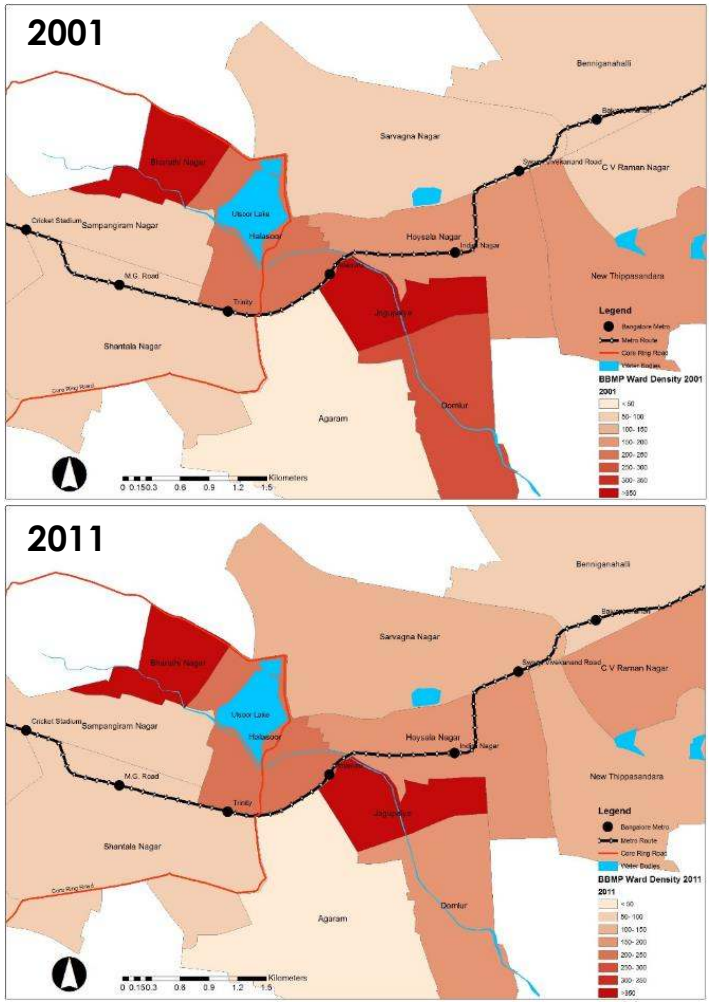


- **A Nominal increment** in prices concludes that land values are inspired by **other characteristics of properties** as well.

This include

- **High Density**
- **Physical attributes** of plot
- **Narrow** roads
- Provided **Infrastructure** facilities
- Established **old market** areas due to which congestion also exists.
- Proposed **land use** profile and Building **Regulations**
- **Social attributes** (Low, Low-middle income groups).
- **Limited scope** for land consolidation

Land Value Increment and Population Density



- Population density around the stations has remained **same** even when the population density of Bangalore city has been **increasing rapidly**.
- The **minimal change in population density** has been due to **tremendous sprawl** in the city area.
- Outward movement of population from **core to periphery** due to higher growth in **land values in central part** of the city.
- A smaller increment in population density of the nearby residential areas, can be attributed to **metro**.
- **Increased commercial space** along the metro due to higher demand which have increased **employment** and decreased densities in some areas.

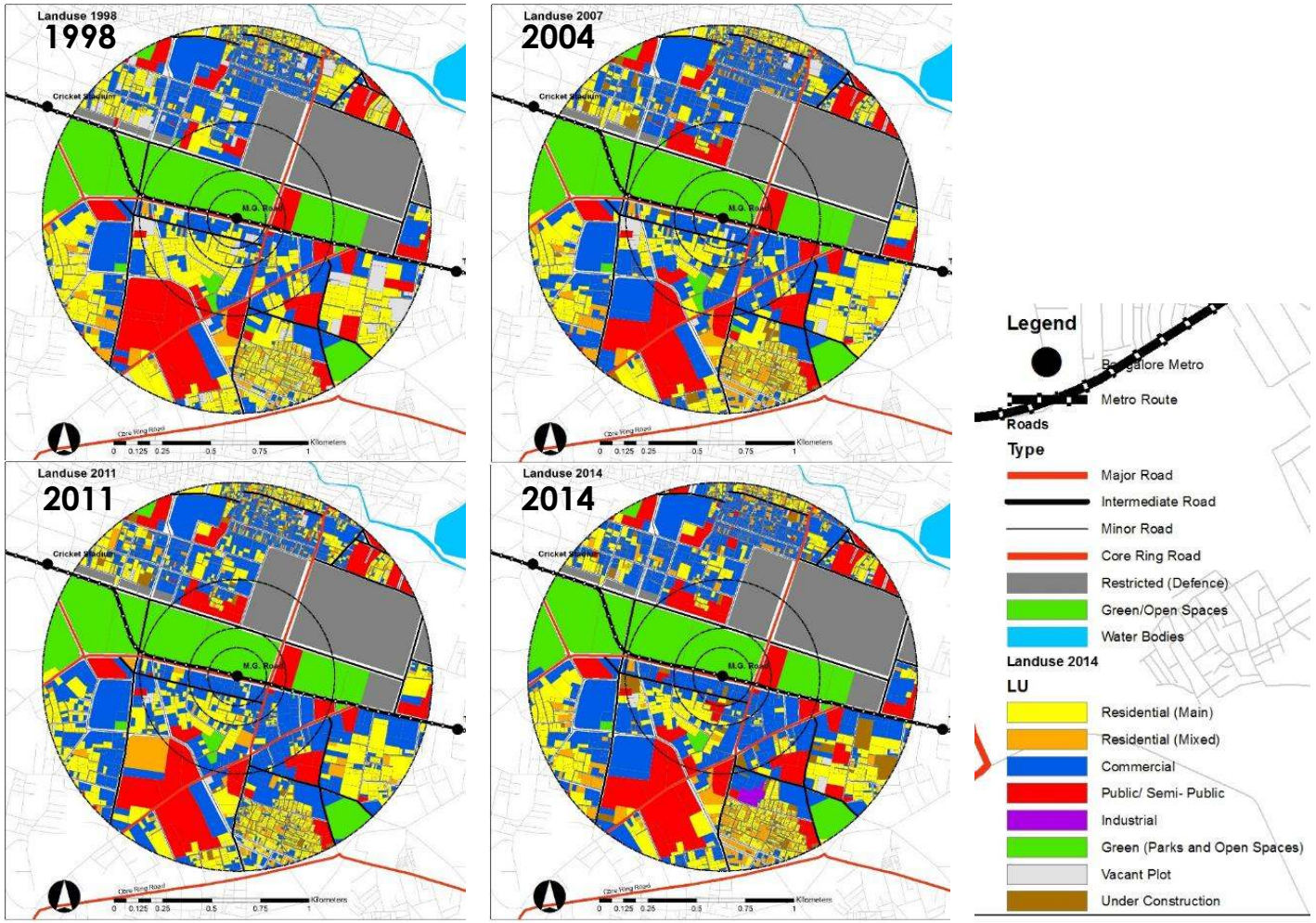
Analysis: Detail Study: MG Road

Existing Land use					
Overall	**150 m Buffer**	**150- 250m Buffer**	**250- 500m Buffer**	**500- 750 m Buffer**	**750- 1000m Buffer**
Commercial purpose (Retail areas, Offices, Restaurants), Mixed land use	Retail Commercial Areas, Shopping Complex, Unclassified area (Military Parade Ground)	Retail Commercial Areas, Hotels, Multi-storied Offices, Residential bunglows	Retail Commercial Areas, Offices, Hotels, Unclassified: Military land, Residential	CBD, Retail Commercial Areas, Mixed Use, Public/ Semi Pubic Areas, Unclassified: Military Land, Residential area	CBD, Retail Commercial Areas, Mixed Use, Public/ Semi Pubic Areas, Unclassified: Military Land, Residential area

MG Road: History

1812	• The low density colonial city had a strong European character, with public life and thus public space centered on and around **South Parade** (MG Road).
Early 19th Century	• During British Era, it was purely a **military road** due to the presence of the Parade Ground and the army barracks.
Post Independence	• Development around M.G. Road created market **pressures for commercial** and entertainment uses. It responded and evolved into a fashionable main street or a colonial street mall.
	• Over the years it became the heart of the **C**entral **B**usiness **D**istrict
1990's	• Bangalore projected as a global city and large amount of capital was channeled into and M.G. Road became the **obvious choice** as the business and entertainment hub for the affluent.
Presently	• **Primary road** of Bangalore connecting Old Madras road on one side and the State Legislature complex and the older city on the other. • MG road and its surroundings are still the **shopping and entertainment** hub of Bangalore. The area consists of the most prestigious offices.

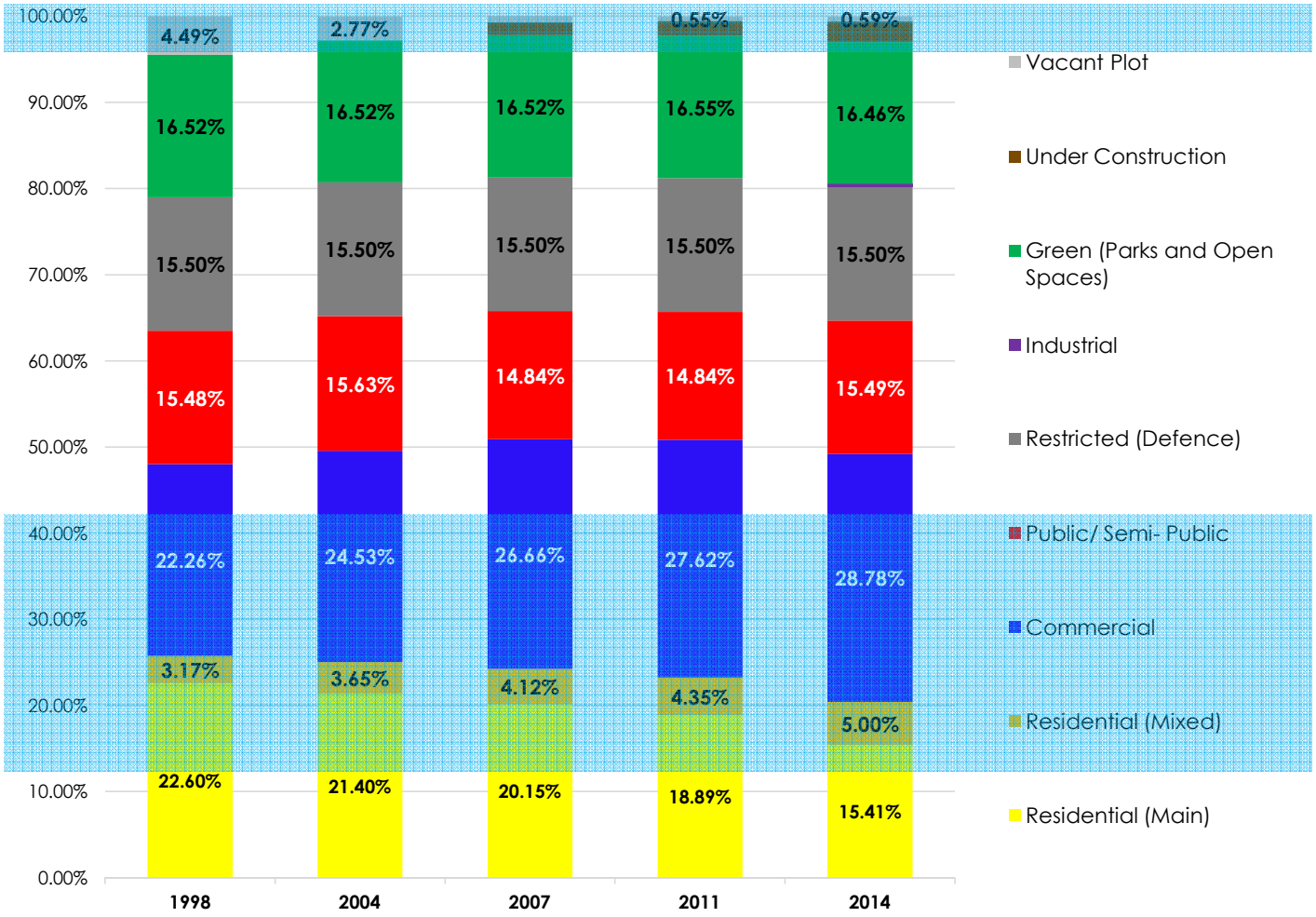
Land use changes over a Period of Time



Data Sources: *BBMP Property Tax Database, CDP, RMP 2015 and Primary Survey*

- In **1998,** the prominent land uses along the M.G. Road have been **commercial and Defence**.
- Various **residences also existed** in spite of converting to commercial
- Surrounding areas on the **South had commercial** use nearby, while in **North a mix of commercial and residential existed**.
- Tendency towards **land use densification** have proliferated since the initial **speculation of Metro.**

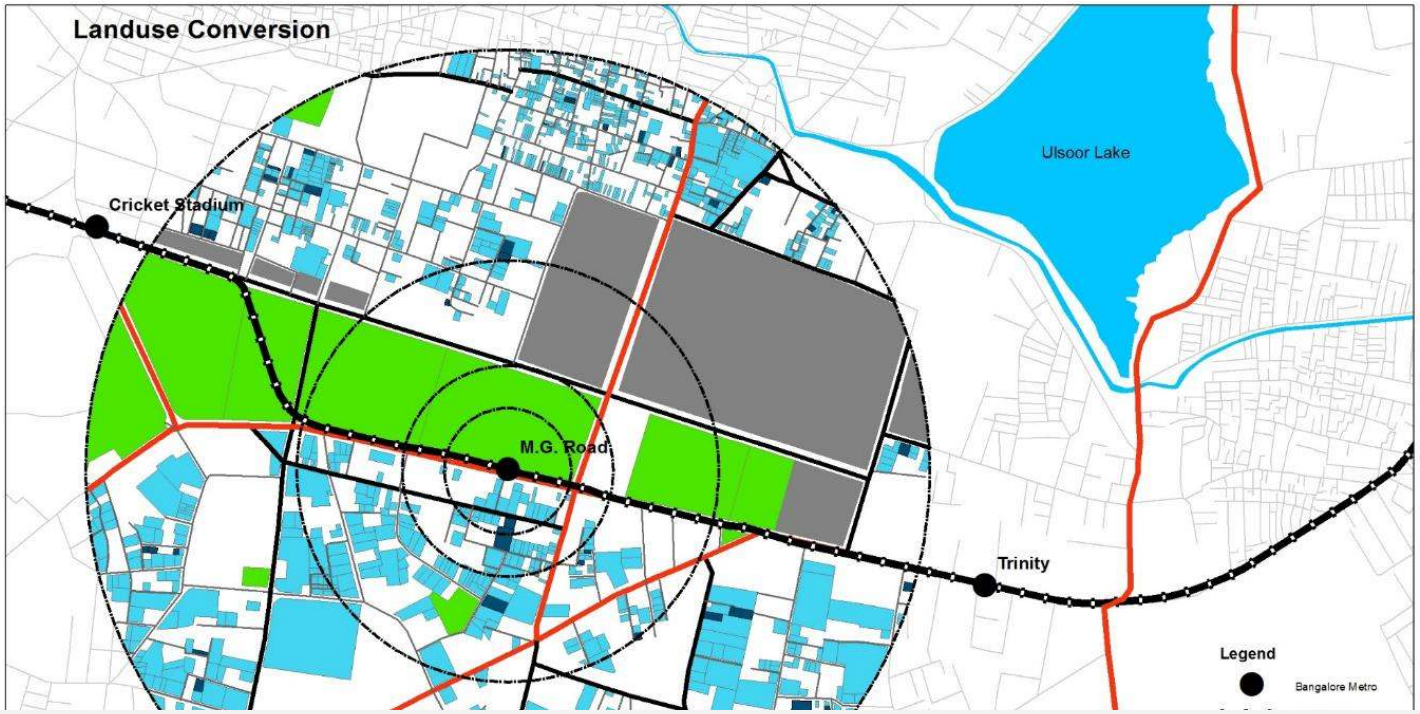
Land use changes over a Period of Time

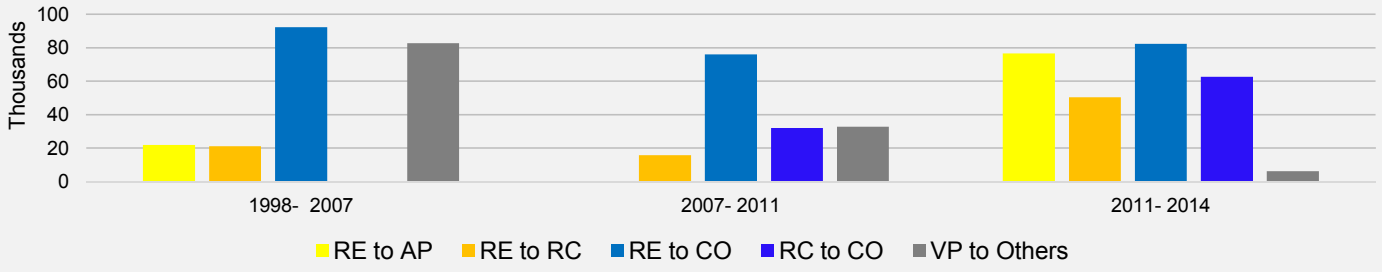


Data Sources: *BBMP Property Tax Database, CDP, RMP 2015 and Primary Survey*

- Metro has induced transformation in land use in abutting areas.
- There is a considerable increase in **demand of retail and office spaces**.
- In **nearby areas**, there is **increment** in the **commercial use and mixed use,** while there is **decrease in the area under residential use** has been observed.
- **Commercial spaces has been increased from 22.3% to 28.8%.**

Land use Conversion





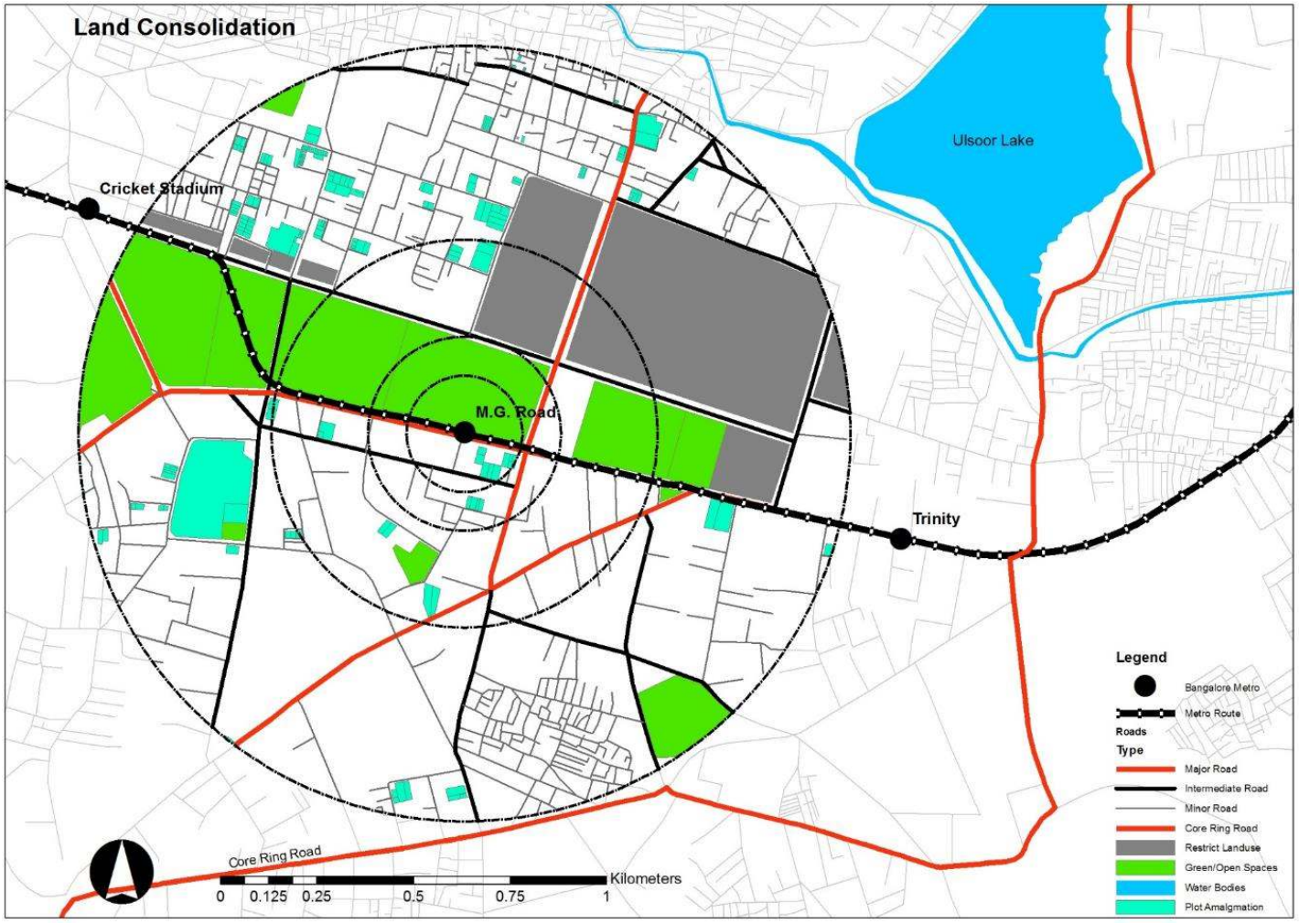
- Properties have seen one and two time conversions

Determined changes:

1. Conversion from **residential properties- to** condominium units, to mixed-parcels (including retail, services, and offices) and to dedicate commercial activities;
2. **Mixed use properties to commercial usage**
3. **New development** in the abutting vacant land or open spaces.

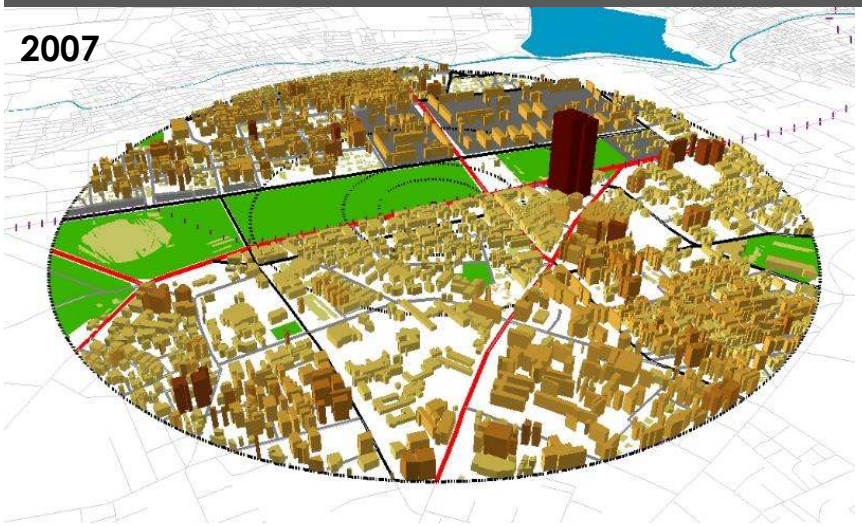
- Approx. **55%** (.65 ml. sq. mt.)of total private land has been converted since 1998.

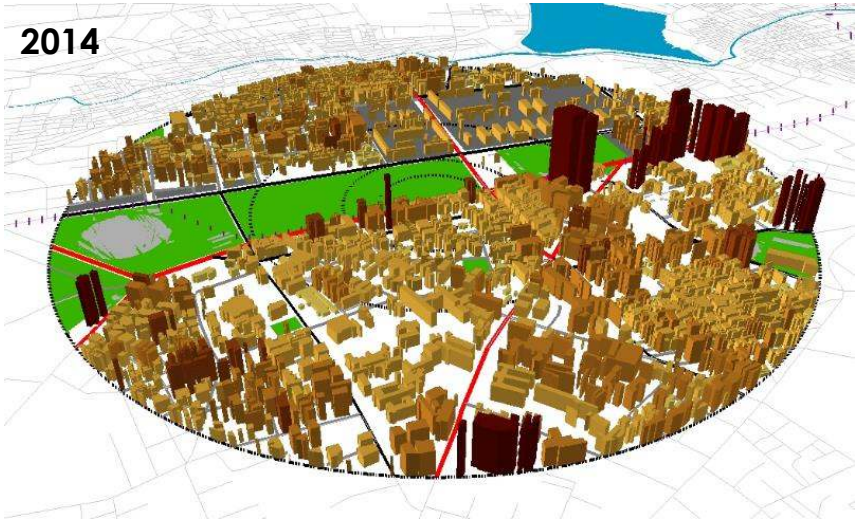
Plot Amalgamation/ Land Consolidation

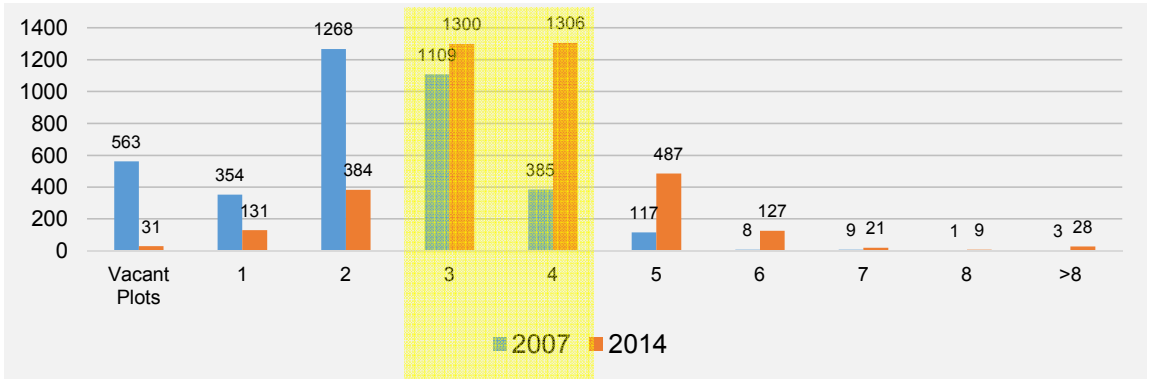


- Amalgamation is a process, where two or more **small land parcels are transformed into a large parcel** to provide opportunity for a bigger development.
- The consolidation prospect is directly influenced by the **owner's willingness to sell and number/size of the plots.**
- Approx. 200 land parcels have amalgamated since the 2011.
- **Benefits include opportunities for higher developments in terms of FSI and building heights**.

Built Form: Vertical Densification







Land is scarce. (No scope for horizontal expansion)

Increased demand for office and retail spaces

Densification in terms of building heights

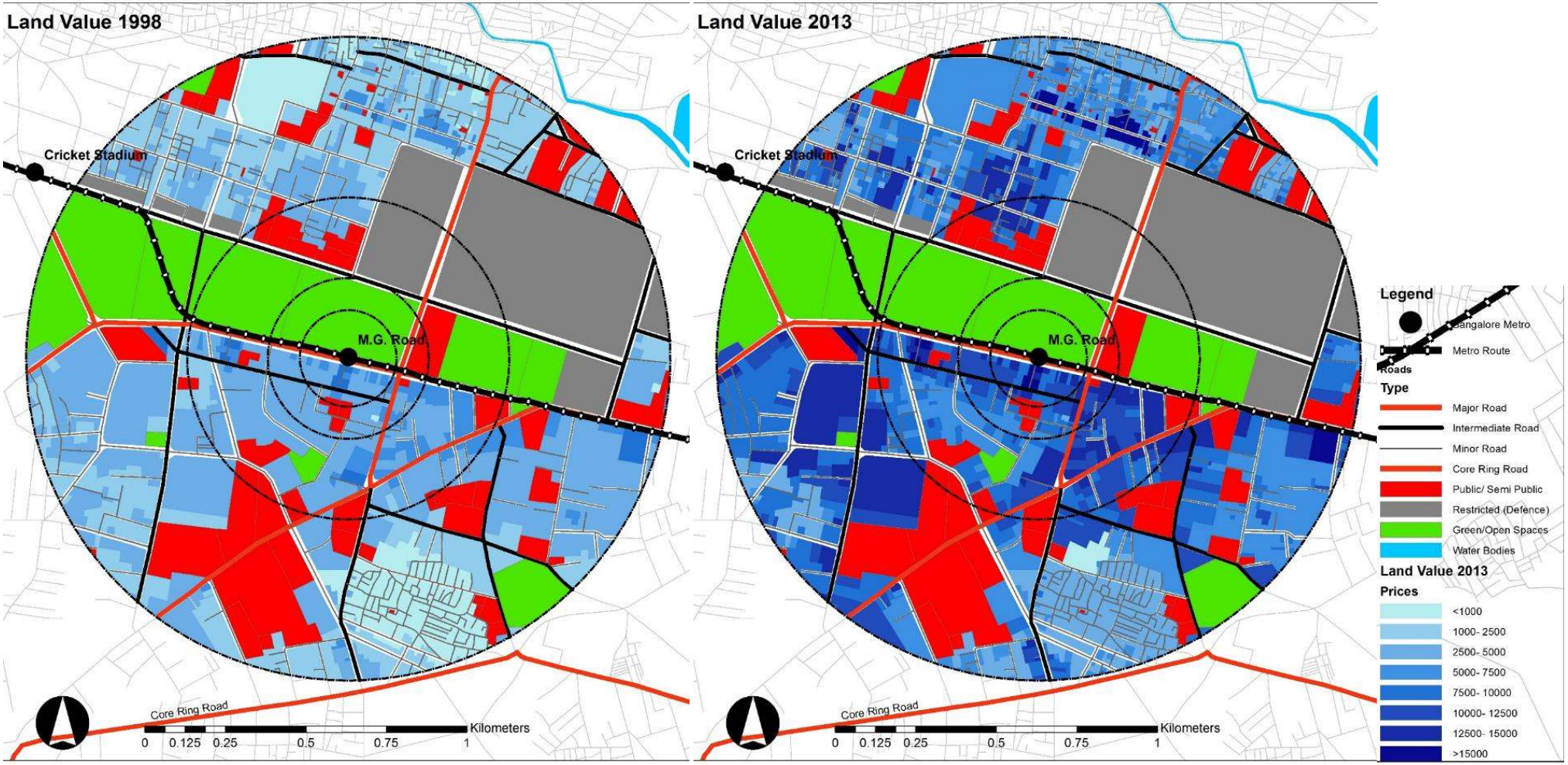
Locational advantage of the area (Nearby CBD and part of Off-CBD.)

Encouraged by RMP 2015. (FSI of 4 in 150 m buffer of metro)

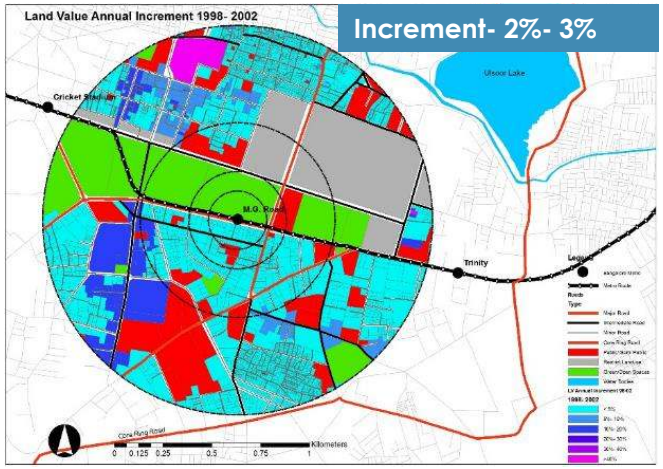
Additional FAR of .25 or .50 (Located within Core ring road)

Most of buildings were 2 & 3 storied, which have been converted to 4 & 5 storied.

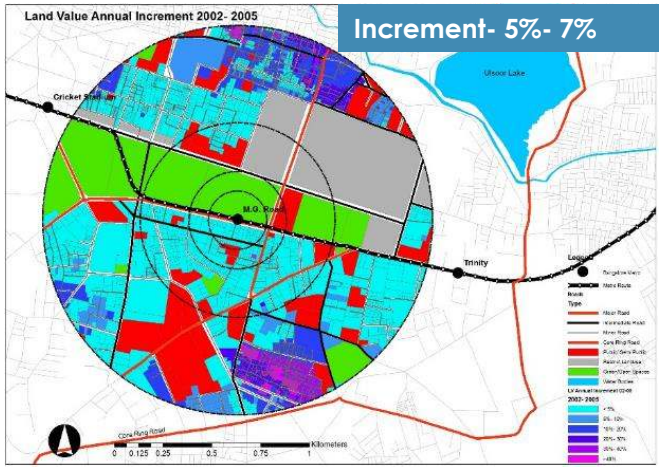
Land Value Increment as a Function of Time



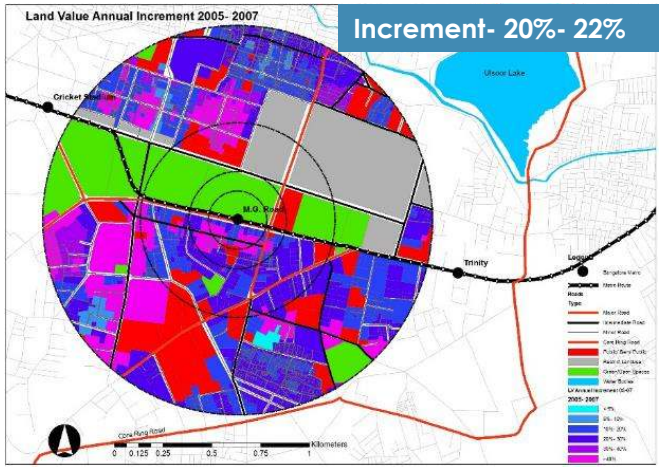
Land Value Increment as a Function of Time



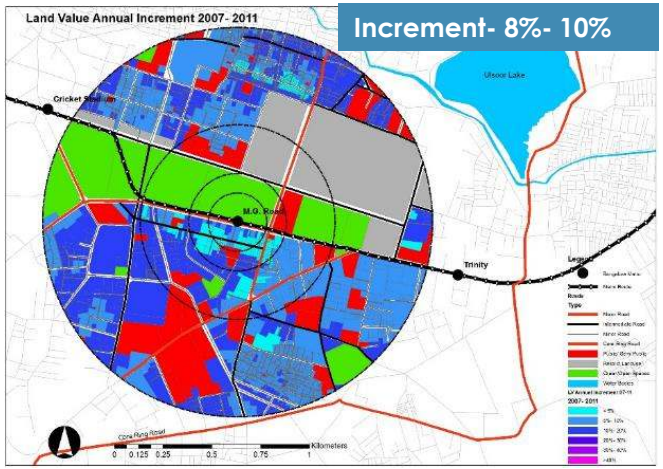
Increment- 2%- 3%



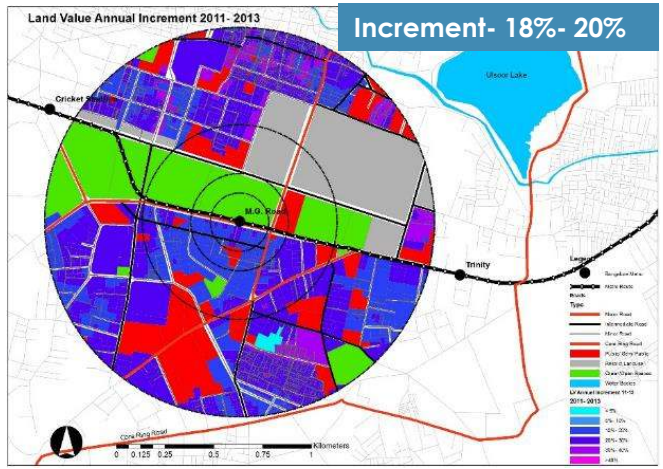
Increment- 5%- 7%



Increment- 20%- 22%



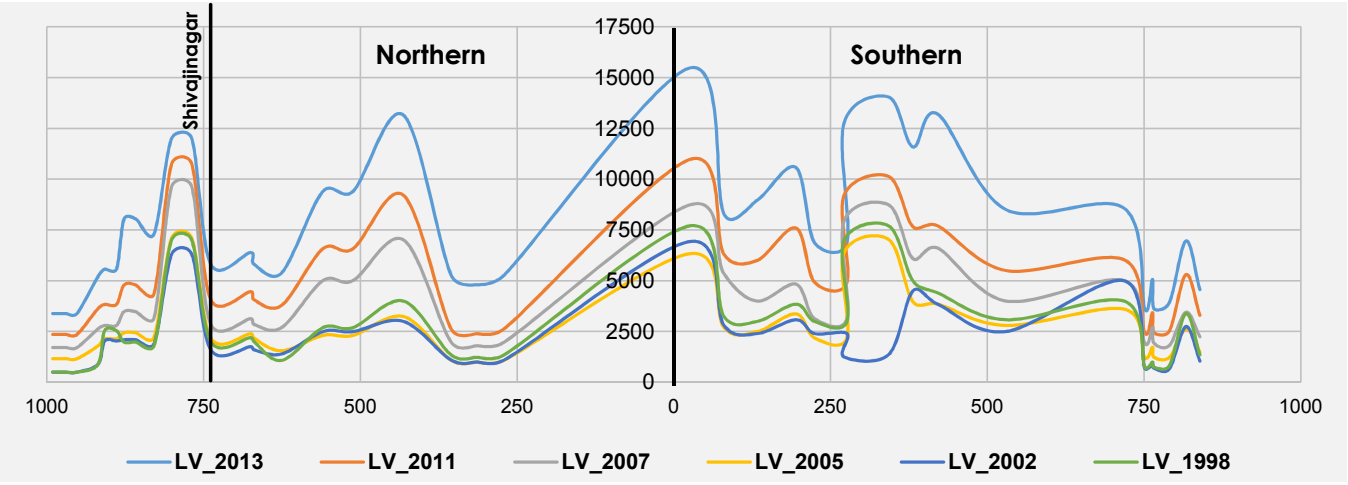
Increment- 8%- 10%

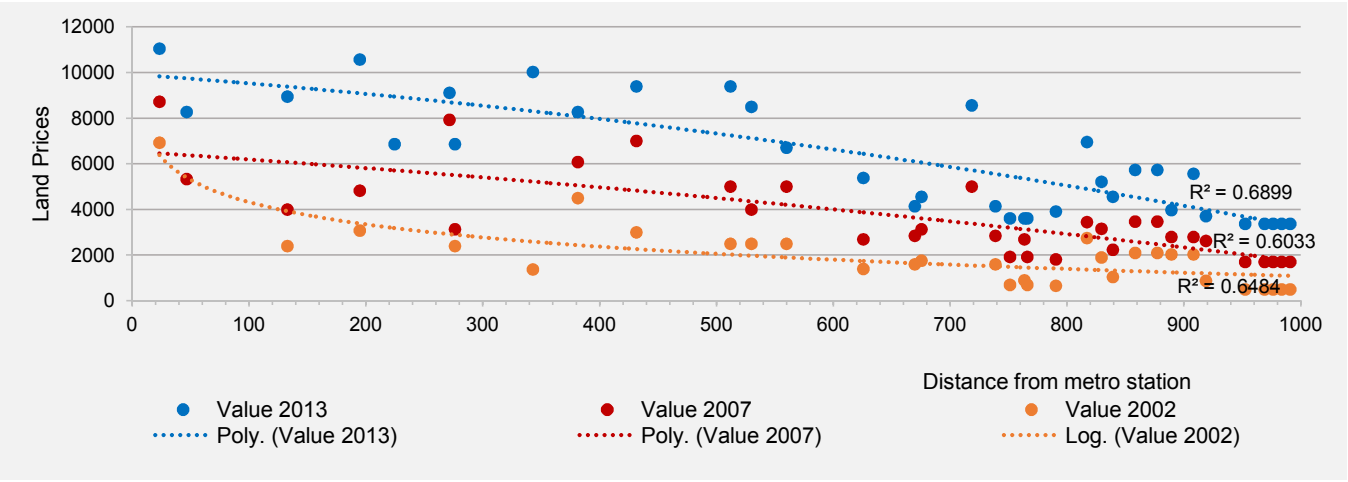


Increment- 18%- 20%

- During the Full period **CAGR is 15%- 17%**.
- A constant raise in the land prices in the **proximate areas** during all the project stages.
- Small increment **during the early stage of project** is due to **already saturated prices** in these areas.

Land Values as a Function of Distance from Metro

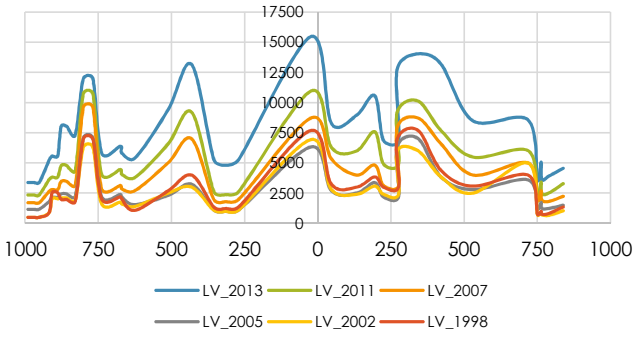




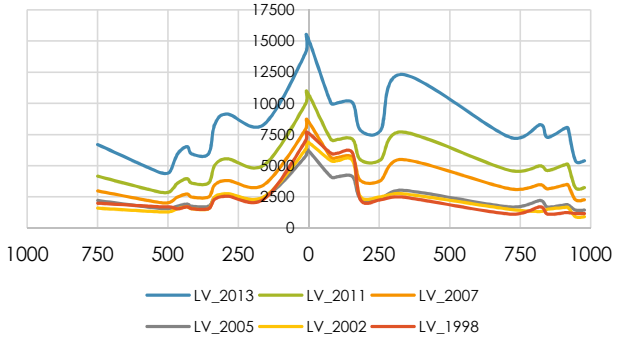
- **Land value are more in close vicinity to station**, while increment is more as we drift away from metro station, however, this holds true only till a **threshold distance of 750 m**.
- **Prices are higher on Southern side** of the metro. **Highest consistency** has been observed in the plots within the buffer of **250m to 500m**.
- On **Northern side**, land values are higher after 750 m, which is due to the **CBD factor**.

Station Specific: Land Values as a Function of Distance from Metro

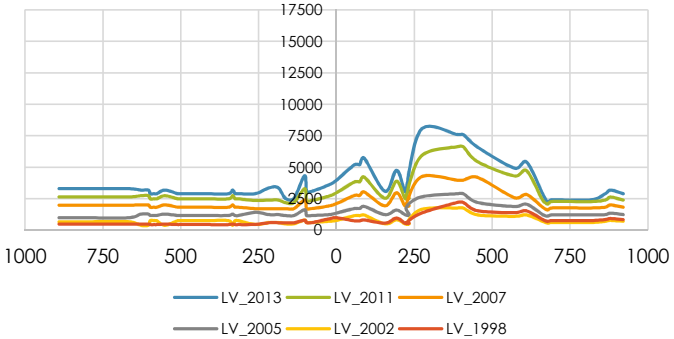
MG Road



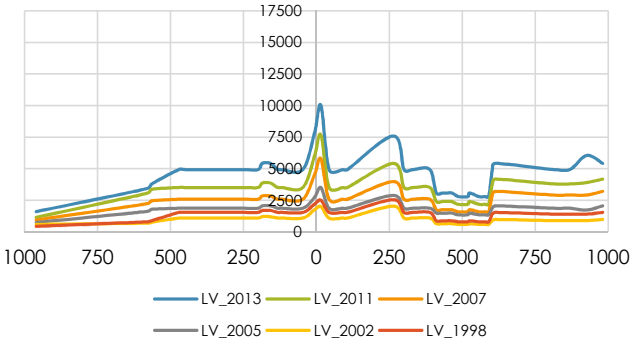
Trinity



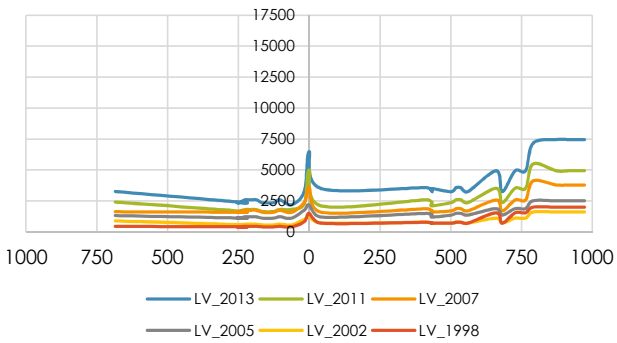
Halasuru



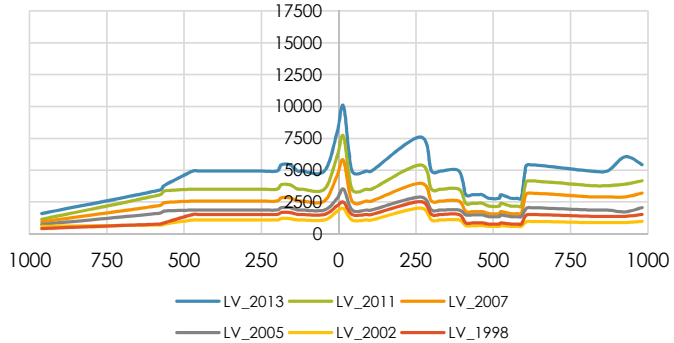
Indiranagar



Swamy Vivekanand Road



Baiyyappanahalli



Conclusions

Impact on Development Pattern

Land use Changes

- **Limited influence on land use changes** due to the **Land ownership profile**,
- Land use impact have occurred **after 2005**. Metro's impact in terms of **conversion of**; residential to apartments, to mixed use and residential or mixed to commercial and new development on open/ vacant land.
- Land parcels have **amalgamated to take leverage of permissible higher development** opportunities in terms of FSI and building heights.

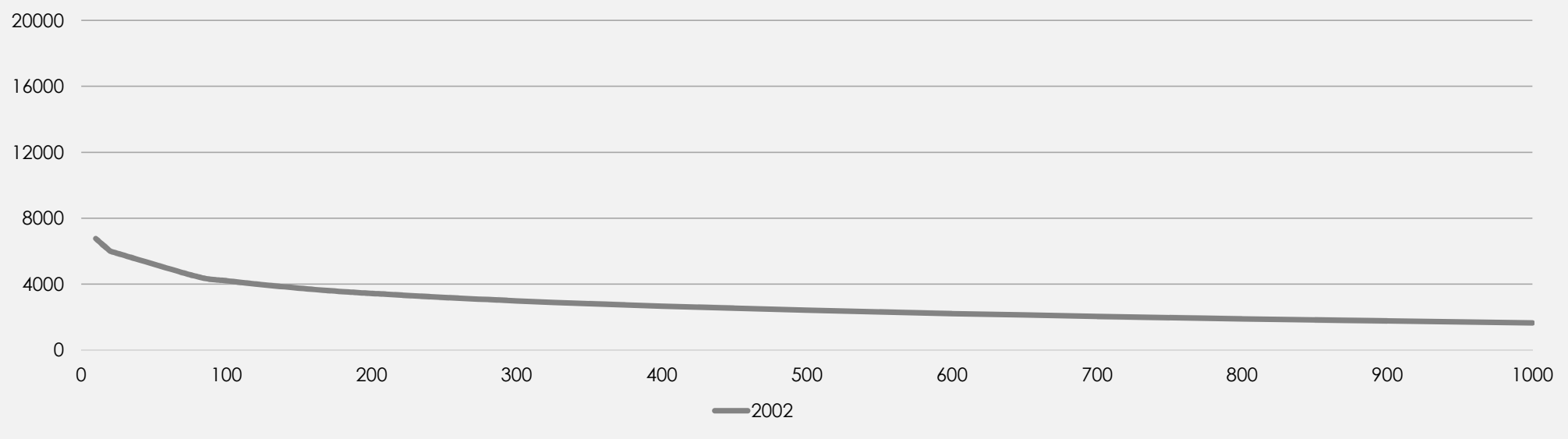
Land Value Increment

- Metro have a **positive impact on land values in nearby areas** land along the metro corridor. Partial benefits are leveraged due to the existing land ownership/use profile.
- The CAGR in prices since the metro initiation is around **9%- 11%**.
- Absolute increment in land prices is higher in immediate vicinity. Highest rise has been seen in between the **buffer of 150m- 500m**.

Built form Densificati on

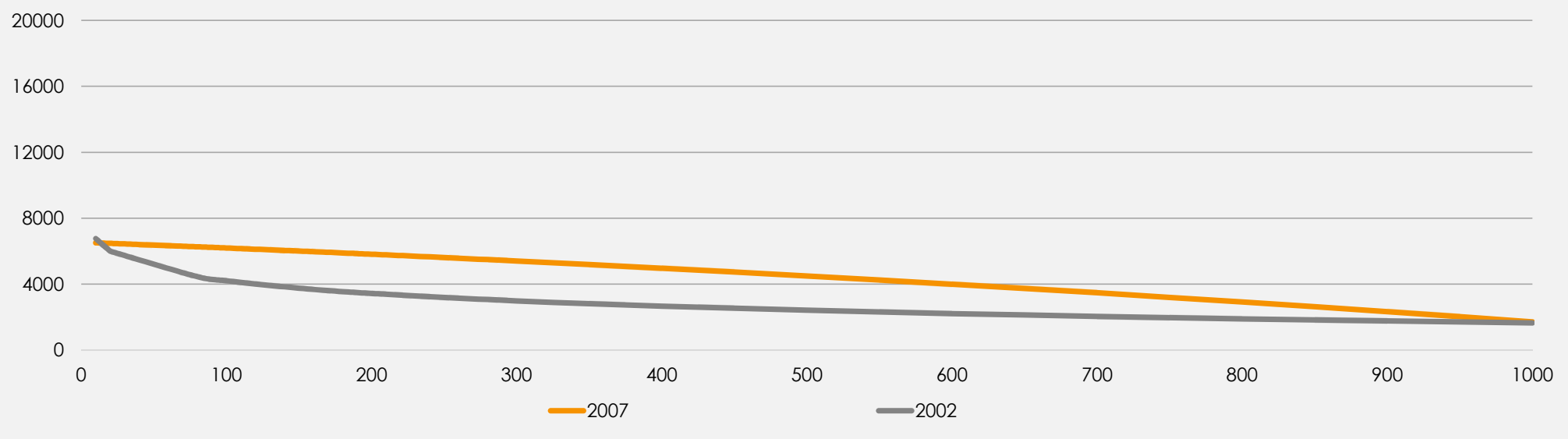
- Land use densification has emerged in terms of **increased building heights**.
- Due to increased demand of commercial & retails spaces, land scarcity for horizontal expansion and favorable development opportunities, buildings have grown vertically.
- **Higher usage of FSI in the immediate vicinity** of metro station.

Land value as Distance Decay Function



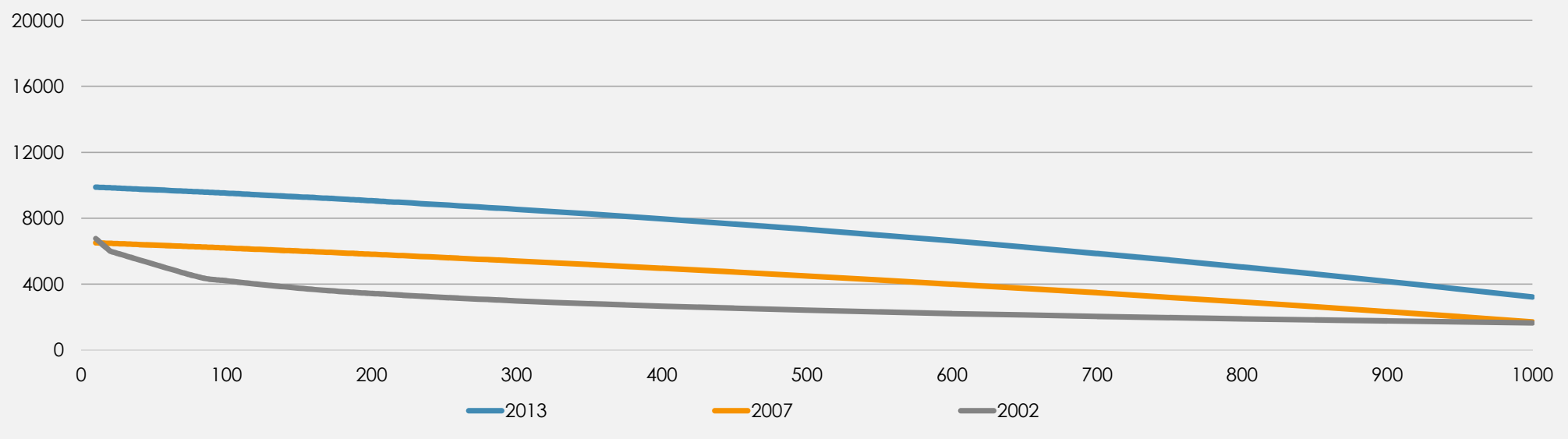
Higher Land Value closer to station but further it dropped of immediately.

Land value as Distance Decay Function



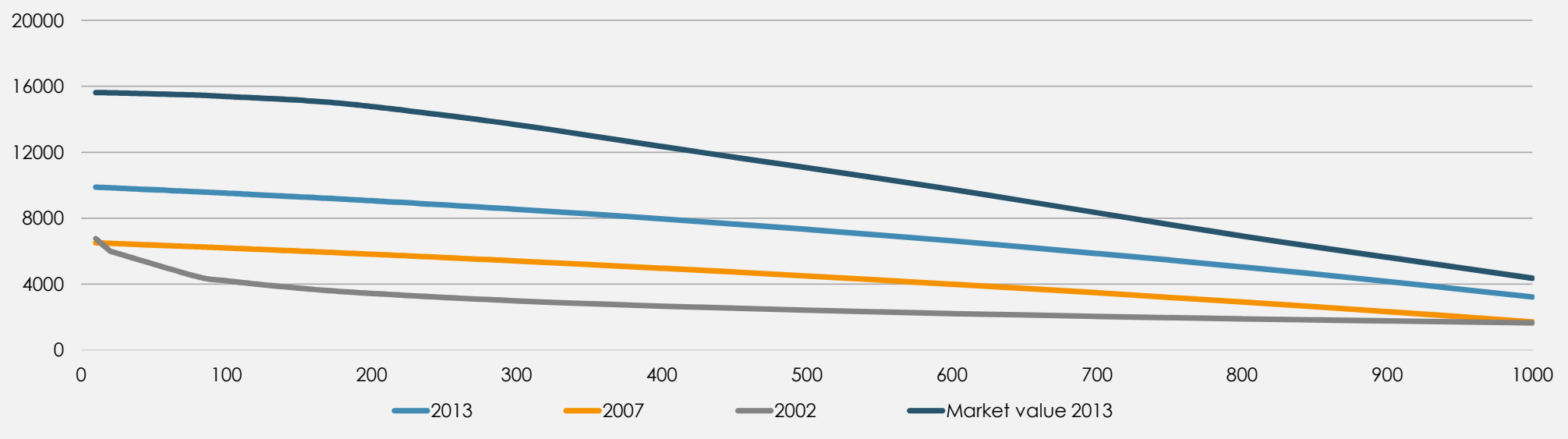
Higher Land Value closer to station but further it dropped of immediately.	More consistency and Land value benefits have been realized to a greater distance.

Land value as Distance Decay Function



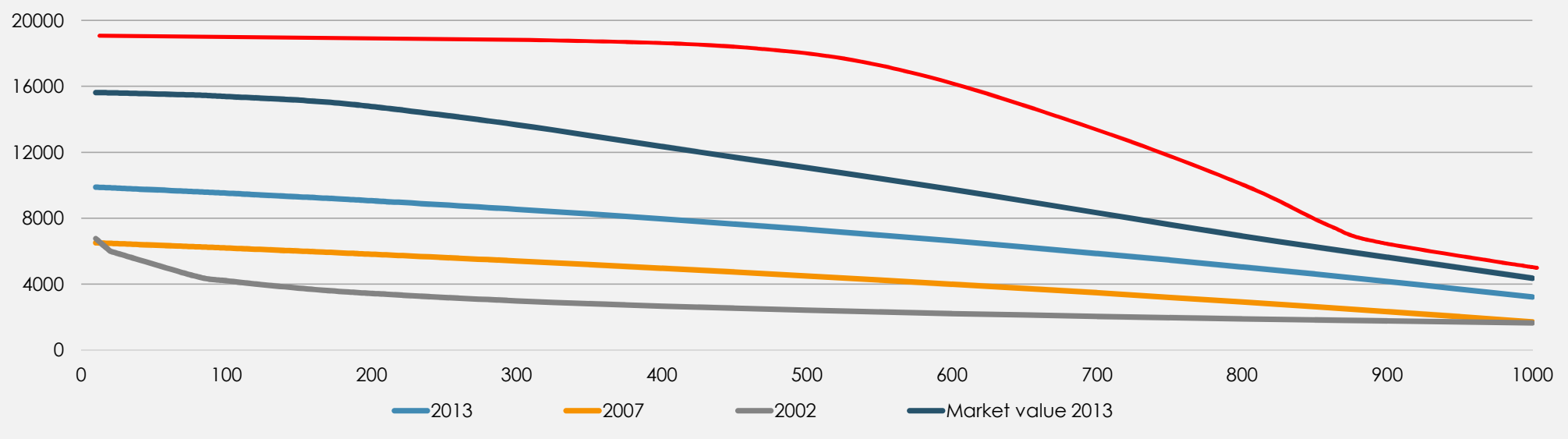
Higher Land Value closer to station but further it dropped of immediately.	More consistency and Land value benefits have been realized to a greater distance.	Land prices have became stagnant till a buffer of approx. 200m.

Land value as Distance Decay Function



Higher Land Value closer to station but further it dropped of immediately.	More consistency and Land value benefits have been realized to a greater distance.	Land prices have became stagnant till a buffer of approx. 200m.	With use of deviation factor, higher stagnation of land values have been determined

Land value as Distance Decay Function: Forecasted Benefits



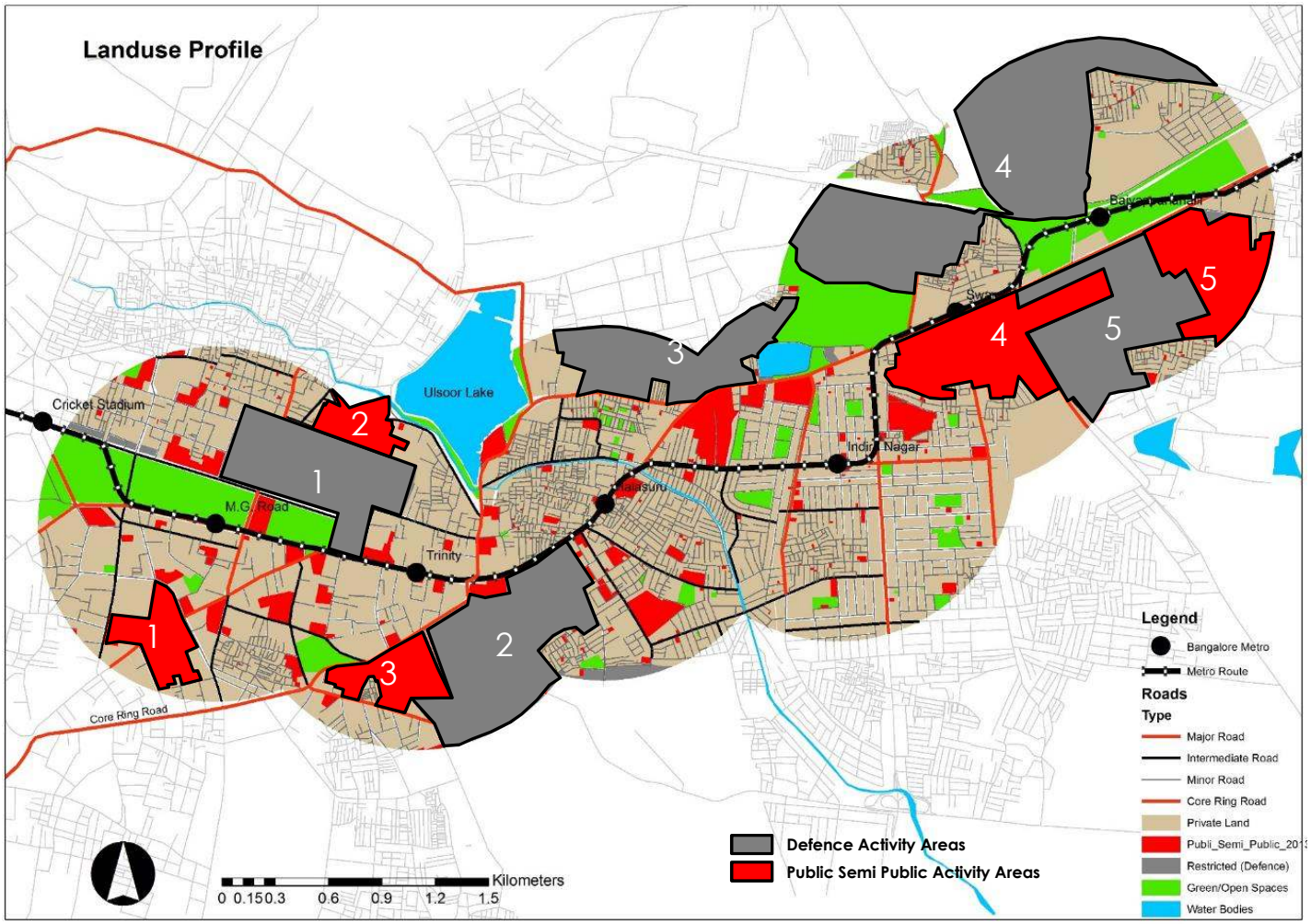
Higher Land Value closer to station but further it dropped of immediately.	More consistency and Land value benefits have been realized to a greater distance.	Land prices have became stagnant till a buffer of approx. 200m.	With use of deviation factor, higher stagnation of land values have been determined

Comparison with other empirical studies

Project	Premium rate	Property type	Catchment Area (Within)	Author, Year Published
San Francisco BART, California	50%	Residential: Unit rents	400m	Bernick, 1991
MARTA, Atlanta	11 to 15.1%	Residential and Commercial	90m	Cervero, 1993
Sacramento LRS, California	62.0%	Residential	275m	Landis, 1995
San Francisco BART, California	50%	Residential and Commercial	400m	Bernick, 1991
Chicago METRA CRS, Illinois	20%	Residential	300m	Gruen, 1997
Tokyo Tokaido Line, Japan	57%	Commercial	50m	Cervero, 1998
San Diego Trolley System	25%	Commercial	400-800m	Cervero and Duncan, 2002
Dallas DART, Texas	18.2%, 12.6%	Residential sales	Undefined 400m	Clower, 2002 Weinstein and Clower, 2002
Dallas DART, Texas	10%	Commercial	400m	Weinstein, 1999 Clower, 2002
Breda, Arnhem and Scheidam stations, Netherlands	0.4% to 12%	Commercial: Office rents	Immediate area	Van der Krabben, 2008
Santa Clara Light Rail, California	15%	Commercial: Office sales	800m	Weinberger, 2001
	120% (San Jose stations only)	Commercial	400m	Cervero, 2002
Market Square, Denver, Colorado	60%	Commercial: Office rents	Immediate area	Cervero, TCRP, 2009
Bangalore Metro (All Stations)	**18%- 20%**	Residential and Commercial	1000m	
	22%- 25%	Residential and Commercial	500m	
	30%- 32%	Residential and Commercial	250m	
	30%- 34%	Residential and Commercial	150m (Immediate area)	
Bangalore Metro, MG Road Station	**22%- 25% (3800/sq.ft.)**	Residential and Commercial	1000m	
	28%- 32% (6100/sq.ft.)	Residential and Commercial	500m	
	36%- 40% (5900/sq.ft.)	Residential and Commercial	250m	
	40%- 45% (7500/sq.ft.)	Residential and Commercial	150m (Immediate area)	

Potential for Value Capture

Development Precincts



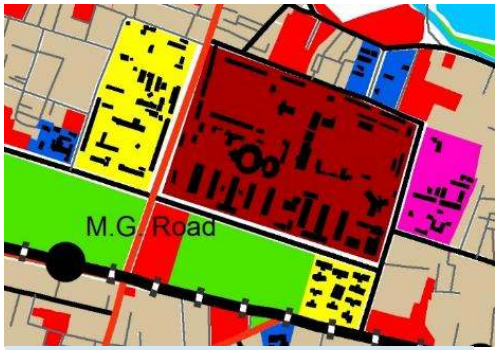
Concept of Property Development:

- Proposed corridors are **not financially viable** but are **very attractive for economic growth.**
- **To finance part cost**, it has been proposed develop and **exploit the potential of commercial utilization of real estate** along/close to the proposed alignment.

Issues:

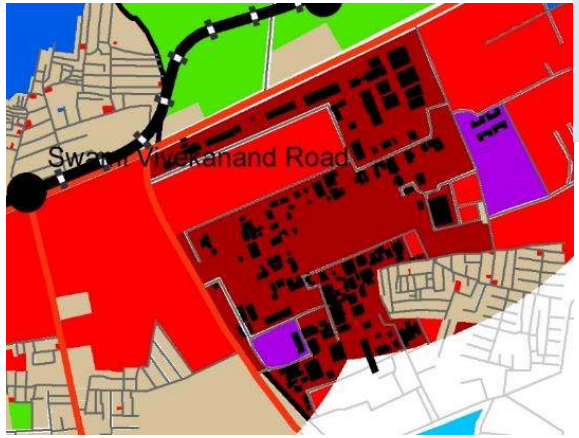
Govt. land or cheaper land is not available along two corridors.

Defence Land: Activity Areas

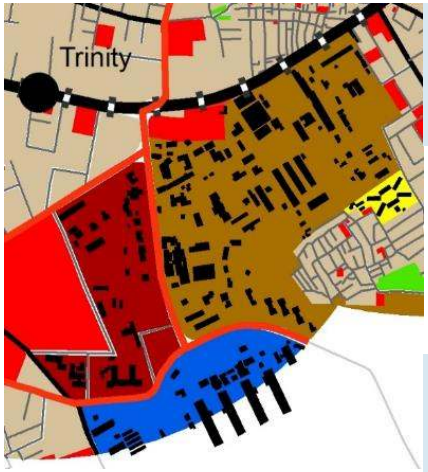


1. Army Public School, Public Relation Office, Quarters and Canteen area.

3. Madras Eng. Group (MEG)

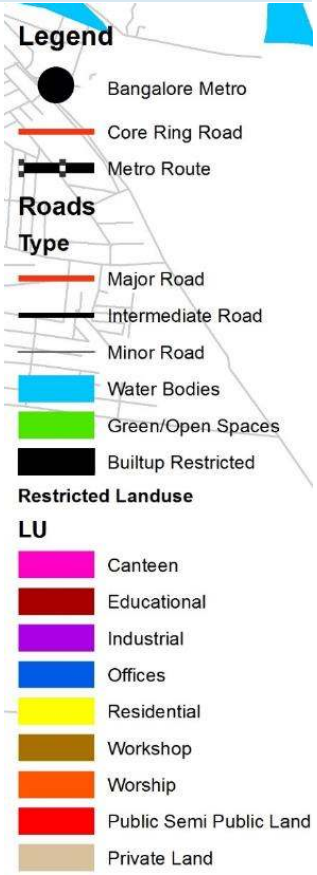


5. HAL Engine Division and DRDO

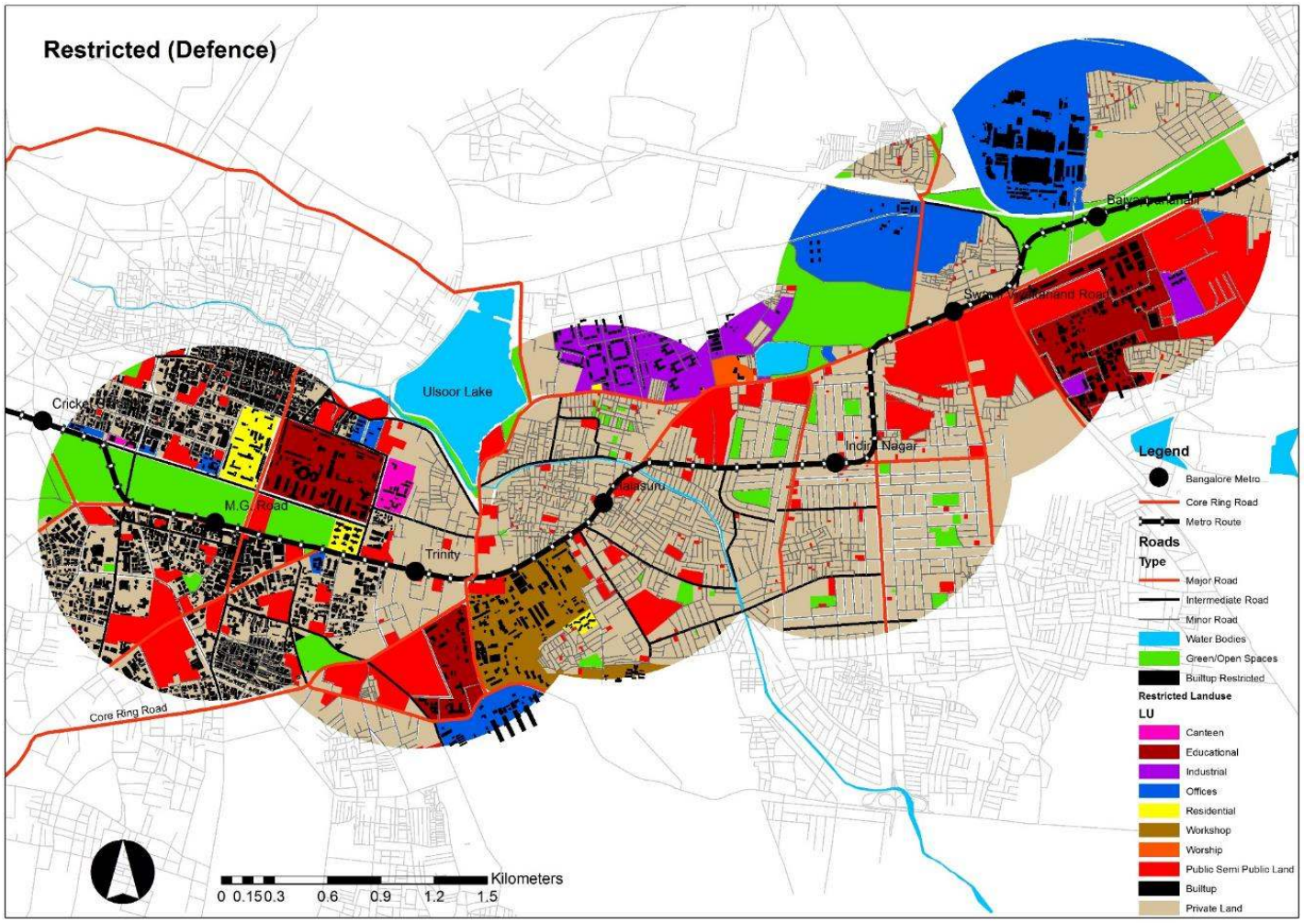


2. ASC College, Workshop, Mess area and Offices.

4. Defence Office Areas



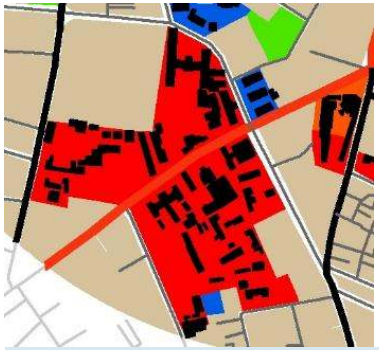
Defence Land: Activities



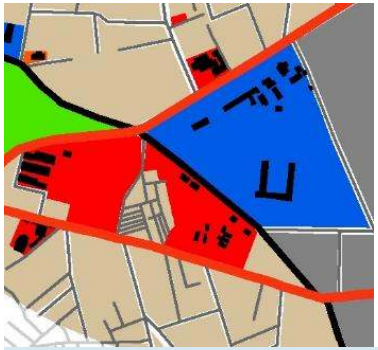
Activities:

- Defence Offices,
- Educational Areas,
- Residential Quarters,
- High Tech Industries,
- Workshops,
- Mess,
- Canteen areas etc.

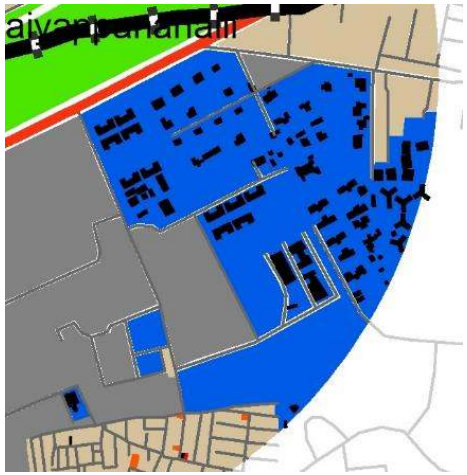
Public and Semi Public: Activity Areas



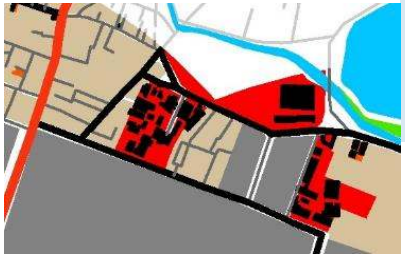
1. Schools and Colleges



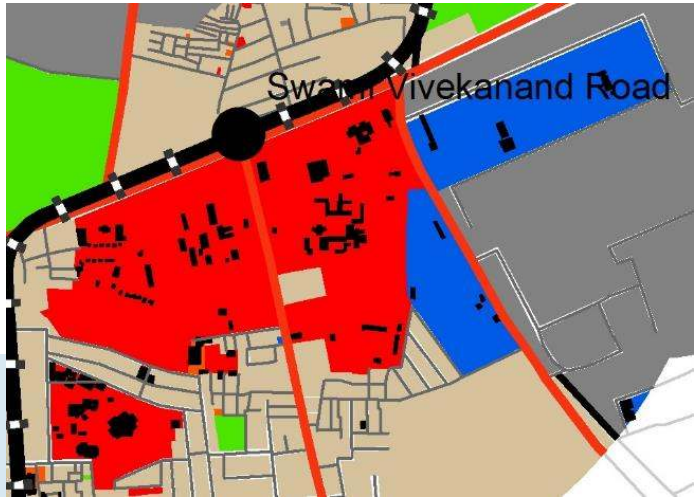
3. Kendriya Vidhalaya ASC & Hostels and Office of ADGP to Police



5. HAL Officer Quarters

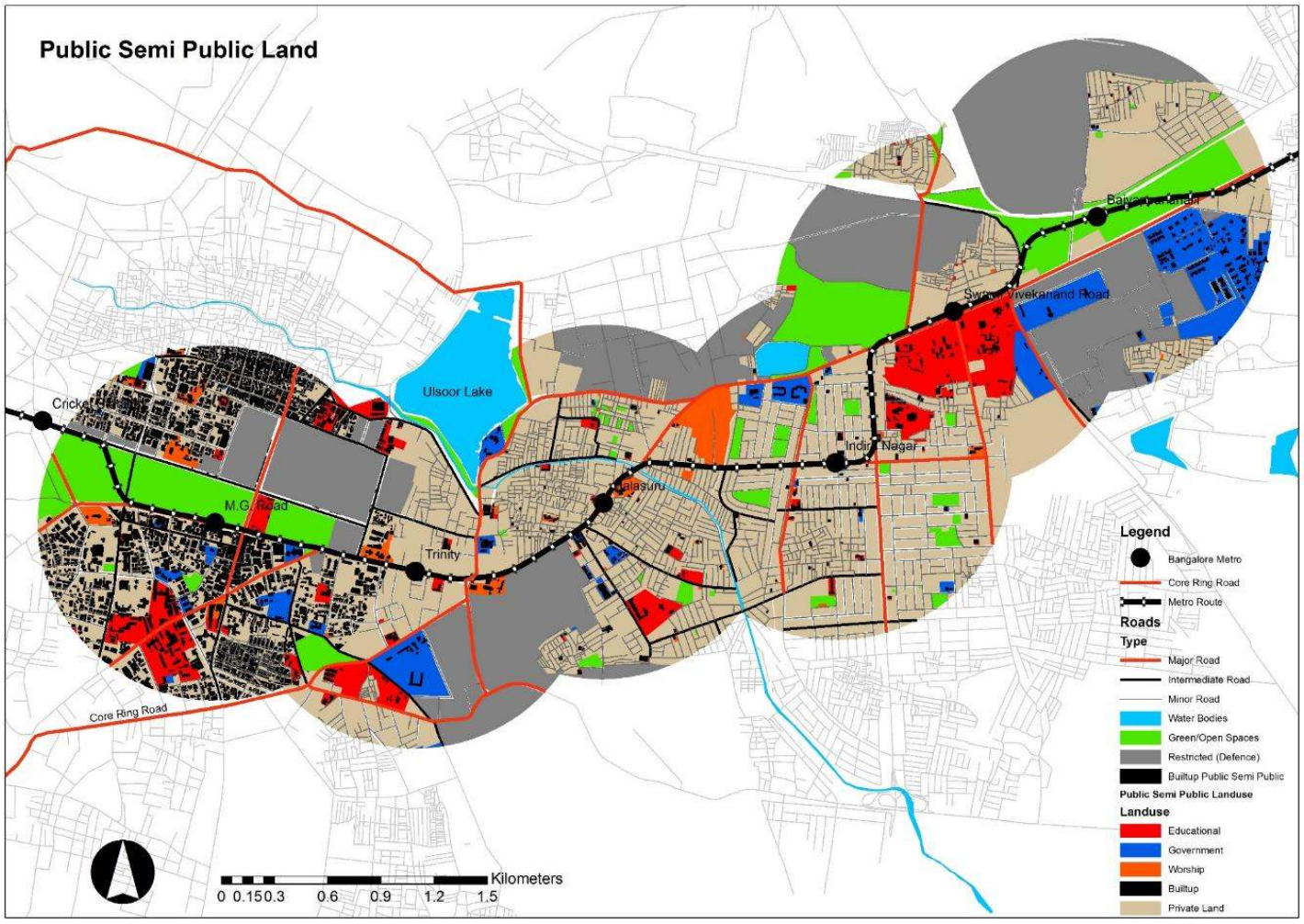


2. RBANM Educational Complex and Hasanth College.



4. Govt. Hospital and School and BWSSB Office Areas

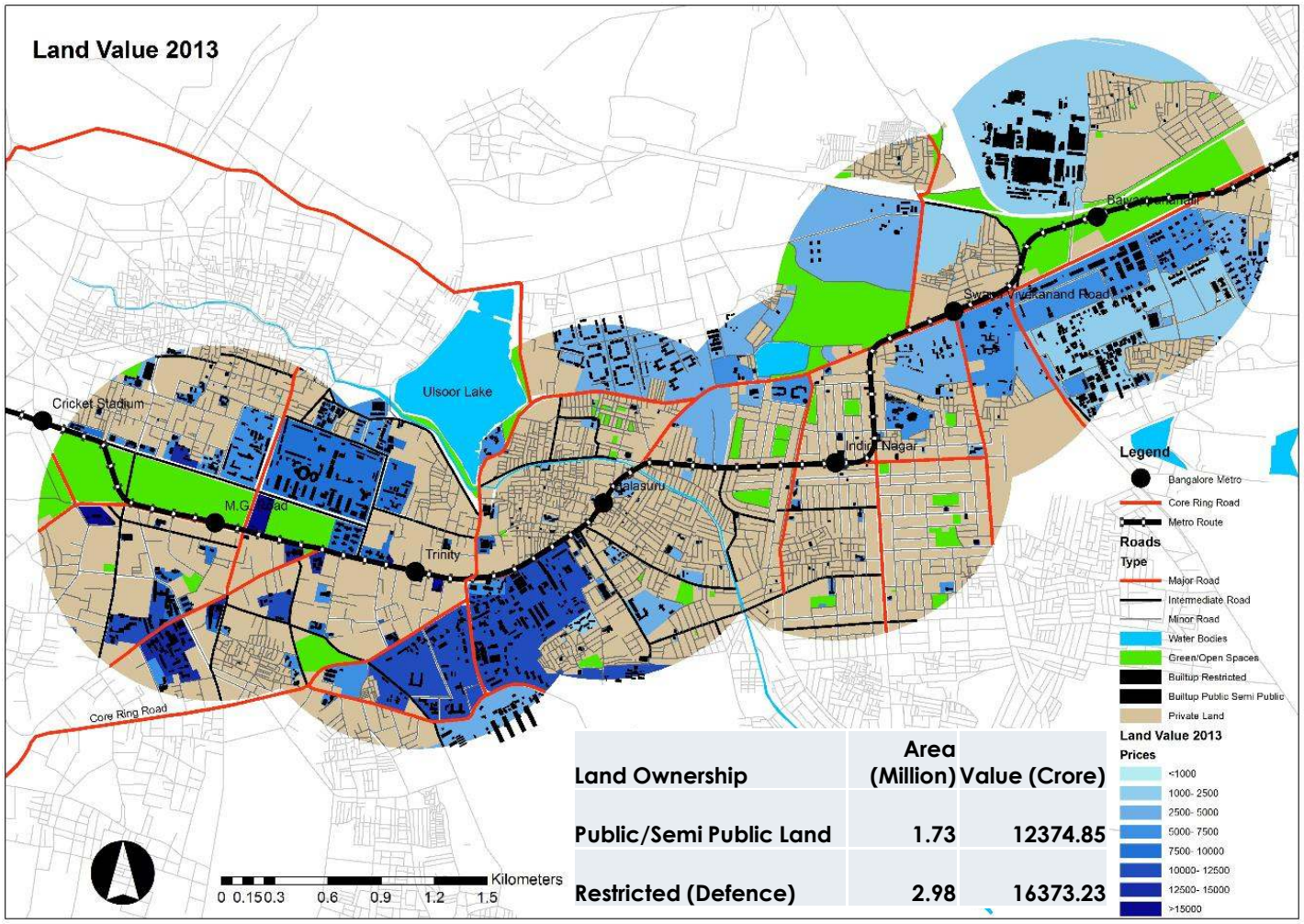
Public and Semi Public: Activities



Activities:

- Government Offices,
- Educational Areas,
- HAL Residential Quarters,
- Worship Areas,
- Health Facilities etc.

Minimal Gains to Leveraging Potential



Land Ownership	Area (Million)	Value (Crore)
Public/Semi Public Land	1.73	12374.85
Restricted (Defence)	2.98	16373.23

- Due to the land ownership type minimal land use change and land value gains have been perceived.
- **But There is potential of Densification, Institutional Development, Redevelopment, and conversion.**

- How Can Public/Semi Public area be more intensified?
- Should Defence Land remain in the core city area?
- How much of this area have potential to cash benefits?

THANK YOU.