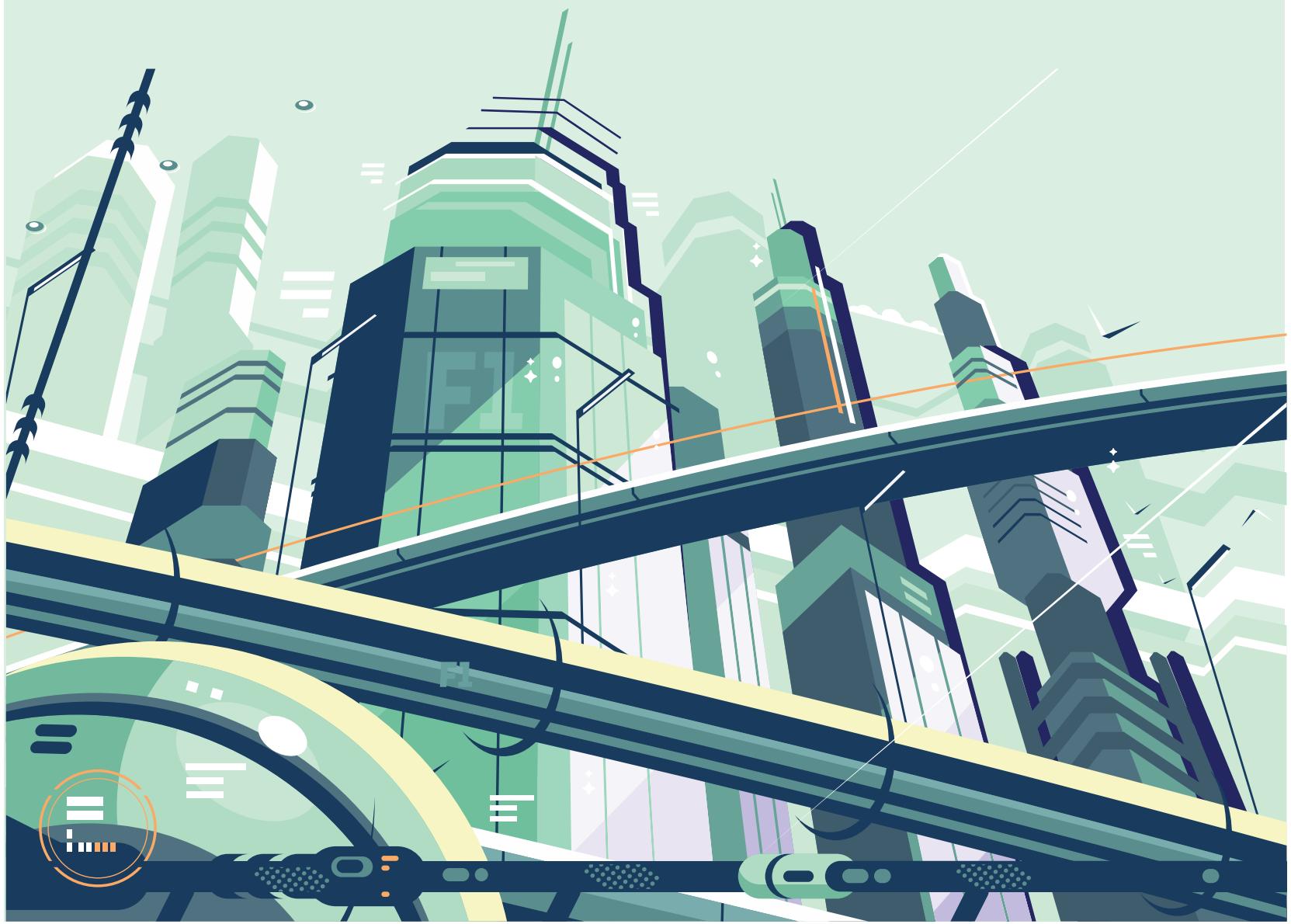


# Bengaluru Urban Infrastructure Report – 2020

A comprehensive Take on Major Transit Oriented Infrastructure Projects and Key Impact Markets

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# FOREWORD



**Shishir Baijal**

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Bengaluru is one of the major economic growth engines of India. It contributes more than one-third to Karnataka's Gross State Domestic Product and is a major driver for job creation in the state. Apart from earning the age-old moniker of being India's IT capital, it is now the start-up capital of India and a leading fintech hub. Owing to the huge economic opportunities, job creation and projected population increase from 11.69 million in 2011 to 16.48 million by 2021, the need to expand and upgrade the Bengaluru Metropolitan Region's (BMR)'s infrastructure and public services has never been as pronounced as it is now. Particularly, the urban mobility infrastructure. It is a major challenge for the urban local bodies to formulate and implement plans for basic infrastructure, transport systems, pollution control system and waste management system in Bengaluru in line with the way that it has distinguished itself on the world stage as a multifaceted metropolis. To make 'Brand Bengaluru' more attractive, visionary schemes costing USD 16.16 Billion (INR 1.2 lakh crore) have been outlined to provide services which are critical for managing its urban sprawl. Transport is one of the major problems plaguing the city and as per our findings, key projects - which include the Bengaluru Suburban Rail Network, Bengaluru Metro Rail (new lines and extensions), Peripheral Ring Road and Satellite Town Ring Road - are being implemented under various models at an estimated cost of more than USD 11.4 billion (~INR 84,800 crore). These projects are set for completion within the next ten years and can help minimize the conflicts of urbanization to a great extent and ensure that the city's growing population can enjoy a better quality of life.

The '**Bengaluru Urban Infrastructure Report 2020 –A comprehensive Take on Major Transit Oriented Infrastructure Projects and Key Impact Markets**' provides an insight into the aforementioned transport infrastructure projects. The report analyses their impact on the real estate market in terms of locations that will see increased real estate traction due to mounting demand. We have looked into the role that regulatory interventions and systematic execution of planned transport infrastructure plays, alongside the organic development of the city. While the debate on urban infrastructure has moved beyond transport and on to other factors that affect the sustainability of the environment and impact air and water, transport infrastructure remains a prominent factor that affects the real estate market. This report is a sequel to the 'India Urban Infrastructure Report – A Special Focus on Mumbai Transport Infrastructure' and deciphers the Bengaluru Metropolitan Region (BMR)'s ongoing transport infrastructure projects' decisive role in the growth of real estate in the city. Per our findings, Bengaluru's transit-oriented infrastructure projects are likely to unlock incremental real estate development potential of over 3.5 million sqm (38 million sq ft) in the next five years across select key impact markets.

We hope that you find this report relevant and an interesting read.

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# EXECUTIVE SUMMARY

Bengaluru is the shining jewel in Karnataka's crown. Its metamorphosis from the pensioner's paradise to the IT Capital of India has made Karnataka home to over 5,500+ Information Technology and Information Technology enabled Services (IT/IITeS) companies, 750 multinational corporations contributing to over USD 58 billion of exports.

Due to widespread in-migration for employment opportunities, Bengaluru's population has grown sharply in the last two decades. More than half of its population consists of migrants today. The number of migrants in Bengaluru far outpaces the entire population of every other city in Karnataka and is greater than the combined populations of Mysuru, Mangaluru, Hassan, Dharwad and Bellary.

As on 2011, Bangalore Metropolitan Region (BMR) had a total population of 11.69 million which is projected to increase to 16.48 million by 2021. As per these estimates, the decadal population growth rate of 41.3% between 2011-2021 will outpace that of the 2001-2011 period at 38.9%. This stupendous population growth has led to unchecked urban sprawl and translated into varied challenges of urbanisation. It presents a tricky situation where providing infrastructure to keep pace with population growth has become difficult for urban local bodies.

The growth pattern of Bengaluru is characterized by Bengaluru city as the urban core which has already enveloped the nearby satellite towns and small urban nodes nearby on the radial road network in the region, eg Anekal on Hosur Road, Hoskote on Old Madras Road, Devanahalli on Bellary Road and Kanakpura on Kanakpura Road. Accelerated growth and functional diversification with the IT boom has created a conundrum for the urban planning bodies with regard to preparation of future Master Plans. Different scenario planning with projected population estimates cannot factor in accurately the growth arteries due to the myriad set of buildings that have proliferated around employment hubs and along its peripheries.

The pace of organic development cannot support the rapid urbanization given the lack of infrastructure and poor mobility, leading to an adverse impact on the living conditions for the residents and impacting the natural resources such as air and water. Indiscriminate dumping of toxic effluents and sewage have made some of the lakes unusable. Lake development and restoration ranks high on Bangalore Development Authority's (BDA) agenda and after the successful restoration of Jakkur Lake, many more projects are currently underway in the city.

The carrying capacity of the city's public transport infrastructure has also come under pressure inviting unwarranted criticism whereas the fact of the matter is that Bengaluru was never planned to support the increasing population of migrants, as nobody envisioned it becoming India's IT behemoth during the 1940-1970s era when its economic base was diversifying. As per the Revised Master Plan (RMP) 2015, the area allocated for transport and communication was 7.3%, whereas the general norm is 20%. Most cities achieve only 15%. Bengaluru is the world's fourth largest IT cluster after Silicon Valley, Boston and London, where this allocation is much higher to facilitate movement of population which helps reduce congestion.

The traffic volumes at most of the junctions have already exceeded capacity. Junctions like Central Silk Board, KR Puram and Hebbal are having more than 3 lakhs vehicles per day. As per our findings, key transit-oriented infrastructure projects - Bengaluru Metro Rail (new lines and extensions), Peripheral Ring Road, Satellite Town Ring Road and Suburban Rail Network - are currently being implemented under various models at an estimated cost of more than USD 11.4 billion.

With Metro Rail Phase 2 extensions and new lines adding 127 kms to Namma Metro's operational corridor and another 270 kms in the offing via arterial road projects, we are hopeful that the conflicts of urbanization will be minimized to a great extent and the city's growing population can enjoy a better quality of life. Once completed, these projects will have a marked influence on the city's character and provide some relief to citizens from incessant infrastructure woes. These projects are expected to be completed within the next ten years and will give a fillip to the real estate market in many locations across the project corridors. All the leading private developers and land operators hold vast land banks along the project corridors, especially in north, north-east and southern parts of Bengaluru.

In this report, we have identified the key real estate markets that will emerge from some of the transit-oriented infrastructure projects planned for completion in the next 10 years. While some of them may take longer to complete, they are already acting as catalysts in Bengaluru's real estate market. These projects will help bring new locations to the forefront and also help developers plan their future real estate footprint which will benefit the commercial, residential and warehousing asset classes in the long term. They will also be instrumental in driving incremental real estate development along some of the well-established office hubs as also isolated locations which needed public transport or road connectivity.

**Methodology for identifying key impact markets along the project corridor**

- i. Evaluating the catchments along the metro rail corridor and the major road and suburban rail projects
- ii. Identifying catchments which currently lack connectivity
- iii. Assessing the connectivity scenario of those catchments after the infra projects are operational
- iv. Evaluating the scope for real estate traction in that catchment based on
  - a. Reduction in travel time to key locations OR
  - b. Availability of land for greenfield development OR
  - c. Scope for greater real estate traction via redevelopment

The objective of the study is to identify key impact markets from the perspective of potential for heightened real estate traction (i.e. demand and supply). The objective and methodology are not intended to gauge the scope for price appreciation in our earmarked key impact markets, as it is based on a different set of parameters which are not covered as part of this report.

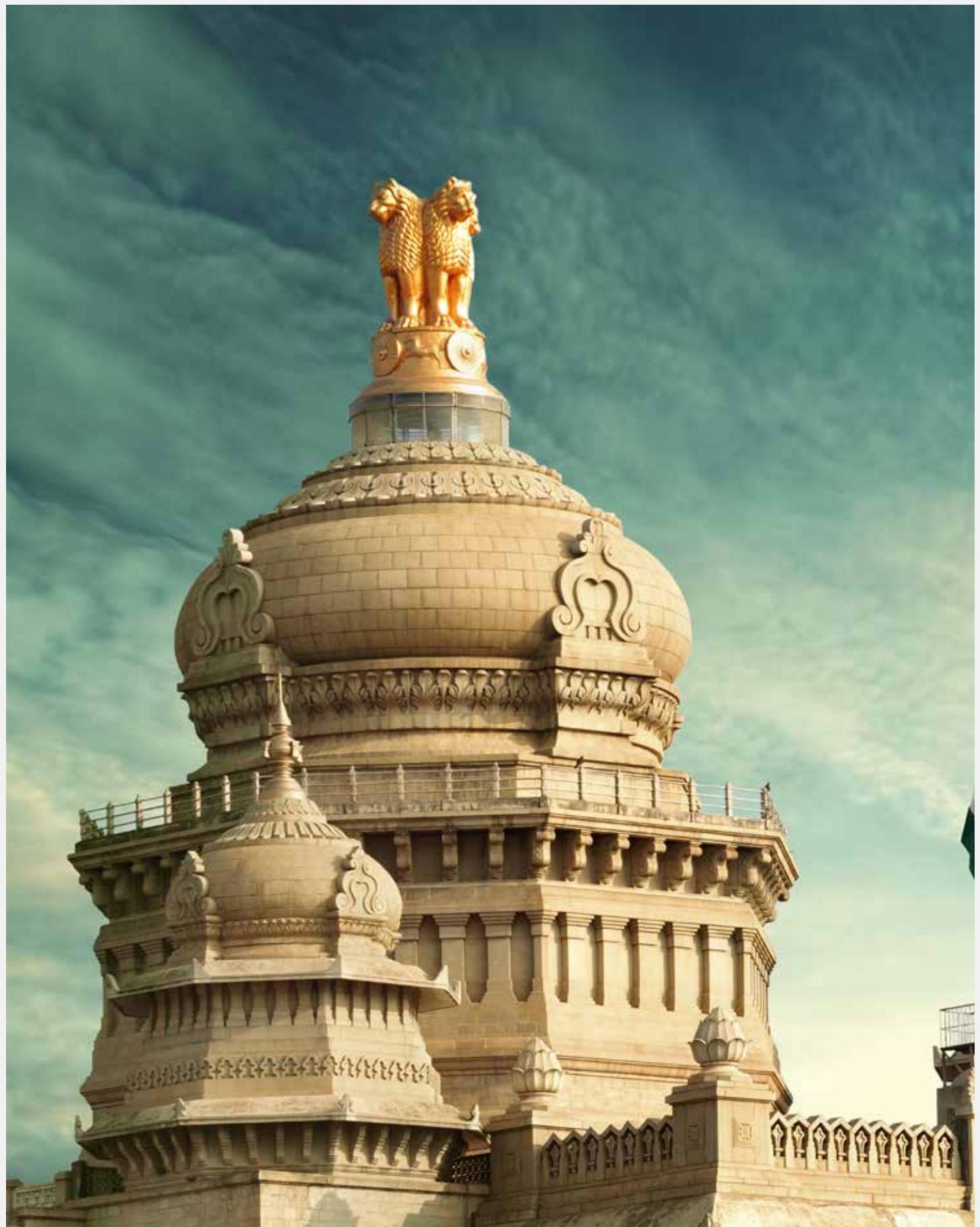
Based on our assessment, the following key impact markets are likely to emerge which will open new avenues of real estate development for developers and investors. Consumers of real estate may benefit from a location insight into these markets to evaluate their real estate interests in the long term along these infrastructure nodes.

Per our findings, Bengaluru's transit-oriented infrastructure projects are likely to unlock incremental real estate development potential of over 3.5 million sqm (38 million sq ft) in the next five years across select key impact markets.

Kogilu	Jakkur to Kogilu Cross belt	Mallasandra to Anjanpura Township belt
Avalahalli	Begur	Whitefield
Channasandra	Electronic City Phase I	Yeshwantpur
Varthur to Sulikunte belt	Electronic City Phase II	Kengeri
Dabaspete to Peenya belt	Bellandur to Marathahalli belt	Baiyappanahalli
Sarjapur to Attibele belt	Mahadevpura to K.R Puram belt	Jnana Bharathi
Hoskote	Hosur Road and Bannerghatta Main Road	Nayandahalli
Yelahanka	J P Nagar Phase 9th and 10th	Carmelaram

Source: Knight Frank Research





# BENGALURU'S URBANISATION STORY

## a) Urban Population grows unabated

Bengaluru is the capital of the southern state of Karnataka. It is also India's fifth-largest metropolitan area. While it has a long history of manufacturing (especially textiles), the last few decades have seen it transform into a global center for Information Technology and related services with several domestic and international corporations locating offices here. It is consistently rated as the leading IT city globally because of its IT firms and large high-tech talent pool. In 1991, the Ministry of Electronics and Information Technology set up the Software Technology Parks of India (STPI) in Bengaluru. STPI provided the infrastructure stimulus for Bengaluru to enter the global technology market and it slowly transitioned to higher-value-added activities by capitalizing on the programming demands of the 'Y2K' crisis.

Bengaluru is the third most populous city of India, with a very diverse demography. The Bengaluru urban agglomeration, known as the Bengaluru Metropolitan Region (BMR), comprises Bengaluru urban district, Bengaluru rural district and Ramanagara district. The Bangalore Metropolitan Region Development Authority (BMRDA),

a regional development authority has jurisdiction over BMR and is functioning as per the provisions of Bangalore Metropolitan Region Development Authority Act (BMRDA), 1985. The total extent of BMR in terms of area is 8005 sq km. As of 2011, BMR had a total population of 11.69<sup>1</sup> million which is projected to increase to 16.48 million by 2021. During the last decade (2001–2011), nearly 38.9% population growth was observed in the BMR, which can be attributed primarily to the influx of IT/ ITeS employees in the city, whereas during the decade prior to that, the population growth was 29.3%.



### Population growth in Bengaluru Metropolitan Region

Source: Census 2011, Knight Frank Research

<sup>1</sup>Census of India, 2011

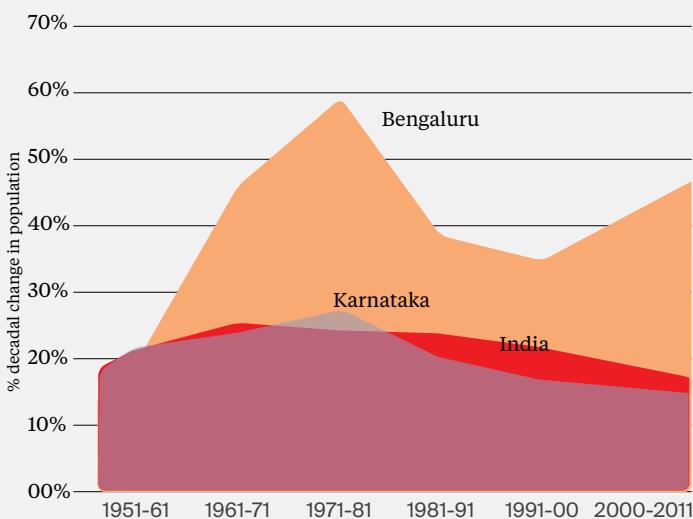
The decadal growth rate (2001-2011) in urban areas is more than the rate registered in rural areas, being 46.7% and 16.5% for urban and rural areas respectively<sup>2</sup>. Due to widespread migration for employment opportunities, education and marriage, Bengaluru urban's population grew sharply between 2001-2011 as compared to the decadal growth rates for both India and Karnataka. Bengaluru Urban comprises 82% of the BMR population which is largely attributed to a huge share of migrant population from neighbouring states. More than half of the state capital's population consists of migrants today. The number of migrants in Bengaluru far outpaces the entire population of every other city in Karnataka and is greater than the combined populations of Mysuru, Mangaluru, Hassan, Dharwad and Bellary.

**Table 1: Decadal % Change in Population**

Year	India	Karnataka	Bengaluru Urban
1951-1961	21.64%	21.57%	19.61%
1961-1971	24.80%	24.22%	46.55%
1971-1981	24.66%	26.75%	59.08%
1981-1991	23.87%	21.12%	38.44%
1991-2001	21.50%	17.51%	35.09%
2001-2011	17.64%	15.67%	46.68%

Chart 1:

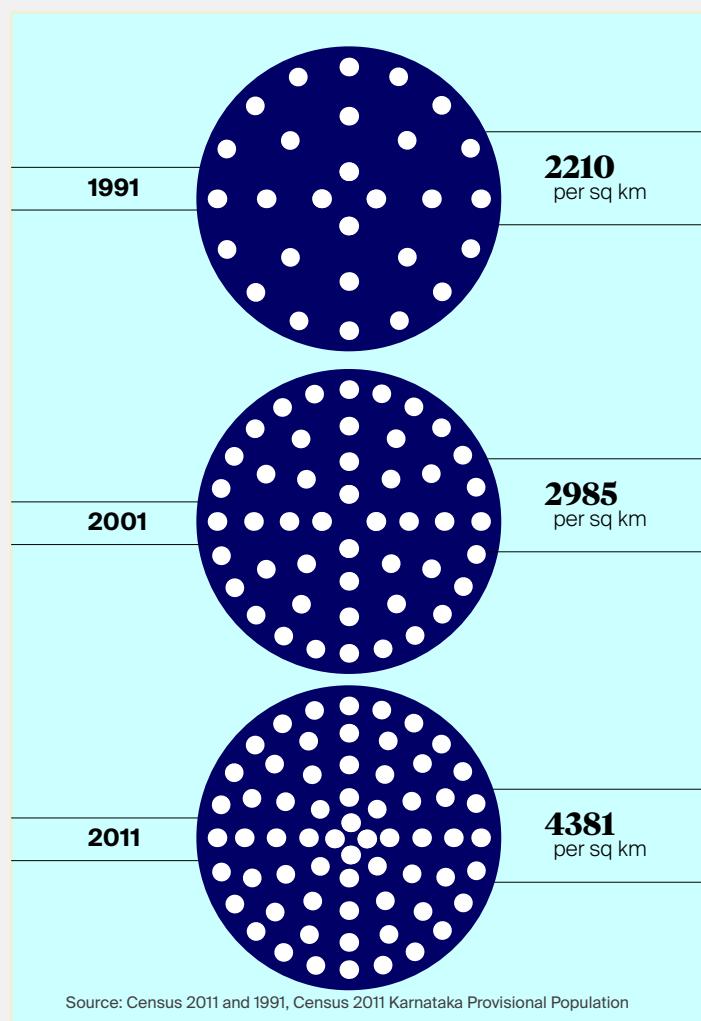
**Comparison of percentage growth in population**



Source: Directorate of Economics and Statistics, Karnataka, Census of India

**As of 2011, BMR had a total population of 11.69 million which is projected to increase to 16.48 million by 2021. During the last decade (2001-2011), nearly 38.9% population growth was observed in the BMR, which can be attributed primarily to the influx of IT/ ITeS employees in the city, whereas during the decade prior to that, the population growth was 29.3%.**

Business growth in the city has caused an unregulated urban sprawl. Looking at the density of population presents an alarming picture. The density of population is defined as the number of persons per square kilometre. For Bengaluru Urban, the density recorded as per 2011 Census was 4,381 persons per sq km. This is a striking increase from a density of 2,985 persons per sq km in 2001, and means that on an average 1,300 more people have inhabited every square kilometre of the city<sup>3</sup>.

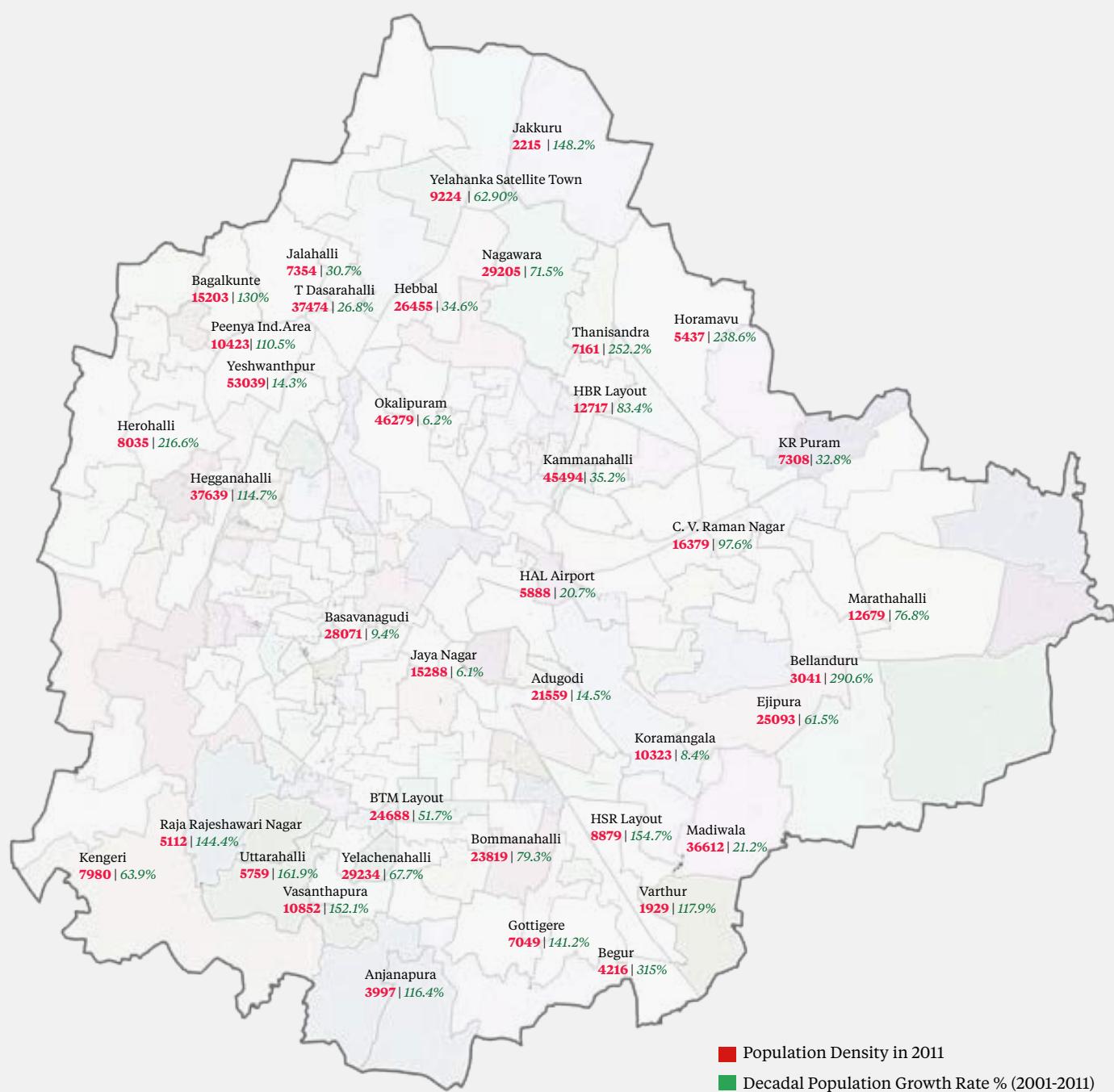


<sup>2</sup>Census of India, 2011

<sup>3</sup>Bangalore Mobility Indicators 2010-2011

The core areas of the city have higher population densities, which reduces as we move away from core to peripheral areas. However, in the case of Bengaluru, a different trend has been observed within Outer Ring Road (ORR) and beyond ORR. The fact that the decadal percentage change in the population density is at the highest with 118% for the wards located outside ORR, whereas the core city areas inside ORR exhibited only 17% growth during the 2001-2011 period corroborates the rapid growth in suburbs due to availability of land and scope of growth. As per BBMP's Restructuring Committee's ward list, following master wards have seen exponential rise in population density between 2001-2011, which dwarfs the city average.

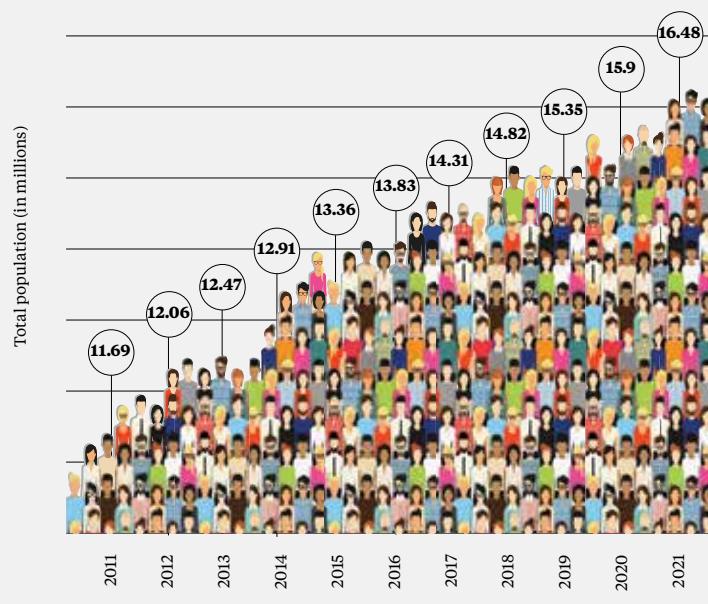
### Population Density and Decadal Population Growth Rate %



The population boom is in stark contrast to the carrying capacity of infrastructure in many locations. The pace of development of the city's outskirts cannot support the rapid urbanization given the lack of infrastructure and poor mobility, leading to an adverse impact on the living conditions for the residents.

As per the projected population of Karnataka<sup>4</sup>, Bengaluru Metropolitan Region's population will be 16.48 million by 2021 which surpasses the decadal growth rate of 2001-2011. Per these estimates, the decadal growth rate of population between 2011-2021 would be a whopping 41.3%. This unprecedented population growth has translated into varied challenges of urbanisation, urban management in general and urban land in particular. For the urban local bodies, it presents a tricky situation where providing infrastructure to keep pace with population growth has become difficult scenario. While providing sustainable living conditions to citizens and to reduce the conflict they create with the environment, the urban local bodies must not only plan for layouts and IT Parks, but also develop the city's outskirts in a planned, phased manner and come up with feasible solutions. Not only does rapid urbanization and in-migration have severe implications for governance, it also increases demand for investments in urban infrastructure, since governments have to cater to a larger and more diverse population.

Chart 2:  
Projected population in Bengaluru Metropolitan Region

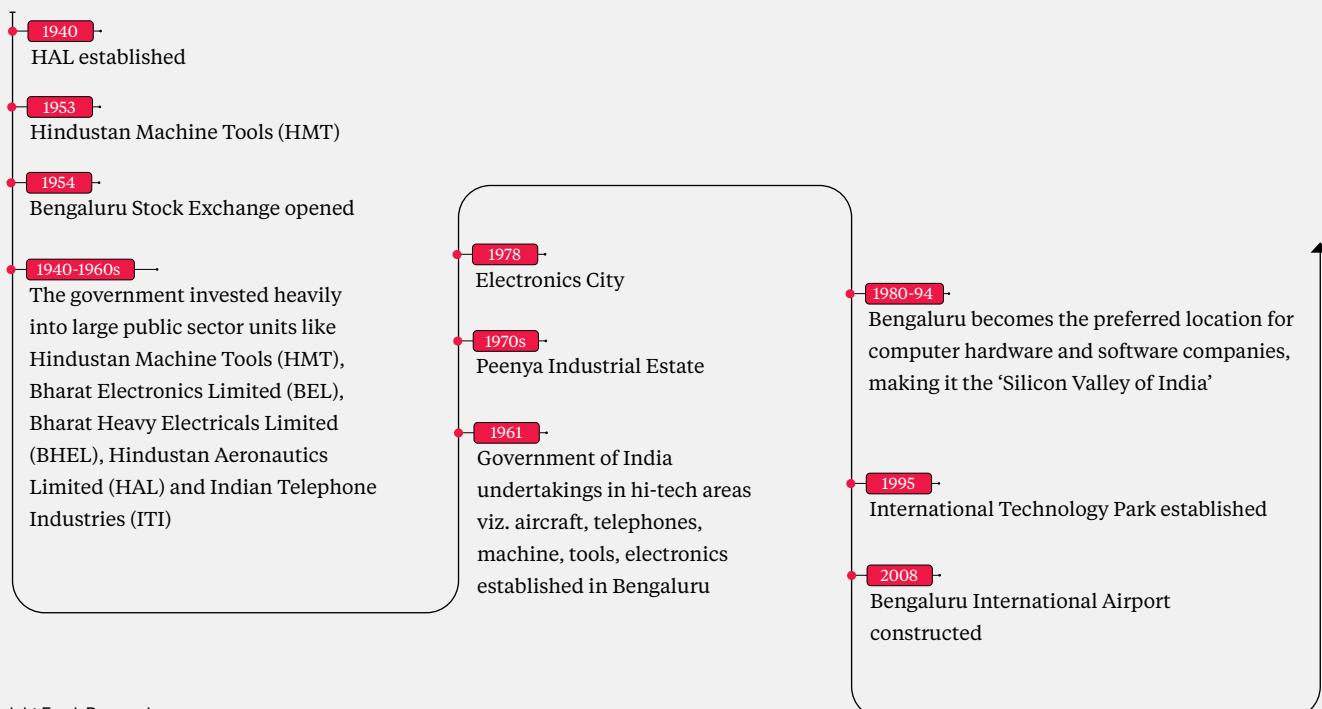


Source: Directorate of Economics & Statistics, Bangalore

## b) Strong economic environment

Bengaluru's economy is diverse and has evolved historically from being a centre of trade and commerce to Public Sector Undertakings (PSU) to a gradual shift to manufacturing and the IT/ITeS sector. Whilst the major drivers of the economy have changed, the sectors that existed historically have remained as cornerstones and are significant in the present scenario as well. Aerospace, IT, biotechnology, manufacturing, e-commerce and logistics are expected to be driving the city's economy in the future. Bengaluru has also emerged as the start-up hub of the nation, bringing innovation and diversity of economy, contributing to GDP and adding to employment opportunities.

### Evolution of Bengaluru's Economy



Bengaluru Urban contributes 36% to state GSDP<sup>5</sup> at current prices, which is the highest across all districts. Bengaluru made a giant leap in the IT sector by establishing the country's first extended facility of the international gateway and network operations centre at the STPI in the Electronic City. The share of Karnataka in Information Technology exports is nearly 40% of the country's exports of USD 155 billion, mainly because of Bengaluru's emergence as an IT hub<sup>6</sup>.

### c) Burden of infrastructure delivery

With increasing urbanization in its hinterland, Bengaluru is facing enormous challenges in providing infrastructure and services to meet the needs of the growing population. To cater to the needs of a vast and diverse population base, the responsibility to provide municipal services, city planning and urban infrastructure services such as urban transport, electricity, water and sanitation, rests with numerous local bodies and agencies. The governance structure of Bengaluru is as below:

Table 2:  
**Bengaluru's governance structure**

Elected urban local body	Bruhat Bengaluru Mahanagar Palike (BBMP)
Statutory Authorities	Bangalore Development Authority (BDA) Bangalore Metropolitan Region Development Authority (BMRDA) Bangalore Water Supply & Sewerage Board (BWSSB) Bangalore Metropolitan Transport Corporation (BMTC) Bangalore Metro Rail Corporation Limited (BMRCL) Lake Development Authority (LDA) Karnataka Slum Clearance Board (KSCB) Karnataka Urban Infrastructure Development and Finance Corporation (KUIDFC) Bangalore International Airport Area Planning Authority (BIAAPA) Bangalore Electricity Supply Company (BESCOM)
State Government Departments	Police Department , Public Works Department Health Department , Education Department Revenue Department. Town Planning Department Horticulture Department, Motor Vehicles Department

Source: Knight Frank Research

Table 3:  
**Summary of responsibilities of the various agencies**

Functions	Agency
Urban planning/Town planning	Bangalore Development Authority, Bangalore Metropolitan Region Development Authority
Water supply	Bangalore Water Supply & Sewerage Board
Roads and bridges	Bangalore Development Authority, Bruhat Bengaluru Mahanagar Palike
Public health, sanitation and solid waste management	Bangalore Water Supply & Sewerage Board, Bruhat Bengaluru Mahanagar Palike
Fire Services	Fire Department
Slum improvement and upgradation	Karnataka Slum Clearance Board, Bangalore Development Authority, Bruhat Bengaluru Mahanagar Palike
Urban amenities such as parks, gardens, playgrounds	Bangalore Development Authority, Bruhat Bengaluru Mahanagar Palike
Vital statistics – registration of births/deaths	Bruhat Bengaluru Mahanagar Palike
Public amenities like street lighting, parking lots, bus stops etc.	Bangalore Development Authority, Bruhat Bengaluru Mahanagar Palike

Source: Knight Frank Research

5. Economic Survey of Karnataka 2019-20

6. Economic Survey of Karnataka 2019-20

The BMRDA was set up in 1985 to address the problems of the region and prepare a Structure Plan. The Bengaluru Metropolitan Committee has been constituted for the BMR region. Over a period, there have been significant challenges in the delivery of indispensable infrastructure in the form of new roads, flyovers, widening of existing road network, mass transit systems, Smart City projects, water supply and drains in tune with the continuous growth of the city.

Bengaluru is facing water management and garbage management issues. As the city started progressing and growing radially with the migration of employees from the IT/ITeS sector, the Garden City's infrastructure needs changed more rapidly than previously anticipated.

As per Karnataka State Budget 2019-20, USD 16.16 billion (INR 1.2 lakh crores) has been earmarked as part of far-reaching visionary schemes

to make 'Brand Bengaluru' more attractive on the world stage. Also, the BBMP is provided with USD 309 million (INR 2,300 crores) in the current year to implement the Nava Bengaluru Kriya Yojane for development of efficient and consumer friendly infrastructure in the city. Presently, there are many infrastructure projects in various stages of implementation in Bengaluru. Once completed, these projects will have a marked influence on the city's character and provide some relief to citizens from incessant infrastructure woes. There is also a proposal to convert prime commercial streets of Bengaluru like Commercial Street and Brigade Road into pedestrian roads.

Table 4:

#### **Major Infrastructure Projects in Bengaluru**

S no.	Project Name	Current Status
1.	Construction of Uni-directional Underpass along ORR and widening of existing flyover with new flyover along NH 7 at Hebbal Junction.	Flyover at NH 7 is in progress and 39 nos. of piling group, 09 nos. piers and 02 nos. piers caps have been completed.
2.	Arakavathy Layout: Road improvements, drainage works, electrification work, name boards and other work by BWSSB in 13 villages in Arakavthy layout.	Drain and water works are partially completed. Electrification process is also in progress. Water and sanitation to be provided by BWSSB is yet to start.
3.	Developmental works in already formed layout: Banashankari 6th Stage (Block 1 to 11) and Further Extension of Banashankari 6th Stage (4th 'B', 'T' and 'H' Block)	
3a.	Road works for 2017-18	80% of the work is completed; the rest is in progress.
3b.	Water supply works	The work is in progress.
3c.	Underground Drainage Facility	Work in progress.
4	Construction of Affordable Houses for EWS, LIG and MIG	BDA has taken up construction of 14637 units across 14 different locations in Bangalore.
5.	Construction of Six Skywalks	Completed and handed over to BBMP. The six locations being: Kalyananagar Junction, Babusabpalya Junction, Kala Mandhir, Near Marathahalli Junction on Outer Ring Road and KR Puram Sante Maidan, KR Puram Govt. College and Battarahalli Junction along Old Madaras Road (NH-4).
5a.	Further, with the sponsorship of Embassy Group, skywalk has been constructed near Manyata Tech Park under CSR. A skywalk has also been constructed with the sponsorship of ORRCA near Ecospace, Devarabeesanahalli.	Completed.
6.	Annual Report Pertaining to Nada Prabhu Kempegowda Layout	The authority has taken up formation of Nada Prabhu Kempegowda layout in 12 villages of Bengaluru North & South Taluk after acquisition of 4043 acres 27 guntas. About 40539 sites of various dimension are proposed to be formed. About 21124 number intermediate and corner sites of various dimension are already formed in the handed over land of 2383 acres 11 guntas.

7.	Improvements to 9 major junctions along ORR from Central Silk Board Junction to Hebbal flyover	Flyover at Veerannapalya, Doddanekkundi Junction, Kalyannagar, Mahadevapura and HSR Layout 14th Main, Bellandur, Devarabeesanahalli and underpass at Kadubeesanahalli and Hennur Junctions are completed. Other minor works are in progress. The 9 major junctions along ORR are: Veerannapalya, Hennur, Kalyannagar, Nagavara, Mahadevapura, Kadubeesanahalli, Bellandur, Devarabeesanahalli and HSR Layout, 14th Main Junctions
8.	Improvements to 6 major junctions along Outer Ring Road [ORR] from Kanteerava Studio to Hebbal flyover	
8a.	Grade separators [underpass / flyover] in major junctions at Bhadrappa Layout, Kuvempu Circle & BEL Circle, Tumkur Road, Kanteerava Studio.	Completed.
8b.	Re-alignment and upgradation of Outer Ring Road from Kanteerava Studio Junction to ALISDA and construction of underpass to Tumkur Road Junction at Goraguntepalya Works	Piling work nearing completion, land acquisition in progress.
9.	Bengaluru Metro Phase 2 (Extensions)	
9a.	Baiyappanahalli to Whitefield (Purple Line) (R1A, R1B)	Civil work is done, expected completion by 2022.
9b.	Mysuru Road to Kengeri (Purple Line)	Work in progress, expected completion in 2021.
9c.	Hesarghatta Cross to Bengaluru International Exhibition Centre (BIEC)	Work in progress, expected completion by 2022
9d.	Yelachenahalli to Anjanapura	Work in progress, expected completion by 2021
10.	Bengaluru Metro Phase 2 (New lines)	
10a.	RV Road to Bommasandra	Work in progress, expected completion by 2022
10b.	Gottigere to Nagawara	Work in progress, expected completion by 2024
10c.	Bengaluru Metro Rail Phase 2A (Outer Ring Road (Central Silk Board to KR Puram)	Expected Completion by 2025.
10d.	Bengaluru Metro Rail Phase 2B (K R Puram to Kempegowda International Airport)	Expected Completion by 2025.
11.	Bengaluru Metro Phase 3	
11a.	Hebbal to JP Nagar	30 kms stretch. At DPR stage for Public Private Partnership. Targeted completion by 2028.
11b.	Magadi Road Extension	13 kms stretch. At DPR stage for Public Private Partnership. Targeted completion by 2028.
12.	Peripheral Ring Road (PPR)	Work in progress
13.	Satellite Town Ring Road (STRR)	Focuses on easing out the huge traffic jams and congestion. Encircles major areas like Dobbaspet, Doddaballapura, Devanahalli, Sulibele and Hoskote.
14.	Suburban Rail Network	Aims at covering major areas of the city including KSR Bengaluru City to Devanahalli, Baiyappanahalli to Chikkabanavara, Kengeri-Cantonment-Whitefield and Heelalige to Rajanukunte. Further details are awaited.

Source: Knight Frank Research, Bangalore Development Authority Report 2018-2019

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## CHALLENGES CREATED BY URBAN DEVELOPMENT IN BENGALURU



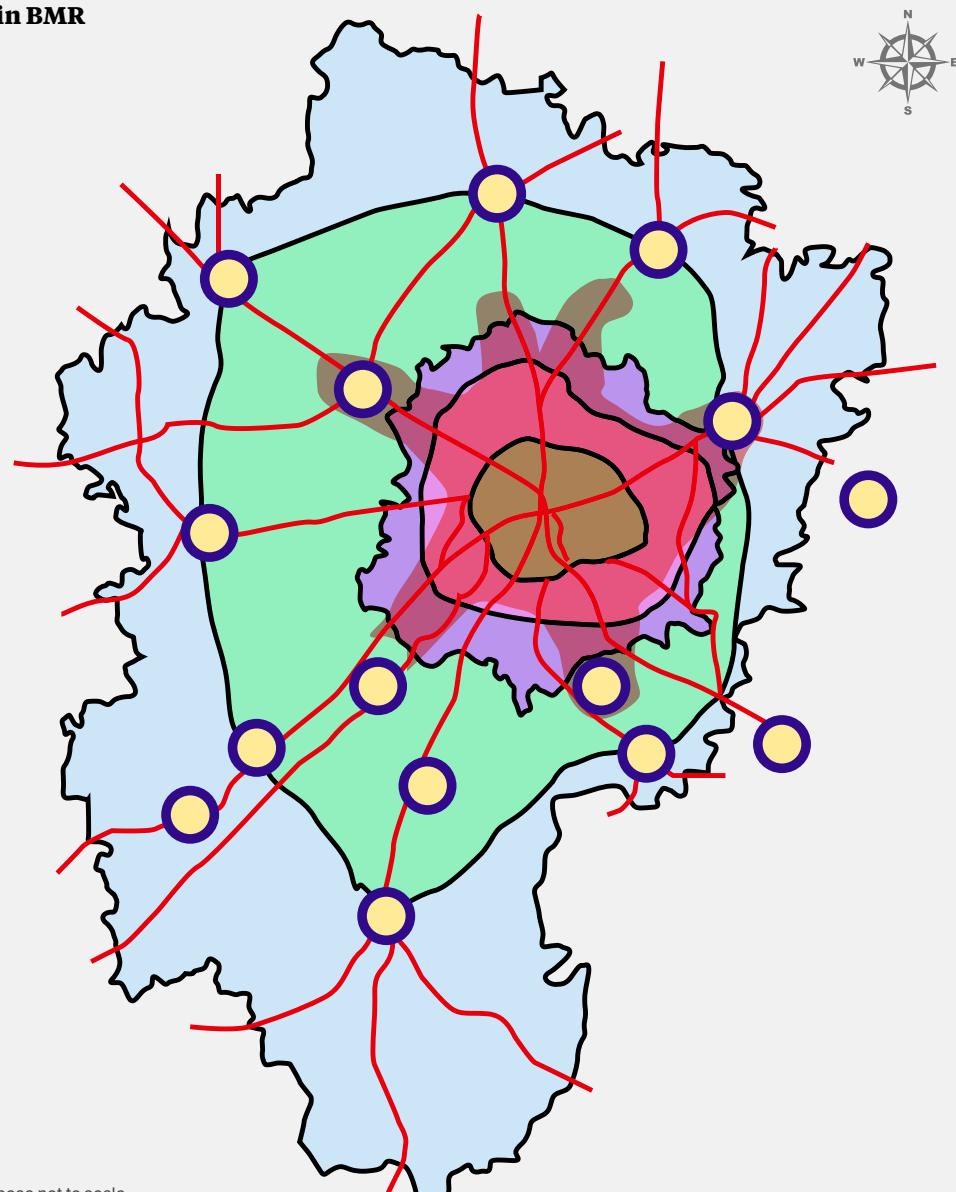
### a) Urban sprawl and unchecked ribbon development

Within urban Karnataka, the share of Bangalore Urban Agglomeration (BUA) in terms of area has more than doubled from 17.66% in 1951 to 35.96% in 2011. The population shows an increasing trend in BMR because of Bengaluru city's astonishing population growth. The growth pattern in the BMR is characterised by Bengaluru City as the urban core (which has already engulfed Yelahanka, Kengeri, Jigani, Yeswanthpur which were once satellite towns) and small urban nodes all around as satellites developed on the radial road network in the region – like Anekal on Hosur Road, Hoskote on Old Madras Road, Devanahalli on Bellary Road, Neelamangala & Dobaspete on Tumkur Road, Bidadi & Ramanagara on Mysuru Road, Kanakapura on Kanakpura Road. At present, the ribbon development is seen on all major radial roads, prominent ones being Tumkur Road, Bellary Road, Old Madras Road, Mysuru Road and Hosur Road. However, the benefits of Bengaluru's growth have not been equally distributed. While the city may continue to have a low-density core when compared to the outskirts, the built-up area has increased at the cost of

the city's vegetation and water resources. In particular, the growth on the city's peripheries towards the north and south-west, is putting an increasing amount of pressure on Bengaluru's natural and economic resources.

In Bengaluru, the arterial roads laid or widened in the past two decades have witnessed big ticket construction around them. In the peripheral areas of the city, when one ventures into a 'layout', narrow streets are a common sight. Several retailers and multiplexes have been using the space along the Outer Ring Road corridor as free parking space. Interior access roads on almost all big radial roads, leading deeper within the peripherals, are extremely congested too. Major arterial roads such as Tumkur Road, Hosur Road, Old Madras Road, ITPL Road (Mahadevpura), Mysore Road routinely witness traffic chaos. The purpose of big radial roads should be to serve long-range connectivity and that alone. However, in the given scenario, they also serve as commercial/business roads, parking lots, and residential access roads which lead to traffic bottlenecks in the peripheral areas.

**Urban Growth Pattern in BMR**



Source: Draft Revised Master Plan  
All maps are for representational purpose not to scale

## b) Impact on natural resources

Population growth and rapid urbanization has led to large-scale depletion of Bengaluru's natural resources. Economic growth has had a major impact on ecosystems and biodiversity, leading to encroachment and pollution of water bodies, the felling of thousands of trees and urbanisation of green spaces. The impact of a lack of proper planning for socio-economic and environmental aspects of city development is visible in climate change, scarcity of access to clean water and loss of lakes, wetlands and green spaces, all of which are embedded within multiple land use categories. The socio-economically vulnerable population is especially susceptible to these changes due to the pressure on air, water and land.



### i. Air

Bengaluru's breezy air is hiding some serious air pollution. It has a high degree of particulate matter (PM) of 2.5. PM 2.5 is that speck of dust that

can slip past the human body's defense mechanism and cause massive damage to the lungs and heart. Contributors to air pollution are unique to each city. Vehicular pollution is among those concerns that contributes maximum to air pollution in Bengaluru. Data<sup>7</sup> indicates that 60-70% of the emissions originate from vehicles. This makes Bengaluru the only city in India to be the most impacted by vehicular pollution. Bengaluru is also impacted because of issues such as treatment of waste and usage of diesel generators for electricity. Adding to these specific concerns, the discourse and existing reforms around Bengaluru's air has been limited.

Because of heavy vehicular emissions, Bengalureans who spend time in traffic and outdoors, especially in areas with high traffic density, face a threat of chronic exposure to PM 2.5. Over a period, these deposits cause inflammation of the blood vessel and other diseases. Rampant tree cutting, rise in high-rise buildings and paved streets have now left the city with many polluting sources. Non-communicable diseases are on the rise in Bengaluru and air pollution has been highlighted as a major concern.

We have tracked the Air Quality Index of Central Silk Board Junction for a period of 12 months. This junction is a major traffic bottleneck in Bengaluru. Situated at the intersection of the major employment hub of ORR, BTM Layout, Hosur Road, it also provides connectivity to Electronic City and is often cited as of the busiest intersections in India.

Chart 3:

**CENTRAL SILK BOARD JUNCTION AIR QUALITY INDEX (12 MONTHS)**

October 2019								November 2019								December 2019							
	Mon	Tue	Wed	Thu	Fri	Sat	Sun		Mon	Tue	Wed	Thu	Fri	Sat	Sun		Mon	Tue	Wed	Thu	Fri	Sat	Sun
W1		56	117	54	93	84	84	W1					59	91	75	W1							50
W2	70	85	61	78	89	97	77	W2	82	131	143	155	159	145	114	W2	27	29	68	89	129	139	88
W3	44	35	46	43	34	43	30	W3	127	139	69	75	62	65	68	W3	59	54	54	71	65	64	50
W4	29	43	68	66	50	47	62	W4	74	69	52	51	100	96	84	W4	62	65	59	90	111	112	117
W5	107	102	79	57				W5	97	85	91	88	59	53		W5	132	124	124	109	123	123	103
January 2020								February 2020								March 2020							
	Mon	Tue	Wed	Thu	Fri	Sat	Sun		Mon	Tue	Wed	Thu	Fri	Sat	Sun		Mon	Tue	Wed	Thu	Fri	Sat	Sun
W1			NA	NA	120	90	141	W1						134	143	W1							108
W2	128	75	77	99	114	111	98	W2	108	102	96	97	126	142	139	W2	117	150	184	160	126	80	104
W3	109	NA	NA	NA	108	107	83	W3	117	101	104	102	109	136	140	W3	84	86	93	83	87	86	86
W4	71	97	104	97	123	115	117	W4	115	114	122	126	126	90	98	W4	74	69	81	92	108	107	106
W5	130	144	145	148	147			W5	110	110	124	101	106	112		W5	74	110	120	61	66	62	58

<sup>7</sup> A joint study by Indian Institute of Science, University of Melbourne and Chang'an University.

April 2020								May 2020								June 2020							
	Mon	Tue	Wed	Thu	Fri	Sat	Sun		Mon	Tue	Wed	Thu	Fri	Sat	Sun		Mon	Tue	Wed	Thu	Fri	Sat	Sun
W1			66	67	85	93	90	W1					76	74	65	W1	69	33	28	24	35	43	49
W2	85	66	34	59	60	47	74	W2	77	83	90	69	81	65	71	W2	51	57	58	49	42	54	40
W3	66	83	94	90	78	83	76	W3	64	58	40	49	74	50	79	W3	34	43	47	48	47	55	55
W4	70	60	55	58	59	87	73	W4	66	57	59	60	81	59	70	W4	41	44	55	55	48	40	NA
W5	56	64	62	52				W5	62	74	65	64	60	62	56	W5	NA	31					

July 2020								August 2020								September 2020								
	Mon	Tue	Wed	Thu	Fri	Sat	Sun		Mon	Tue	Wed	Thu	Fri	Sat	Sun		Mon	Tue	Wed	Thu	Fri	Sat	Sun	
W1			54	52	33	30	34	W1						61	58	W1	71	74	78	70	68	107		
W2	34	55	46	50	49	55	60	W2	51	57	63	62	63	65	67	W2	94	57	61	65	59	63	61	
W3	38	64	61	49	39	41	42	W3	62	68	71	72	77	81	76	W3	59	71	75	70	72	56	67	
W4	45	47	35	76	63	55	46	W4	74	72	77	72	75	71	71	W4	51	62	67	79	80	75	80	
W5	48	61	62	54	43			W5	61	81	88	86	94	90	80	W5	77	95	87					
								W6	71															

Table 5.

**AIR QUALITY INDEX SCALE**

AQI	Air Pollution Level	Health Implications	Cautionary Statement (for PM2.5)
0 – 50	Good	Air quality is considered satisfactory, and air pollution poses little or no risk.	None
51-100	Moderate	Air quality is acceptable; however, for some pollutants there may be a moderate health concern for a very small number of people who are unusually sensitive to air pollution.	Active children and adults, and people with respiratory disease, such as asthma, should limit prolonged outdoor exertion.
101-150	Unhealthy for Sensitive Groups	Members of sensitive groups may experience health effects. The general public is not likely to be affected.	Active children and adults, and people with respiratory disease, such as asthma, should limit prolonged outdoor exertion.
151-200	Unhealthy	Everyone may begin to experience health effects; members of sensitive groups may experience serious health effects.	Active children and adults, and people with respiratory disease, such as asthma, should avoid prolonged outdoor exertion; everyone else, especially children, should limit prolonged outdoor exertion
201-300	Very Unhealthy	Health warnings of emergency conditions. The entire population is more likely to be affected.	Active children and adults, and people with respiratory disease, such as asthma, should avoid all outdoor exertion; everyone else, especially children, should limit outdoor exertion.
300+	Hazardous	Health alert: everyone may experience more serious health effects.	Everyone should avoid all outdoor exertion

While the AQI for this location has peaked to the 'Unhealthy for Sensitive Groups' zone in February 2020, the strict lockdown enforced since March-end 2020 due to the Covid-19 pandemic had a therapeutic impact on the city's lungs because of the much-reduced vehicular traffic and closure of construction and industrial activities. In June and July, the location had maximum number of green days over the 12 monthly period tracked as the AQI was between 0-50 or 'Good'. In August and September, the AQI in this location changed to 'Moderate' as the Unlocking progressed to Phase 2.

While Bengaluru's situation with air pollution and AQI was never as bad as that of some other Indian cities, its unabated growth has been the culprit behind poor air quality. Other locations such as Peenya Industrial Area, have also witnessed a dramatic improvement in AQI during the lockdown as almost all industries were inoperative during that period.



## ii. Water

Think water and the images of Cauvery water related problems between Karnataka and the neighbouring state and visions of the burning lake Bellandur in Bengaluru come to mind. A BBC story in 2018 included Bengaluru in a global list of 11 cities to soon hit Day Zero like Cape Town in South Africa, which put the spotlight on Bengaluru's water crisis. Water is a greatly stressed resource in Bengaluru, because of overdependence on only one source, the River Cauvery, and an absence of integrated water management. Though the Supreme Court ruling limits the amount of water that can be released to the city, Cauvery water serves two-thirds of the water requirement of the city. There are several issues with respect to the water crisis in Bengaluru which needs constant and urgent attention:

**Gap between water demand and supply** – BWSSB supplies treated Cauvery water to the city under the Cauvery Water Supply Scheme (CWSS) Stage I, II, III and Stage IV Phase I & II. The BBMP area of 800 sq km includes core area of 245 sq km, eight ULBs spanning 330 sq km, and 110 villages of 225 sq km. BWSSB supplies water only to the core area and ULBs, and not to the 110 villages. The CWSS Stage V is still in the works. BWSSB plans to implement it with financial assistance from Japan International Cooperation Agency (JICA). By 2050, the water demand of the city will increase from the existing 20 thousand million cubic feet (TMC)<sup>8</sup> to 45 TMC. Apart from this, BWSSB has also highlighted that water supply through Cauvery schemes alone will not be able to meet Bengaluru's future water demand. BWSSB has shifted its focus from water supply management to water demand management as part of its Vision 2050 and will manage water sources in line with the State Water Policy. In addition to identifying additional water resources, a diverse water resource portfolio, resource recovery and catchment-scale rainwater harnessing have been identified as key solutions.

**Climate change impact on water supply** – Studies of the Cauvery basin have indicated an increased but irregular rainfall pattern coupled with a warming environment. By 2050, the Cauvery basin is expected to have a 10% increase in rainfall, although it would be of high intensity with reduced frequency. The temperature is likely to increase between 1.2 degree Celsius to 1.4 degree Celsius with an increase in drought frequency from the current 1 in 20 years to 1 in 5 years<sup>9</sup>. Such events will drastically impact the availability of water in the Cauvery river and warrant a larger buffer storage for supply.

**Impact of Water Scarcity** - The city's groundwater reservoirs are being rapidly depleted without an adequate opportunity for recharge to fulfil the water tanker requirements of the city's far off peripherals.

Other than water shortage, water pollution is a great concern too. To sustain urban life, water supply and sanitation facilities are critical factors. In urban areas, water which is a scarce commodity, is wasted and polluted in many ways. According to the Water and Sanitation Program administered by the World Bank, the amount of non-revenue water, which basically means water unaccounted for and wasted (eg. leakages, theft, unauthorised connections and collection inefficiencies, etc.) was estimated to be as high as 40% to 70% in Indian cities in 2009. Recent estimates by the Municipalities of Bengaluru peg this number between 20% and 25%<sup>10</sup>.

**Wastewater management and reuse** - Wastewater reuse, although established in many countries, is still in a nascent stage in India. There are three major stages in wastewater treatment – primary, secondary and tertiary. In Indian cities, secondary treatment plants are most common and treated water from these facilities are let out into lakes and rivers. Bengaluru has the highest number of apartments that treat sewage, most of which use at least some of the treated water for toilet-flushing and gardening. There are only a handful of tertiary treatment plants in the country that supply water to industries. One such plant is in Yelahanka, Bengaluru. Currently, Bengaluru generates 1400 MLD wastewater, as per BWSSB's conservative estimates. The city has total treatment capacity of 721 MLD, but on an average, only 520 MLD gets treated. Most of Bengaluru's wastewater flows downstream untreated. Wastewater reuse is an important part of the solution to Bengaluru's water situation. If individual houses and smaller apartments treat their own sewage, there is great potential to achieve sustainable water for the city. Selecting appropriate technologies will better maintain STPs and improve the quality of treated water released into the environment.

**Bengaluru's waterscapes** - Rivers, lakes and groundwater systems are all interdependent components of the integral waterscape of Bengaluru. Bengaluru was built around several lakes that acted as rainwater reservoirs and replenished natural aquifers that provided a renewable source of water for the city. Due to the unforeseen tech boom, Bengaluru's unprecedented water needs led to falling groundwater levels and highly polluted lakes filled with flammable chemical waste. The highly polluted and nearly extinct rivers Arkavathi and Vrishabhavathi, encroached lakes and depleting groundwater levels pose a bigger threat to the waterscape of Bengaluru.

**Vanishing lakes** - Bengaluru is an apt example of an Indian city

exploiting its water resources till its very survival has come into question. It was one of the first Indian cities to market itself as a tech hub in the 1990s and experienced prolific economic growth, with global tech giants such as Google, Microsoft, IBM and Dell starting large scale IT/ITEs operations in the city. Indiscriminate dumping of toxic effluents and sewage have also slowly made these lakes unusable. Bellandur Lake which is the city's largest lake, often froths or bursts into flames while other lakes have been encroached upon and yet others have just dried up.

From over 260 lakes in 1960, Bengaluru now has only about 80, though efforts are underway to restore some of them. Jakkur Lake is a notable example of a concerted effort by the government and community to restore it, an effort that has borne fruit after nearly a decade. Jakkur

Lake was cleansed by the BDA. However, littering and dumping of garbage had resumed and threatened to erase the efforts of the authority. Concerned citizens approached the authorities and a comprehensive plan was put together with the help of horticulture and plants experts to not just increase the green cover in the area but also to attract butterflies, migratory birds and bees. This balanced, socio-ecological model gave equal importance to conservation of flora and fauna. It has now transformed from a polluted and dying lake to an ecological hotspot and a sustainable and usable water resource for the city. Following are some of the ongoing lake development projects undertaken by BDA.

Table 6:  
**Ongoing lake development projects in BDA - 10 lakes**

<b>Sl No.</b>	<b>Name of Lakes</b>	<b>Contract Amt (Lakhs)</b>	<b>Financial Progress (Lakhs)</b>
1	Amruthahalli Lake	317.37	0
2	Arakere Lake	711.41	590
3	B Narayanapura Lake	159	140
4	Byrasandra Lake (Jayanagara)	322.62	280
5	Doddanekkundi Lake	952.49	0
6	Dubasipalya Lake	386.67	50
7	Gangashetti Lake	151	140
8	Hosakerehalli Lake	912.32	480
9	Manganahalli Lake	88.19	10
10	Nelagadhirenahalli Lake	204.89	10
<b>Total</b>		<b>4205.96</b>	<b>1700</b>

Source: BDA Annual Report 2018-19



<sup>8</sup> BWSSB Blueprint for the future

<sup>9</sup> BWSSB Blueprint for the future

<sup>10</sup> Knight Frank' India Urban infrastructure Report, 2020

**"I request the citizens to minimize wastage of water and reuse treated water. I urge them to not release untreated water in the Storm Water Drain/Rajkaluve. Save water, Save Bengaluru"**

B.C. Gangadhara  
Chief Engineer, BWSSB



### **iii. Land**

The Local Planning Area (LPA) of BDA is spread over an area of about 1219.50 Sq Km (area under LPA of BDA as per RMP-2015). The LPA of BDA comprises the major part of the BBMP and 251 villages in the periphery of BBMP. Bengaluru has witnessed accelerated growth and functional diversification with the IT boom. With economic growth and unprecedented population growth, significant planning challenges, particularly with respect to urban land management have become common. This creates a difficult situation for the urban planning bodies when it comes to preparing the Master Plans and envisioning how the city and its peripheries will grow in future. Different scenario planning with projected population estimates cannot factor in accurately the growth arteries due to the myriad set of buildings that have proliferated around employment hubs and along its peripheries. This leads to a situation where Floor Area Ratio (FAR) / Floor Space Index (FSI) is not appropriately utilized as the accompanying transport infrastructure, such as the metro, which could have fueled holistic and even real estate development, did not get prioritized across the length and breadth of the city at the time when in-migration was rising and the need for augmenting public transport infrastructure was at its peak. In Bengaluru's case, this has led to unplanned development and overpopulated hubs in some pockets, whereas many locations with land availability have remained barren of real estate development due to lack of connectivity. This has created uneven pressure on land in many locations in the same city.

In Bengaluru, the Draft Revised Master Plan (RMP) 2031 which was created to supersede Revised Master Plan 2015 had to be withdrawn by BDA in 2020. The primary reason behind withdrawing the RMP 2031 was to integrate the Transit Oriented Development (TOD) Policy put out by BMRCCL with this plan. The TOD approach adopted in several global cities envisages mixed land use and development along transit corridors. In case of Bengaluru, metro rail, bus hubs and the suburban rail network will require integration of transit and land use patterns which will have a huge impact on zoning regulations, especially along the metro corridors. The Draft RMP 2031 had set aside large buffer zones around lakes (rajakaluvus)

(75 meters) and drains (up to 30 meters) as per the National Green Tribunal's (NGT) order which was struck down by the Supreme Court later. This also necessitated the need for its withdrawal as it is directly related to land use patterns. Presently, the entire planning process for the city is a work in progress. A collective effort between BDA, the public and other statutory authorities is required, so that on the ground inputs can be included and the pressures on urban land can be addressed.

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# TRANSPORT INFRASTRUCTURE AND MOBILITY



With the advent of high technology industries, particularly in the IT/ITeS and biotechnology sectors, people have largely occupied the spaces around North-South, North-East and South-East parts of the city. As per the RMP 2015, the area allocated for transport and communication was 7.3% whereas the general norm is 20%. Most cities achieve only 15%<sup>11</sup>. Bengaluru is the world's fourth largest IT cluster after Silicon Valley, Boston and London, where this allocation is much higher to facilitate movement of population which helps reduce congestion. Growth in job opportunities in the IT sector and other important sectors such as research institutions, space and aerospace organizations, manufacturing etc, have led to an exponential increase in the intra-city travel demand. This has led to people opting for personal mobility options due to lack of suitable public transport options for travel in minimum time. In recent years, the bad traffic situation in the IT capital has given rise to shared mobility solutions such as carpooling and ridesharing services, but those alone cannot resolve the traffic woes.

It is a known fact that Bengaluru is facing tremendous pressure on its transport infrastructure. The highest peak hour traffic at screen line locations<sup>12</sup> is 10,699 PCUs (11,989 vehicles)<sup>13</sup>. The traffic volumes at most of the junctions have already exceeded capacity. Junctions like Central Silk Board, KR Puram and Hebbal are having more than 3 lakhs vehicles per day. The urban mobility infrastructure in Bengaluru has fallen behind the curve, with increasing road congestion, longer commute times and environmental stress emerging as binding constraints for the city's march towards achieving its ecologically sustainable economic potential. As per a recent report by Boston Consulting Group<sup>14</sup>, peak hour congestion level, i.e. the percentage of additional time required to travel in peak hours is the second highest in Bengaluru at 162% amongst the top four metropolises in India.

**Public Transport Infrastructure trails behind** – Public transport system used in Bengaluru is not able to keep pace with the rapid and substantial increase in the transportation demand. The focus of policymakers has been to augment traditional road infrastructure measures as solutions to traffic related problems and the gap in public transport availability hasn't been addressed so far. Also, last mile connectivity with the Green and Purple Line of Phase I of Bengaluru

Metro and the BMTC buses remain a problem for commuters. As per BMTC's Annual Administration Report 2018-19, the number of vehicles owned reduced from 6,677 in 2017-18 to 6,634 in 2018-19. BMTC carries 45% of the city's traffic but is yet to keep pace with the high growth in travel demand with its fleet size largely remaining stagnant for quite some time.

As on 31st March 2019, BMTC had operated 2,263 routes which is only an incremental 10 routes over and above the 2,253 it operated as on 31st March 2018. As the capacity of existing systems largely remained stagnant, it did not serve as a frequent and reliable transport service for commuters leading to a significant decline in public transport usage in recent decades.

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Table 7:  
**BMTC Performance**

Parameter	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19 as on Aug-18-Prow.)
Depots	39	39	40	40	43	44	45
Fleet Operated	6139	6473	6244	6216	6219	6143	6143
Vehicals Held	6431	6775	6522	6401	6161	6677	6634
Effective Km, Per day (lakh)	12.71	13.14	12.9	12.21	11.52	11.42	11.38

Source: BMTC, Knight Frank Research

<sup>11</sup>RMP 2015

<sup>12</sup>A screen line is an imaginary line on a map, comprising one or more straight line segments. Screenline analysis provides a means of comparing the results of a traffic assignment with traffic count data.

<sup>13</sup>Draft Comprehensive Mobility Plan, March 2020

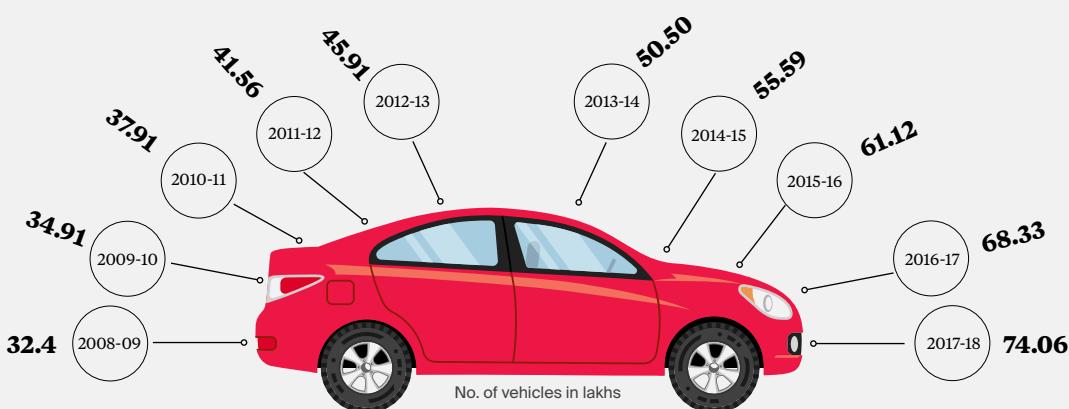
<sup>14</sup>BCG: Unlocking Cities – Ridesharing India

## High vehicular growth in the city -

BMR has a total registered vehicular count of approximately 74 lakh vehicles, with two wheelers constituting the highest percentage of vehicular composition. Between 2008 and 2018, the number of vehicles registered in the city have increased from 32.4 lakhs to 74.06 lakhs.

Chart 4:

### Vehicular growth in Bengaluru



The vehicle ownership increased from 284 vehicles per thousand persons in 2001 to 419 vehicles per thousand persons in 2011, and further to an estimated 640 in 2018. The vehicle ownership is increasing at a much higher rate compared to the rate of growth in population which adds to the traffic woes in the city.

Table 8:

### Total volume of vehicles for peak hour and for 24 hours

S. No.	Junction Name	Peak hour volume vehicles	24 hours volume vehicles
1	Kundalahalli Junction	6280	89599
2	Doddanakundi Junction	8728	101324
3	Hennur Cross	16559	200921
4	Nagawara Junction	14207	167711
5	BEL Circle	10856	126475
6	Gorgunte Palya	6067	104271
7	Central Silk Board Junction	22634	323099
8	HSR Layout 27th Main Junction	15282	172375
9	Tin Factory	15311	16919
10	Hebbal Junction	23924	273755

Source: Draft Comprehensive Mobility Plan, March 2020

The peak hour volumes and 24 hours volume of vehicles at some of the critical junctions in the city presents a strenuous situation. Central Silk Board Junction, Hebbal, Hennur Cross on the Ring Road are choked with vehicles at any given point in time resulting in considerable delays for commuters increasing their travel time. In fact, reaching the Kempegowda International Airport (KIA) from the far-off southern peripherals is such an arduous journey for frequent travellers that many of them opt for reaching the airport hours in advance to factor in traffic delays as

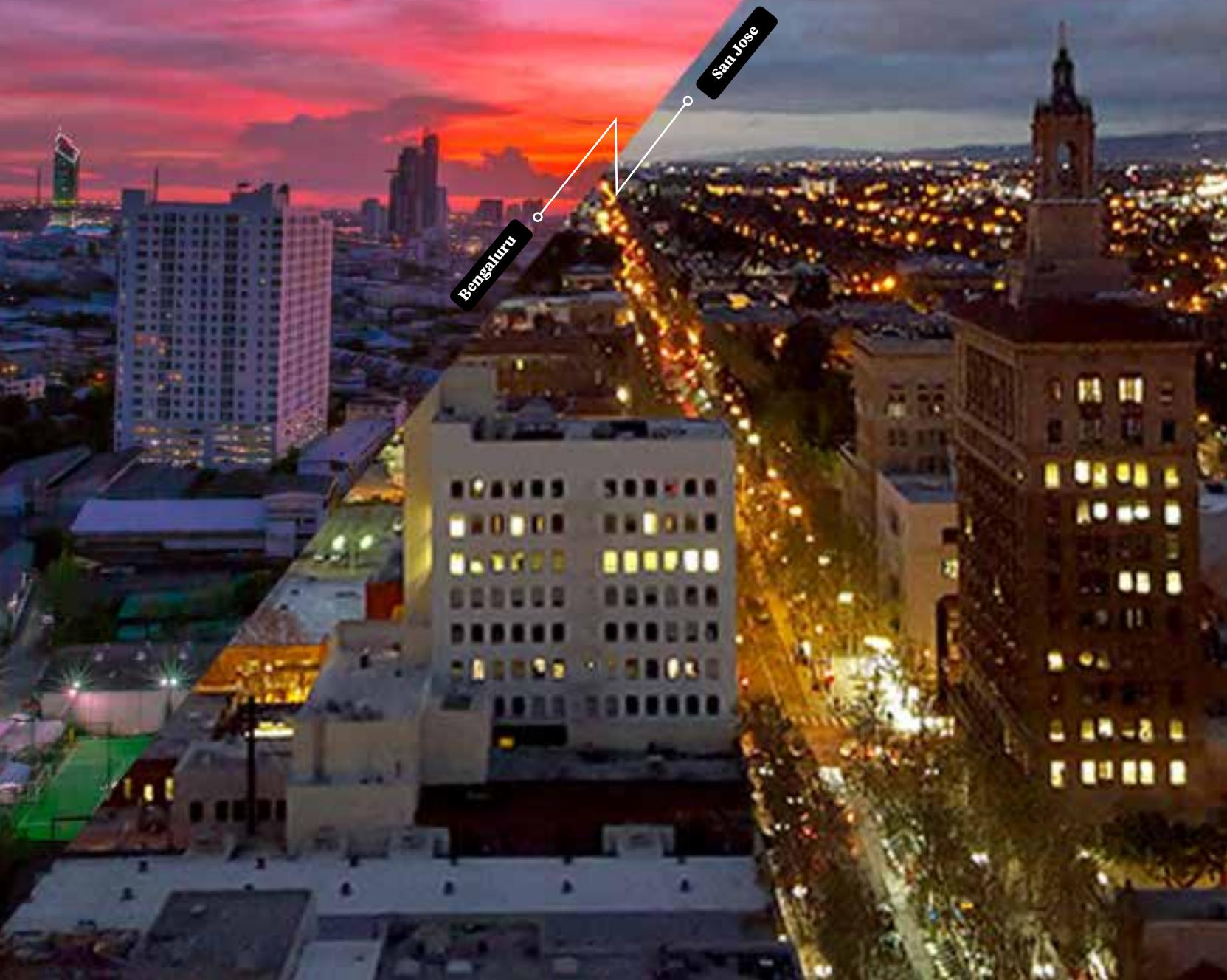
passengers in the past have ended up missing their flights. In fact, the Heli Taxi service was launched amidst much hype in 2018 to allow commuters to reach KIA in a hassle-free manner from Electronics City in just a matter of 15 minutes. However, the cost of using the Heli Taxi burnt a hole in the pocket of the commuter and was not a viable solution for mass transit. Bengalureans stuck daily in nightmarish jams, know that the traffic situation in the city will get worse before it gets better, as the city has been gridlocked, a situation made worse with numerous flyovers, metro construction and road improvement projects underway. Moreover, there are vehicles from outside the city entering every day, clogging its already choked streets.

**Bengaluru's traffic jams come at a price** – Due to gaps in road network planning, traffic engineering and management, the situation in Bengaluru is far from ideal. It is taking its toll on the health and productivity of its residents costing them an average of INR 52,264 per annum on medication and other measures to avoid the congestion<sup>15</sup>. Residents, especially those traveling in private vehicles have been complaining of asthma, stress, respiratory issues, back pain and other illnesses. The number of days of sick leave and additional expenditure by commuters on preventive measures to avoid congestion has been on the rise.

As of 2019, Tom Tom Travel Index rated Bengaluru as the world's number 1 city in terms of traffic congestion, with a 71% congestion level. The time lost in rush hour driving averages 29 minutes per 30 minute trip in the morning and 35 minutes per 30 minute trip in the evening.

<sup>15</sup>Institute of Social and Economic Change (ISEC) "Economic Estimation of Health and Productivity Impacts of Traffic Congestion: A case of Bengaluru city"

# BENGALURU AND SAN JOSE – A COMPARISON OF GROWTH DYNAMICS



The city of San Jose, popularly known as the capital of Silicon Valley, is the most acclaimed technology hub in the world. San Jose is not only the birthplace of Silicon Valley, but is also recognized as the political and financial epicentre of various activities in the San Jose-Sunnyvale-Santa Clara metropolitan area.

San Jose is home to a population of 1.02 million people as of 2019<sup>17</sup>, making it the tenth largest city in America. San Jose's rise towards emerging as a hub for innovation and technology began in the year 1943 with the establishment of IBM's West Coast plant as its pacific headquarters after which the city witnessed a boom in the tech industry and flourishing start-ups. Post 1943, the city experienced several other firsts, marking the beginning of a new era in San Jose wherein it saw a plethora of companies coming from all parts of the country and establishing their businesses there soon after. The economy of San Jose has always prospered given the large concentration of various companies, start-ups and tech giants driving the economy.

San Jose's story of transforming into one of the biggest conglomerations of technology and innovation globally is quite similar to Bengaluru's in some respects. The manner in which San Jose ended up being a quintessential element for the boom in Silicon Valley is analogous to Bengaluru. It occupies a leading place in the world because of its technological presence in the global market and has immense potential to bring about a revolutionary transformation in its urban infrastructure which would benefit the tech industry.

### **Is Bengaluru running along the same lines as San Jose?**

Bengaluru is widely known as the 'Silicon Valley' of India and is among the most tech savvy cities in the country. In the Global Innovation Index Report 2020, the city ranked 60 among the Top 100 Science and Technology Clusters worldwide and was in the Global Innovation Index report 2020, being the only Indian city to make it to the list.

The original title of Silicon Valley belonged to a group of cities located in Northern California which are known to be home to the biggest consortiums in the world including Apple, Google, Facebook and Cisco. Bengaluru has similarly proven to be one of the major hotspots for not only technology, but also research, biotechnology and various other entrepreneurial ventures. Bengaluru's journey and emergence as a prodigy in a field which focuses heavily on technology and innovation, runs parallel to that of San Jose. However, there is a stark contrast between the two cities in urban development. Bengaluru's development was haphazard and turned out to be inefficient as the needs of the city suddenly amplified, with the influx of a large population due to the thriving of the IT industry. On the other hand, San Jose's urbanization was comparatively more structured and systematically implemented.

Although the phases of urbanization in both the cities vary considerably and cannot be compared, there are lessons which can be derived for Bengaluru from San Jose's rapid growth. Both cities adopted planning as an important tool to fulfil their rising needs. Though the road transportation is congested in both cities, the issues in road transport services are rampant and chronic in the case of Bengaluru. The choices

made by the Garden City in terms of road infrastructure has resulted in severe consequences like congestion whereas San Jose boasts an impressive road network despite the supposed problem of heavy vehicular traffic.

### **Bengaluru yet to get 'SMART'**

The concept of a smart city varies across the globe being influenced by its history of urbanization, development and infrastructure, and driven by its unique goals. Universally, an ideal smart city is perceived as one which infuses technology into urban development, public services, transportation, e-governance and so on. From transportation to technological advancement, everything is geared towards creating an efficient and sophisticated city, which at the end of the day, endows the city dwellers with some extra time and ease.



San Jose and Bengaluru are on either side of the spectrum when it comes to their urbanization and growth stories, and this has shaped the approach of each of the cities in forming their vision of a smart city. San Jose's smart city goal is more on the path of enhancing an already well-established network of transportation, utilities, infrastructure and other public services which would lead the capital of Silicon Valley towards emerging as one of the top smart cities of the world.

In contrast, the aspects of prime importance for the development of the smart city of Bengaluru, would essentially come down to erecting a strong foundation in terms of transportation, technology and sustainability for any future endeavours, and to accelerate the actual smart city mission, requiring a high level of technological endowment and competent planning. These initiatives are the stepping stones towards establishing a robust infrastructure that will help the city to pursue and achieve its long-term goal.

Despite the fact that the city of San Jose is a well-recognized technology hub and one of the most prosperous cities in the world, it still hasn't entered the league of top smart cities like Singapore, Tokyo and Dubai. With all the prosperity that San Jose brought, there came the large influx of a population desiring to settle in the capital of Silicon Valley, leading to congestion problems in the city that persist till date. The city was also said to be going through a decade of 'fiscal tightening' and experiencing plenty of connectivity issues wherein 28% of the population lacked broadband access<sup>18</sup>. The smart city initiative aims at bridging this gap, with a vision comprising 12 elements that revolve around urban automation, intelligent infrastructure, seamless delivery of services, strategic business models and more<sup>19</sup>. Although the work is in progress, the city is capable of easily adapting and moulding itself in line with the proposed schemes by virtue of being an already advanced urban establishment, unlike Bengaluru.

Bengaluru smart city mission is one of the 100 cities announced to be a part of India's Smart Cities Mission in January 2018. The proposals encompass two main initiatives: Area Based Development projects (ABD) and Pan City projects.

The key elements of building smart city Bengaluru include 10 projects which are a part of ABD that will not only revitalize the major economic centres of the city but also redevelop other pivotal markets and roads along with it. The Pan City proposal has 8 enumerated projects that largely focus on enhancing e-governance. The core areas of improvement for the smart city are listed in the table<sup>20</sup>. These 'smart city' goals do not revolve around laying down a sturdy foundation for technological reforms in the future, instead these projects are a mere cosmetic touch up for the city. The work has not started in full swing on any of these and the Covid-19 pandemic has further delayed the start.

Table 9:

S. no.	Projects
1	Revitalisation of historic heart of city
2	Integrated mobility towards creating vibrant destinations
3	Shivajinagar bus station and Russel Market precinct
4	Majestic bus station
5	Upgradation and redevelopment of historic economic centres
6	KR market
7	Malleshwaram market
8	Innovation of downstream clean-up of drainage system
9	Ulsoor lake
10	Sankey tank
11	Protection and redevelopment of centrally located parkland
12	Increasing affordable housing stock through slum redevelopment (Swathantra Palya Slum Redevelopment)
13	Retrofitting of a healthcare facility (KC General Hospital)

**San Jose and Bengaluru are on either side of the spectrum when it comes to their urbanization and growth stories, and this has shaped the approach of each of the cities in forming their vision of a smart city.**

<sup>17</sup><https://www.census.gov/data/tables/time-series/demo/popest/2010s-total-cities-and-towns.html#tables>

<sup>18</sup><https://www.sanjoseinside.com/news/how-smart-is-san-jose-silicon-valleys-biggest-city-tries-to-catch-up-with-the-digital-future/>

<sup>19</sup><https://cms7.dot.gov/file/59706/download?token=s1JaCr2o>

<sup>20</sup><https://bengaluru.citizenmatters.in/smart-city-bengaluru-plans-1700-crores-25659#:~:text=The%20major%20key%20of%20the,economic%20zones%20of%20the%20city.>

## Hiccups in urban development

### i. Comparative analysis of the traffic situation in San Jose and Bengaluru

The traffic situation in Bengaluru has been mapped out in the previous sections of the report. The stark contrast between the traffic congestion of the two cities is revealing. Traffic congestion is defined as a condition in transport that is characterised by slower speeds, longer trip times and increased vehicular queuing. San Jose is the 4th most congested city in the United States<sup>21</sup>. Bengaluru on the other hand, holds first place globally with a whopping 71% urban traffic congestion.

Although, rising congestion levels are an indicator of growth of an economy, the traffic laden roads and highways of Bengaluru cause immense distress for its citizens.

Despite the variance, both cities are extremely congested being major centres of attraction for economic and technological activities in their respective countries and hence, measures need to be taken by their governments to reduce the congestion level in both.

### ii. Transportation comparison + takeaways

The most prevalent modes of transportation in San Jose are the light rails and buses among other options like Caltrain and ACE trains. These facilities are used extensively by its people, majorly comprising students who study in nearby universities. This extensive network of public transport connects major hubs across the Silicon Valley, but Downtown San Jose is often left a little uncovered. This system is managed by Valley Transportation Authority (VTA). However, despite the services running without problem, they are not as advanced as one would expect them to be in the 'Capital of Silicon Valley'. One of the possible reasons may be the fact that San Jose is not as densely populated as other giants in the Silicon Valley like San Francisco. A preference towards private vehicles among the population is also observed. Despite this, the public transit services fulfil their goal of connecting the population to major spots locally as well as in other regions of Silicon Valley.

The transportation in Bengaluru is limited to a network of buses managed by BMTC and the Metro Rail which is yet to be fully established. The Bengaluru Metro is managed by BMRCL and is a work in progress. Bengaluru already has an active metro line, but it does not connect to the major IT hubs as yet. However, once the metro rail is fully operational, the city will not lag behind in terms of connectivity and public transportation which is a major component of urban development.

### iii. Water management

Bengaluru is infamous for its dire water scarcity problem prevalent across the city. The scarcity is primarily attributed to the sudden shift in population since the year 2000. As the population increased, the water resources were grossly mismanaged and exploited leading to a rapid decrease and contamination of reservoirs, lakes and rivers. Depletion of groundwater rose at an alarming rate. The city experiences acute water

shortages from time to time, and a majority of the population has to depend on borewells and water tankers to meet the most basic needs. However, there have been consistent efforts by the government to curb excessive usage of water and various initiatives have been introduced to save water including Sewage Treatment Plants (STP), rainwater harvesting and reuse of water. These are in addition to the proposals to revive lakes and rivers which are a major source of water supply in the city.

Although water scarcity isn't as prevalent in San Jose, the city does have a problem with water supply and has experienced frequent droughts over the past few years, resulting in drinking water shortage across the city. There have been flood related disasters too, causing intrusion of salt water into the city aquifers and resulting in degradation of the quality of drinking water. The council of San Jose declared a water emergency in the state and subsequently imposed several restrictions on water usage to encourage water efficient practices amongst residents of the city which included cutting back of water usage up to 20%<sup>22</sup>. In 2017, several restrictions were lifted by the council which declared that the city had overcome the major hindrances. However, despite the consistent efforts to conserve water and to propagate the idea of sustainable use of water, San Jose is still under constant threat of severe drought and water shortage.

### In Conclusion - Lessons for Bengaluru

San Jose depicts an ideal scenario for the city of Bengaluru for urban infrastructural development and growth in terms of city planning and technological advancement among others. Although the two cities are very different with contrasts in their population, demography and technology, facing very different challenges, Bengaluru has the capability to emerge in the global market as a prodigy from India. Bengaluru seems to be bridging the gap with other high-tech cities and levelling up with a quick pace. Be it traffic, public transportation or road infrastructure of the city, Bengaluru is set to make it big in all aspects to become the next big thing in technology and innovation.

<sup>21</sup>[https://www.tomtom.com/en\\_gb/traffic-index/san-jose-traffic/](https://www.tomtom.com/en_gb/traffic-index/san-jose-traffic/)

<sup>22</sup> <https://myemail.constantcontact.com/San-Jos--City-Council-declares-end-of-local-water-shortage.html?soid=1126946575015&aid=hfuBRs1Nns4>

# MAJOR INFRASTRUCTURE PROJECTS AND KEY IMPACT MARKETS

Nearly 127 km of metro and 270 km of road projects are in various stages of construction in Bengaluru. Approximately 45 kms is under pipeline as part of Phase 3. Currently, it is at a DPR stage and will further augment the public transport connectivity by Metro. These projects should transform the way citizens travel in Bengaluru and will influence real estate in the project corridors. All the under-construction metro lines are in different stages of construction and land acquisition. Phases 2A and 2B, connecting KR Puram and Central Silk Board to the city's tech corridor and further on to KIA or the 'ORR-Airport', is the most awaited corridor. The metro projects have been plagued by several issues like construction setbacks, realignments, land acquisition and execution which has delayed the project by several years. Since Phase 1 of the Bengaluru Metro became operational in 2011, several bottlenecks cropped up for the extensions and new lines planned under Phase 2. Average daily ridership in the two corridors under Phase 1 increased to 4.05 lakhs in the year 2019<sup>23</sup>. Once fully operational, usage of the metro is expected to be high which will drive real estate development along the project corridor.

Currently, the real estate market in Bengaluru is recovering from the adverse impact of the Covid-19 pandemic and not many developers are keen to undertake new construction activities and we may not witness action on the ground immediately. However, all the leading players hold vast land banks along the project corridor, especially in north, north-east and southern parts of Bengaluru. Due to the uncertainty of implementation of the RMP 2031 and the TOD Policy in its current form, many developers who hold land positions along the metro corridors may not commence construction until there is clarity on these plans. As clarity emerges and the market revives, we will witness significant real estate traction along the project corridors.

Per our findings, Bengaluru's transit-oriented infrastructure projects are likely to unlock incremental real estate development potential of over 3.5 million sqm (38 million sq ft) in the next five years across select key impact markets.

<sup>23</sup>Draft Comprehensive Mobility Plan, March 2020

**"By 2025, 172 kms of Metro Network should become operational with daily ridership of over 20 lakh serving major IT hubs and other major economic centers. City planners are now looking at mobility solutions with the key focus on multi-modal integration and common fare media by way of national common mobility card in the short to medium term. For medium to long term, the efforts are to facilitate transit oriented development through market based densification of areas, redevelopment through constructive destruction, and augmentation of civic infrastructure so that the people can live and work closer to transit corridors. For supplementing public resources for the TOD, mechanisms for value capture finance should be in place in next 6 to 8 months. Metro is also exploring PPPs for station developments and other non-fare box revenues. Covid-19 and associated consumer behaviour changes may bring about some changes in the mobility patterns in the short term, but we expect the ridership to become normal from 2022."**

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Ajay Seth, IAS  
Managing Director, Bangalore Metro Rail Corporation Ltd.

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## **Objective of this study**

Based on select upcoming transit-oriented infrastructure developments, identify the key impact markets which are likely to witness greater real estate traction.

### **Methodology for identifying key impact markets along the project corridor-**

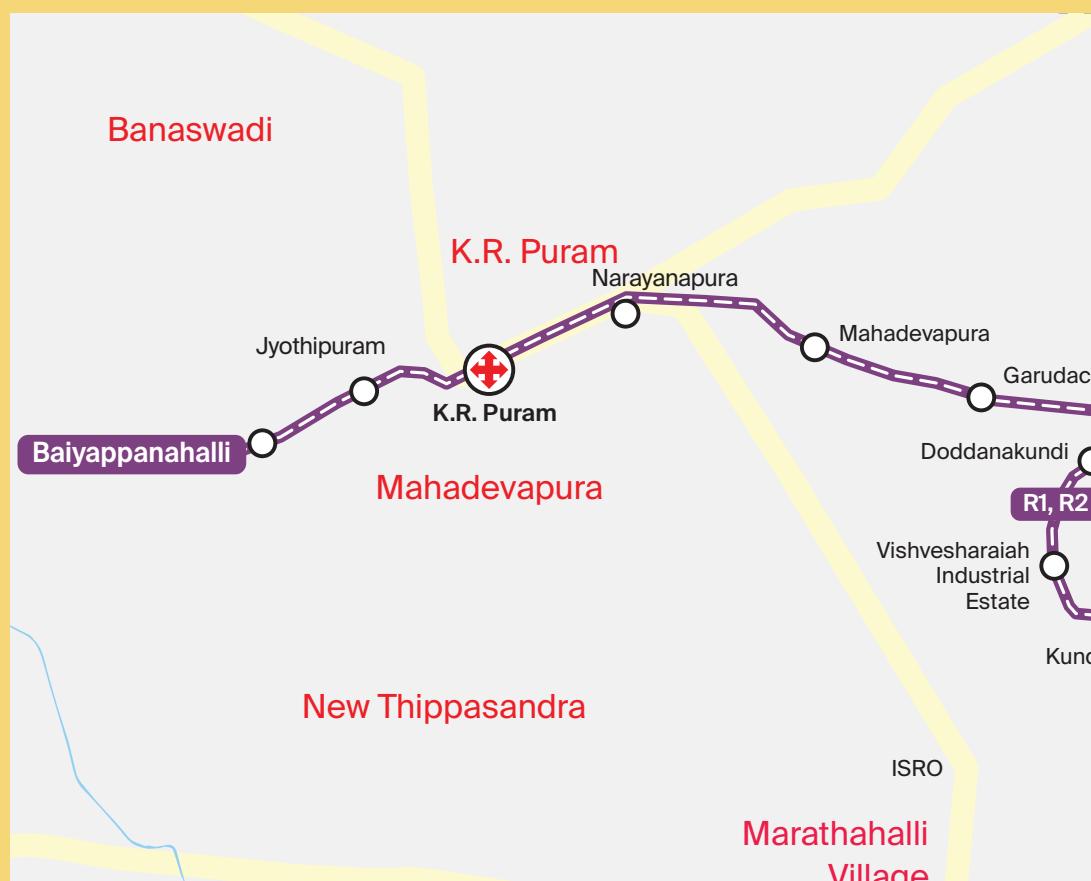
- i. Evaluate the catchments along the metro rail corridor and the major road and suburban rail projects
- ii. Identify catchments which are currently lacking connectivity
- iii. Assess the connectivity scenario of those catchments after the infra projects are operational
- iv. Evaluate the scope for real estate traction in that catchment based on
  - a. Reduction in travel time to key locations OR
  - b. Availability of land for greenfield development OR
  - c. Scope for greater real estate traction via redevelopment

*Note: The objective of the study is to identify key impact markets from the perspective of potential for heightened real estate traction (i.e. demand and supply). The objective and methodology are not intended to gauge the scope for price appreciation in our earmarked key impact markets, as it is based on a different set of parameters which are not covered as part of this report. Due to the Revised Master Plan 2031 and Transit Oriented Development Policy being a work under progress, clarity on the final FSI concepts, mobility plan and land use strategy is still awaited. Hence, the scope of identifying key impact markets is based on parameters ranging from location attractiveness, land bank positions of major developers and corporates, and residential and commercial real estate activity in the nearby markets.*

## Infrastructure projects likely to be completed between 2021-2025



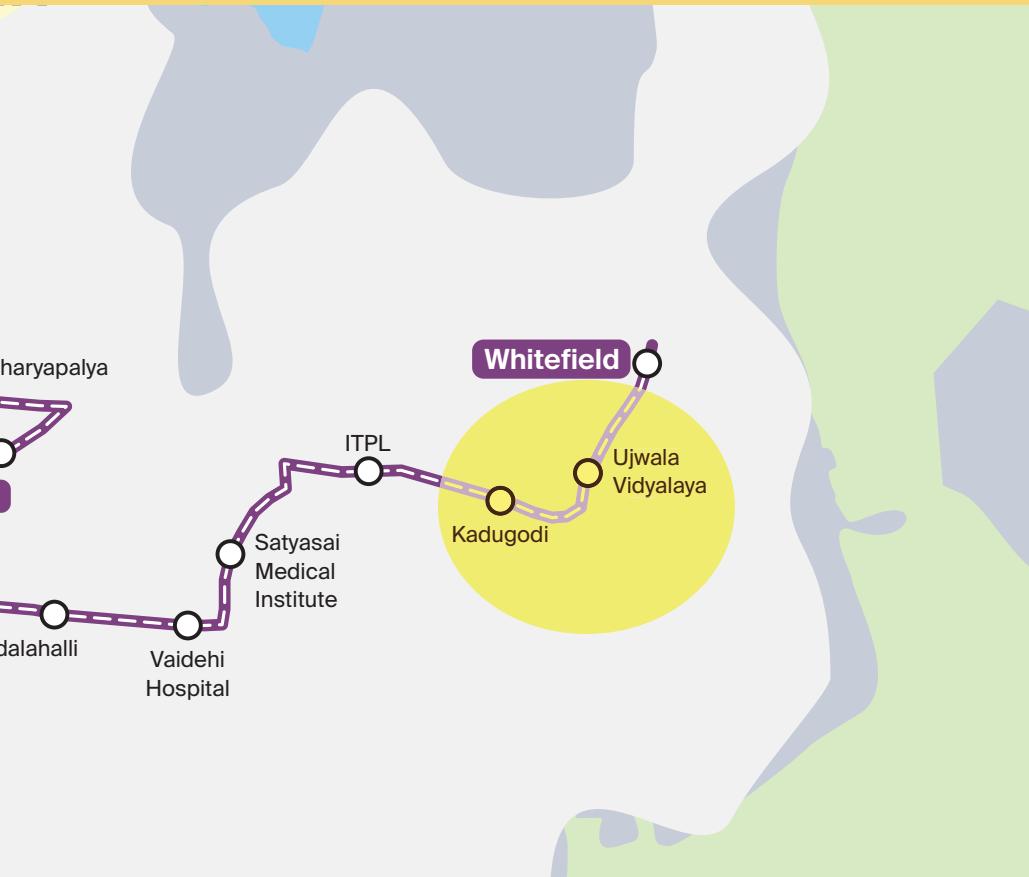
Source: Knight Frank Research, BMRCL  
All maps are for representational purpose not to scale



This metro line under Phase 2 is much awaited as it establishes connectivity to one of the most significant employment hubs in the city - Whitefield. After encountering a number of challenges such as proximity to Benniganahalli lake, properties required for road widening and land acquisition in some parts to tree cutting hurdles, laying of tracks has started on this line. However, it is not likely to meet the previously committed deadline of 2021 due to some disruption in ongoing work and labour shortage during the lockdown. The completion, therefore, will likely be delayed by a year. This is one of the longest stretches of the metro corridor and passes through some densely populated and well established residential and commercial catchments.

Since this metro line is an extension of the Purple Line (Eastern line of Phase I), it would improve access from central and western parts

of Bengaluru all the way to Whitefield. The line starts from the south side of Bangalore Chennai Railway line, crosses Kasturinagar Road and Outer Ring Road to reach the Old Madras Road. The alignment then reaches the Whitefield Road and runs along its median. It then passes along the median of Graphite India Road. After this, the alignment touches the ITPL and Whitefield Satya Sai Ashram. Currently, there are a limited number of primary roads connecting this office market to the dense residential catchments of KR Puram, Indiranagar, Baiyappanahalli and other locations in the central part of Bengaluru. This route has multiple signals, narrow roads and limited capacity, which hinders the flow of traffic creating bottlenecks for office goers commuting to Whitefield. People travelling on this route by car would benefit from this project. Once this metro line is operational, the access to malls and other retail destinations along the corridor will also improve.

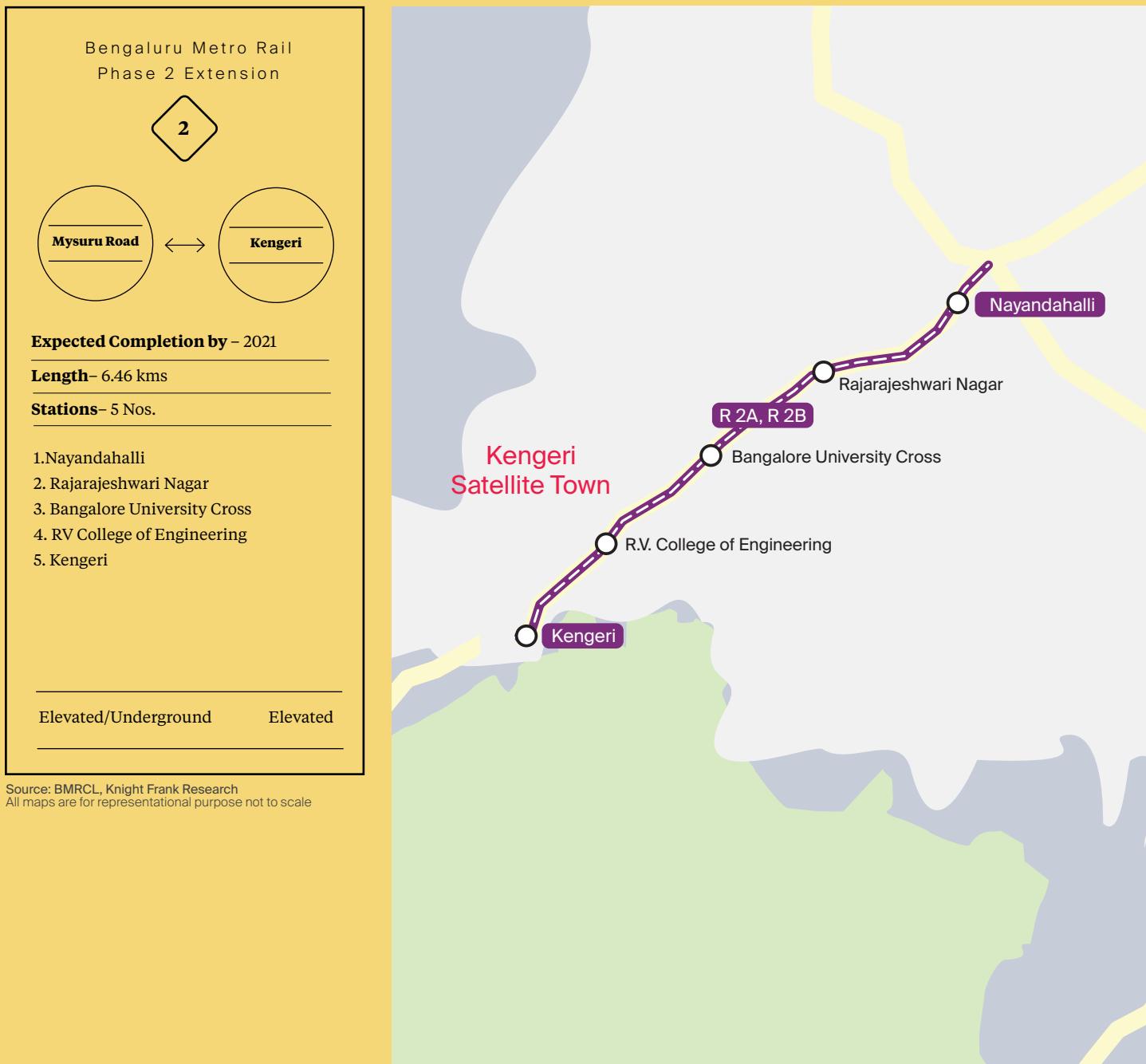


## Key impact markets

*As per BMRC, This metro line is the longest metro line extension providing connectivity to several markets in a single corridor. Considering the length of the corridor and the high ridership, several markets along this corridor will witness real estate traction. However, many markets along this corridor are already developed and do not have much scope for expansion or greenfield development. The few markets that have the potential to witness higher real estate traction than what they currently do, are likely to be-*

**Whitefield:** Whitefield is the most sought-after business district of the city with low single digit office space vacancy, but it lacks connectivity through public transport due to its distant location in the eastern quadrant of the city. Whitefield has emerged as a self-sustained location post the IT boom with people living and working in this area to save on travel time. It takes at least an hour and a half to get in and out of Whitefield during peak hours and an additional hour or more to reach the city centre or northern/southern peripherals by private vehicle. Metro Line 2 is the first of the projects which will bring the metro to Whitefield's doorsteps, making commute easier for people working here. It will reduce travel time to KR Puram by 39 minutes (current travel time by road

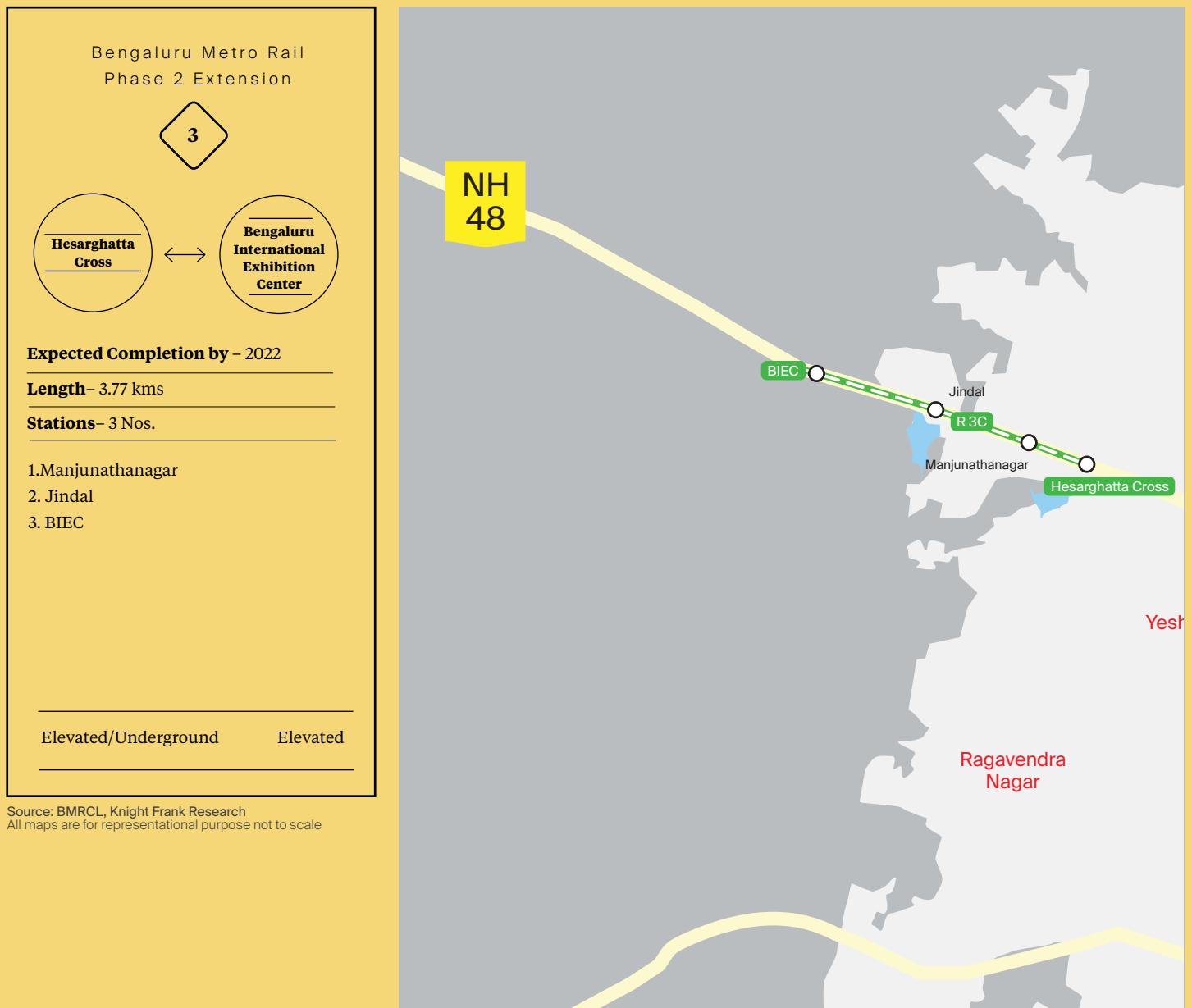
during peak hours is 45 minutes) and to MG Road by nearly 77 minutes (current travel time by road during peak hours is 90 minutes). Metro Line 2 will connect Whitefield to the dense residential catchments in the suburbs and central areas of the city. This project will further augment Whitefield's profile as one of Bengaluru's prime office markets. With metro connectivity in the offing, this developed location is witnessing construction of 13 million sq ft of incremental office space which is expected to become operational in the next four years. Developers remain bullish on building more commercial inventory as enhanced connectivity will lure more tenants in the long term.



The existing metro line of Phase I from Mysore Road to Baiyappanahalli continues on the median of the Mysore Road till it reaches the Kengeri station. This extension of the Purple Line is a 6.46 km corridor with 5 stations. The metro line passes through densely developed catchments along the western and south-western locations of Bengaluru with very little scope for new development.

The satellite town of Kengeri which has come up in the south-western peripherals, just before the NICE Road, has seen a lot of traction for low to mid-segment residential development from local developers in the past few years, post the announcement of extension of metro line. This location has been a fast-developing hub with an abundance of ground water. It caters largely to government employees, garment factory workers or those employed in the small-scale industries in the vicinity. A few

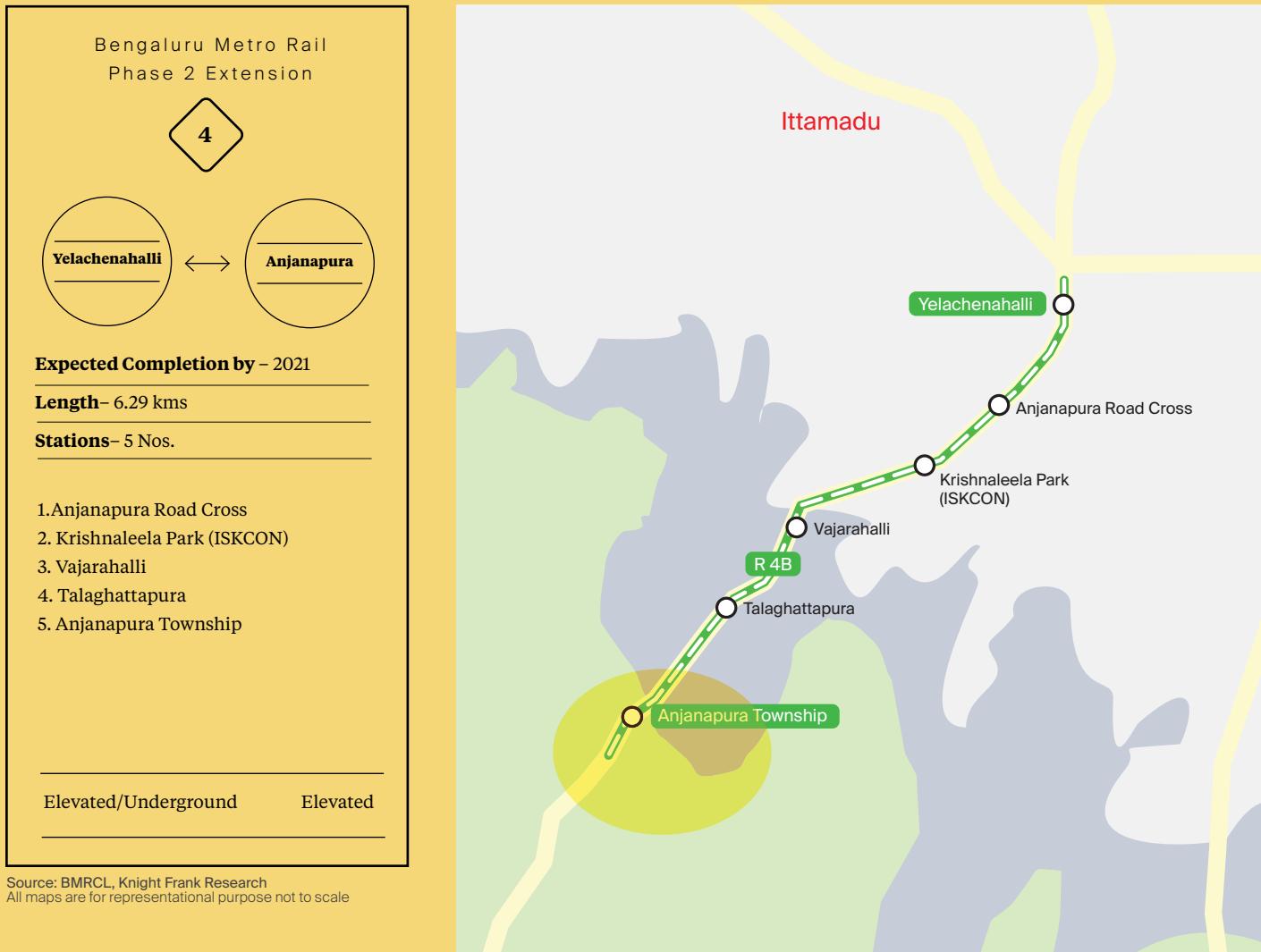
takers from the IT sector are also interested in this location due to its proximity to Electronics City. This location was already well-connected with suburban rail and road network. Enhanced connectivity with the extension of this metro line will only put it on a path to realty growth, once the market revives post the Covid-19 crisis when construction activities resume.



Source: BMRC, Knight Frank Research  
All maps are for representational purpose not to scale

This metro line is one of the extensions of the North-South corridor of Phase I and Phase II. The line from Hesarghatta Cross of Phase I to BIEC along Tumkur Road is an elevated corridor having a route length of 3.77 kms and 3 stations. This is the smallest corridor of the metro line. Provision has been kept for extending the line further in future. A lot of visitors who intend to go the BIEC from various parts of the city and outskirts will now have a faster means of public transport with this

extension as travel by road takes too long. Therefore, a need for extension of Phase I line on the northern side to BIEC has been felt. This metro line passes through a very limited stretch with densely developed catchments and very little scope for new development. If the metro line is extended beyond BIEC, it will open up new micro markets for affordable housing.



This metro line from Putenahalli Cross of Phase I to Anjanapura Township (upto NICE Road crossing) along Kanakpura Road is an elevated corridor having a route length of 6.29 kms and 5 stations (excluding Putenahalli Cross Station). The metro line is nearing completion and a trial run of this route was carried out by BMRC in 2020. It was expected to begin commercial operations on November 1st, 2020 which is also the State Formation Day. This is the first route under Namma Metro Phase 2 that is expected to open. The project has witnessed a lot of delay. It was to be completed by 2018 but the deadline was pushed to 2020. However, due to

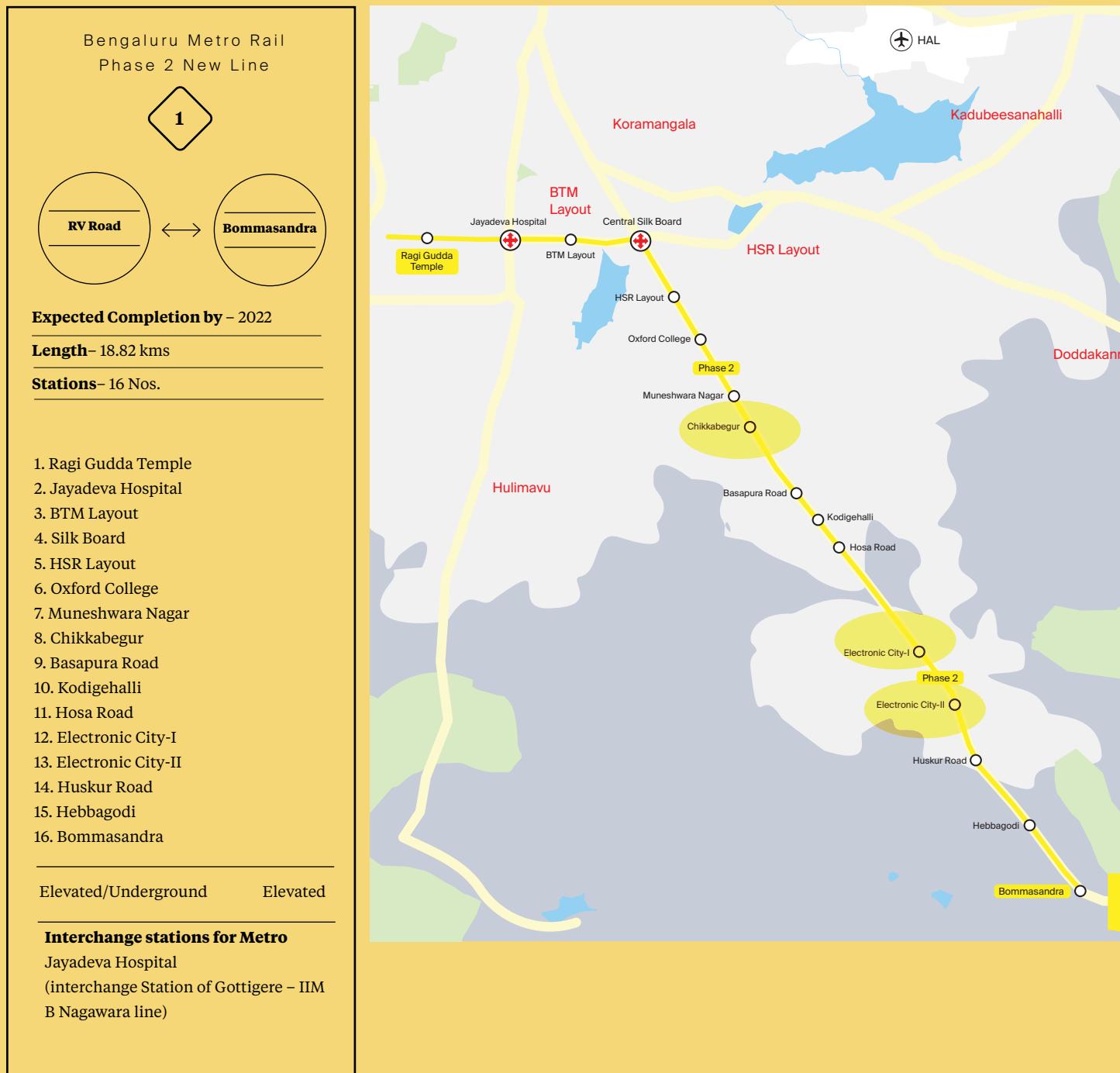
the Covid-19 pandemic and the consequent lockdowns, a further delay has been caused leading to a revised deadline of next year.

This metro line provides connectivity to BIEC and Baiyappanahalli through 2 metro lines. It connects with the upcoming Phase 2 extension from Baiyappanahalli to Whitefield through interchange at Majestic, as well as with the under-construction Phase 2A (KR Puram to Central Silk Board) through interchange at KR Puram.

## Key impact markets

**a. Mallasandra to Anjanapura Township belt:** There are large undeveloped land parcels in this entire belt despite ongoing residential construction. Anjanapura is located in an isolated part of Bengaluru, far-off from any other transportation node. It is closest to NICE Ring Road for faster connectivity to southern peripherals. With the metro line coming in, travel time from Anjanapura Township to Majestic Bus Stand will reduce by atleast 65 minutes (current travel time by road during peak hours is 80 minutes when traveling from within the city. If one used the

NICE corridor, the travel time will increase even further). The metro line will establish connectivity for this entire belt via the upcoming metro Phase 2 extensions to Electronic City via RV Road to Bommasandra (Yellow Line). Anjanapura Township 1 to 8th Block and Anjanapura Extension are BDA layouts with all basic amenities. This belt will benefit immensely from the improved connectivity to both central and southern peripherals and thus witness greater real estate traction.



Source: BMRCL, Knight Frank Research  
All maps are for representational purpose not to scale

This metro line of Phase 2 is 18.82 kms in length and passes through 16 metro stations enhancing connectivity to the far-off southern peripherals on Bengaluru's outskirts. It passes along the RV Road, turns left to the Marenhalli Road, traversing on its median till Jayadeva Hospital Junction flyover, when the alignment shifts to the left. After crossing the Jayadeva Junction flyover, the alignment comes back to the median, traversing till the Silk Board Junction. Here, the alignment turns right to reach the western side of Hosur road. The line then runs along the centre of the western side service lane of Hosur Road. This is set for completion in 2022.

This is a new line with an interchange station at RV Road Station in the Southern Line of Phase-1. BMRCL plans to connect the operational Green Line stretch (Yelachanahalli to Nagasandra) with the Yellow Line via the RV Road Station.

## Key impact markets

*As per BMRCL, passenger ridership of 455,000 is expected on this line by 2031 which is expected to increase to 502,000 by 2041 with a mean trip length of 8.4 kms. As this metro line passes through some markets which are already developed, it is the established markets that are likely to witness further demand. The markets are -*

### a. Begur –

With the Chikkabegur metro station coming up very close to this location, Begur Main Road is set to benefit from the increased connectivity. While real estate development had started in Begur 6-7 years back, Begur Main Road has a lot of vacant land parcels with private operators and developers which provide greenfield development opportunities. Also, there are many small scale industries such as textiles, old knitting units and incense stick factories, most of which have filed for insolvency and can be redeveloped into residential or Grade B and C office developments. This location has smaller plots of less than half an acre, and the redeveloped small offices may see good interest for occupancy from lawyers, chartered accountants and small corporates as rents too are low.

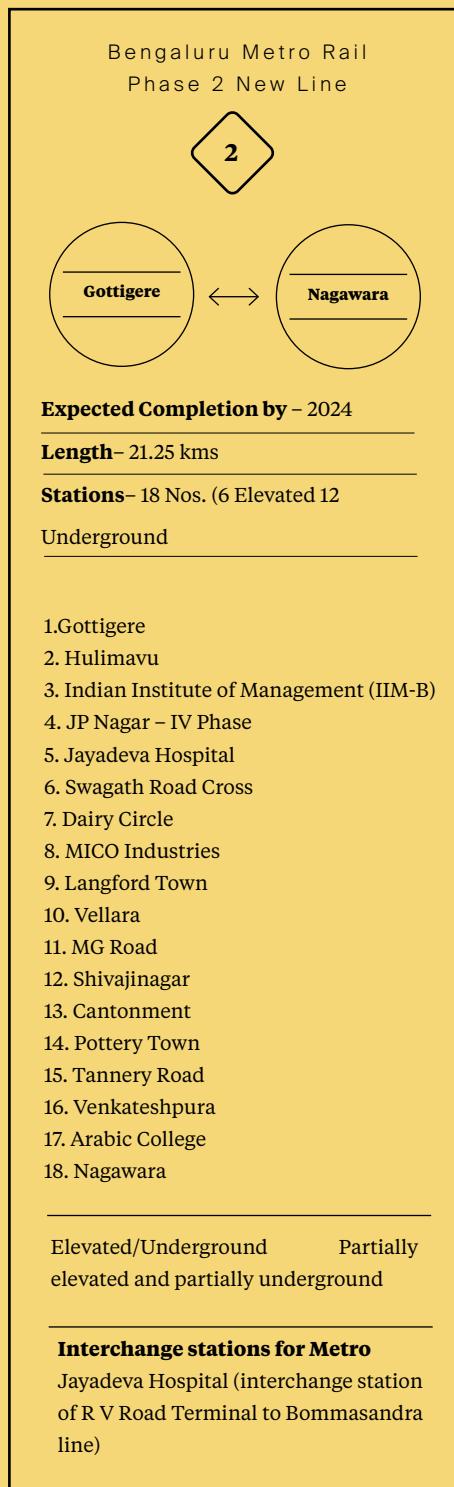
### b. Electronic City Phase I –

Electronic City is a prominent business district and campuses of many IT bigwigs are located here. Despite road connectivity via the Elevated Expressway and Hosur Road, thousands of IT professionals face major traffic woes traveling daily to work. As part of the upcoming metro line, a leading IT company has signed an MoU with the BMRCL for construction of a station at Konappa Agraha in Electronic City I. It will make commute easier for people working in Electronic City. Once operational, it will help ease the traffic situation in the major bottlenecks of Madiwala and Central Silk Board. It will reduce travel time from Electronic City Phase 1 to Central Silk Board by 22 minutes (current travel time by road during peak hours is 30 minutes) and encourage office goers to embrace public transportation. Metro connectivity will give a fillip to the office real estate market in this corridor and encourage more tenants to lease

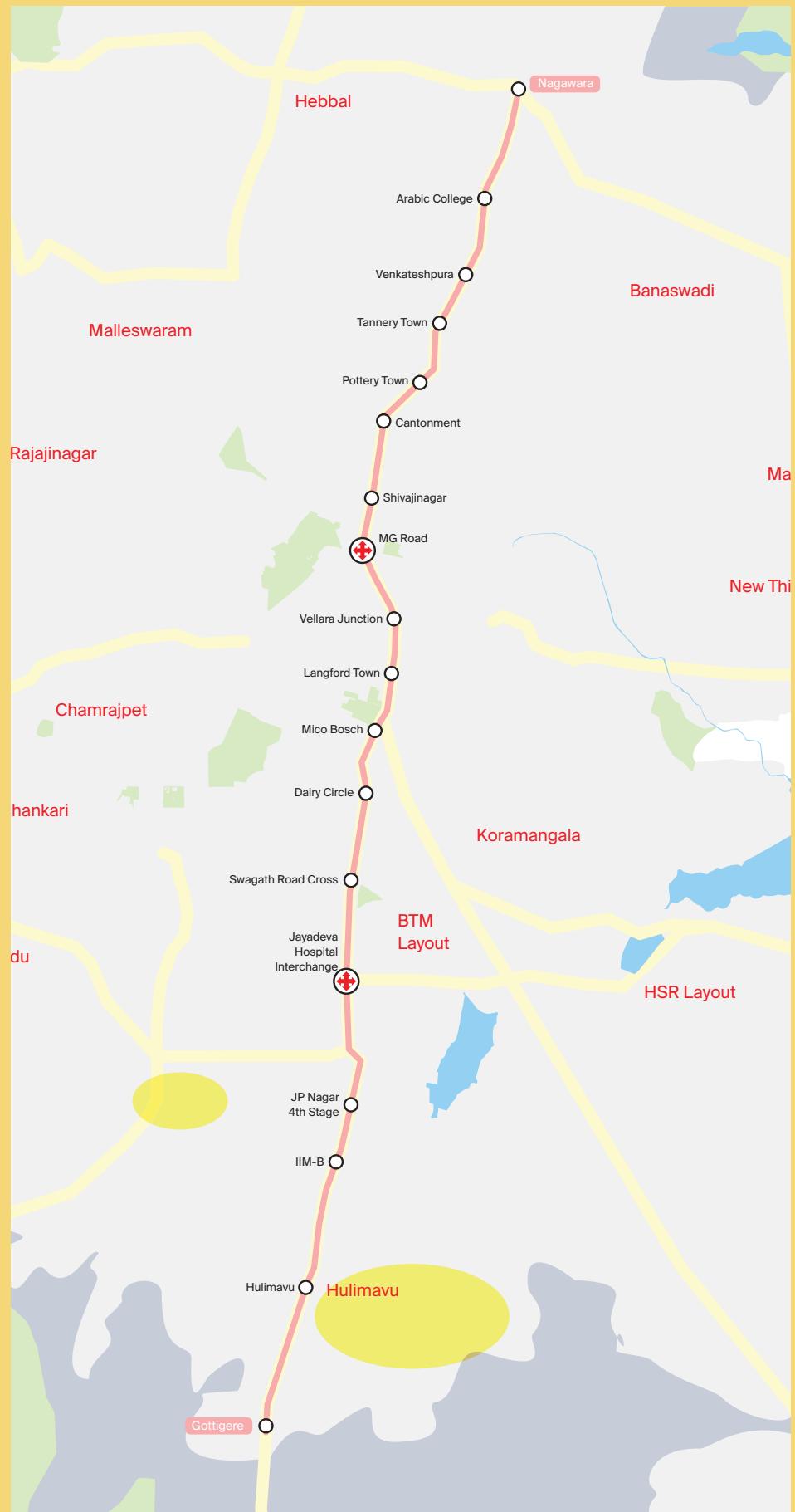
existing office spaces as there will now be an alternative solution to a large number of private vehicles on this belt. At present, nearly 1.8 million sq ft of additional office space is under construction in Electronic City Phase I.

### c. Electronic City Phase II –

By bringing the metro station right inside Electronic City, this project will augment the stature of Electronic City Phase II as one of the important office markets of the city. Electronic City Phase II is a developing locality which has a mix of technology parks, industrial units and residential complexes. The upcoming metro will reduce travel time from Electronic City Phase II to Central Silk Board by 38 minutes (current travel time by road during peak hours is 45 minutes) and encourage mid-income housing projects to take off as job creation is likely to increase manifold once the impact of the Covid crisis tapers off. As ORR is already saturated, a demand spillover for commercial real estate in the next 5 years will also spur office space take up in Electronic City Phase II. A few local developers are coming up with nearly 1.4 million sq ft of new office spaces in this location. The access to educational institutions, malls and other retail destinations along the corridor will improve once this metro line is operational.



Source: BMRC, Knight Frank Research  
 All maps are for representational purpose not to scale



This segment of Phase 2 metro line traverses along Bannerghatta Road as an elevated line up to Swagath Road Cross and then goes underground just after Sagar Hospital near the fire station. The entire length from this point onwards is underground. The line passes through the Dairy Circle and runs along MICO Industries, reaches Hosur Road and crosses Richmond Road at Vellara. After this, the line traverses below Brigade Road and crosses MG Road under the Phase I East West metro line to reach Kamaraj Road. An underground integrated station is planned here, which will be 90 meters from the platform edge of the existing elevated MG Road Station, and connected through escalators and stairs. After this, the underground alignment crosses Cubbon Road to reach Shivajinagar Bus Stand. Further, the alignment passes below Queens Road to reach Cantonment Railway Station, where the Cantonment Railway Metro Station is planned. This station is integrated with the Bangalore Cantonment Railway Station. The line then traverses below Nandidurga Road, Tannery Road and reaches Nagawara after crossing ORR.

Of the total 18 stations, the elevated stations are Gottigere, Hulimavu, IIM-B, JP Nagar 4th Phase, Jayadeva Hospital (interchange station of RV Road Terminal to Bommasandra line) and Swagath Road Cross. The 12 underground stations are Dairy Circle, Mico Industries, Langford Town, Vellara Junction, MG Road (interchange station of East West Corridor of Phase 1), Shivajinagar, Cantonment Railway Station, Pottery Town, Tannery Road, Venkateshpura, Arabic College and Nagawara. A maintenance depot is to be constructed at Kothanur.

BMRCL has requested financing from European Investment Bank (EIB) and Asian Infrastructure Investment Bank (AIIB) for Gottigere-Nagawara Corridor (Reach 6).

## Key impact markets

*As per BMRCL, this metro line is expected to have a daily ridership of 558,000 by 2031 and 619,000 by 2041. Once operational, this metro line will be the longest metro line in Bengaluru providing connectivity to several markets from north to south in a single corridor.*

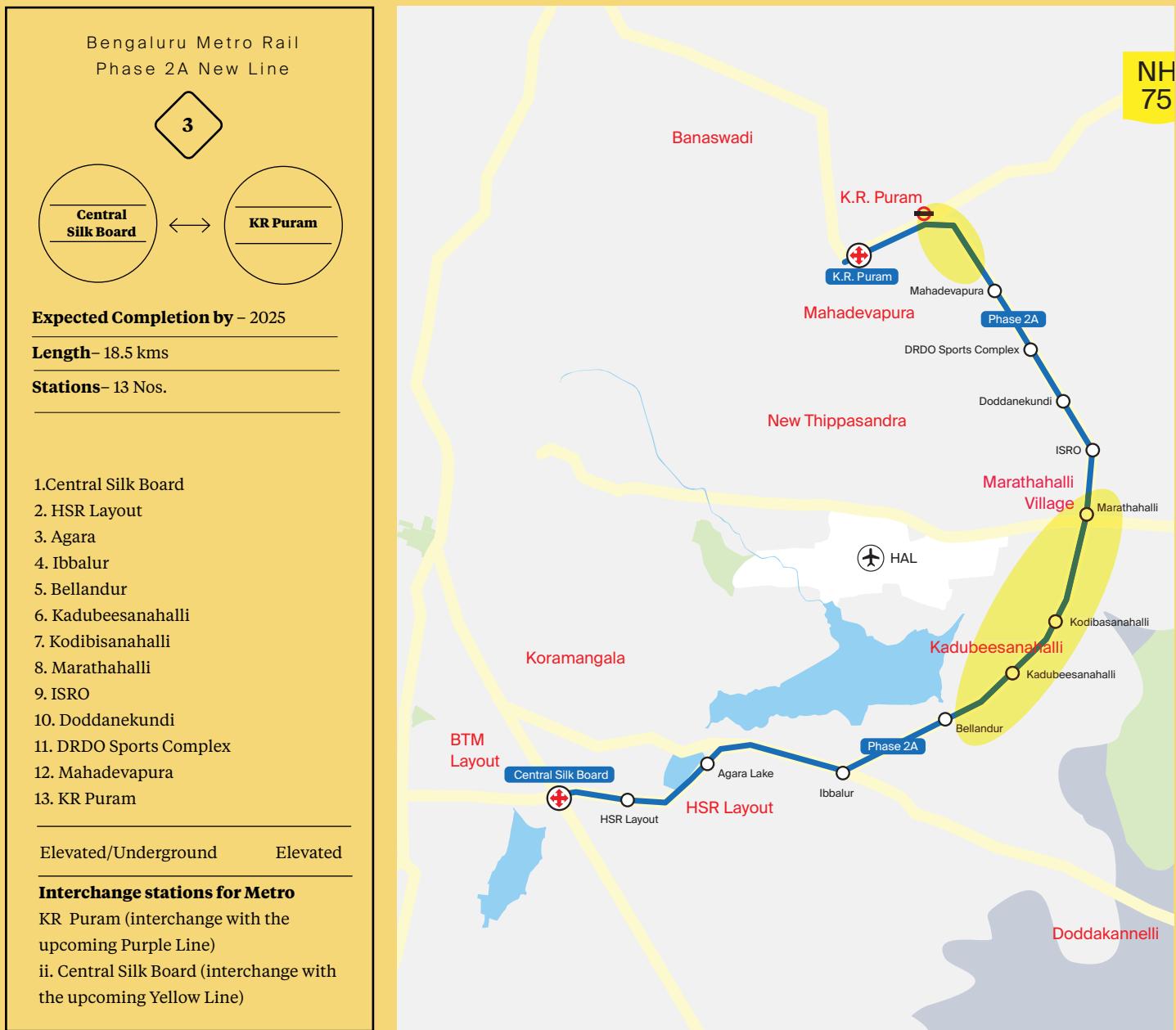
*Considering the length of the corridor and the high ridership, several markets along this corridor should witness real estate traction. However, since this metro line passes from inside the city centre and as many markets along this corridor are already developed, there isn't much scope for expansion or fresh development. In most corridors, land availability is scarce, besides a lot of heritage structures are near the alignment. The few markets that have the potential to witness real estate traction are likely to be-*

### a. The quadrant between Hosur Road and Bannerghatta Main Road -

There are a few vacant land parcels in this quadrant. Locations such as Begur and Hulimavu which are located closer to the established office locations of Electronic City are likely to witness heightened residential development which will continue all the way upto the NICE Ring Road periphery.

### b. JP Nagar Phase 9th and 10th -

Though JP Nagar is an upmarket and cosmopolitan residential location, Phase 9th and 10th have largely remained barren and free of organized residential construction. These phases are set to get a fillip for low rise residential developments like bungalows and independent houses with the arrival of the metro and the maintenance depot coming up in Kothnur, as it is closer to these locations in JP Nagar.



The Bangalore Metro Rail Phase 2A between Silk Board Junction and KR Puram is being taken up to provide better metro connectivity to the Phase 2 segment and to tackle the ever-growing traffic problem of the city. The project will provide metro connectivity on the ORR which is the city's most dense commercial corridor employing more than half a million Information Technology professionals. This IT corridor attracts the maximum office space demand and has always had minuscule vacancy levels. There are a number of big Information Technology Parks on the ORR between Central Silk Board and KR Puram and with various support services and indirect employment, they provide employment to one million people. Thus, it has always had the highest demand for connectivity via a reliable and efficient public transport system which

would provide respite from the traffic nightmares. This stretch has witnessed phenomenal growth of technology campuses over the past decade. While it has the presence of many of the biggest global corporates, metro connectivity was prioritized much later, after the huge burden on transport infrastructure turned it into a transportation bottleneck.

Though the Phase 1 and Phase 2 of the metro network has been planned and Phase 1 is completed, this ORR corridor was left untouched both previously. The metro line passes through two extremities of this corridor, one at Central Silk Board and the other at KR Puram. The DPR for this line was prepared by BMRCL in October 2016 and updated during January 2019 incorporating the requirements prescribed in the Metro Rail Policy –

2017 issued by the Ministry of Housing and Urban Affairs.

At the time of Asian Development Bank's entry into this project in 2019, the work on Phase 2A had already started. Land acquisition was completed and Final Notification for acquisition under Section 28(4) of the Karnataka Industrial Area Development Act was already published. The entire alignment of this line is planned to be elevated. The total length of the alignment is 18.5 km (Central Silk Board side end to K R Puram side end). There are 13 stations planned on this corridor including the two terminal stations.

The Phase 2A metro alignment generally follows the median of the ORR from Central Silk Board to KR Puram. Of the 13 stations, 7 have been planned for commercial development for an area of about 1000 sq m

at each station at concourse level. The area at ground level will be used for intermodal transit and parking. A 6m wide service road has been provided around the stations for integration with BMTC buses to ensure last mile connectivity for commuters. Provision is made for pocket track at Kodibeesanahalli Station and cross overs at Ibbalur-Bellandur-Kadubeesanahalli and Marathalli-ISRO- Doddenakundi Stations, to facilitate smooth train operations and to help in easy turnaround of trains during emergency. Leading tech giants, corporates and private property developers have signed MoUs with BMRCL for the construction of metro stations on this stretch via a concession agreement for a period of 30 years.

## Key impact markets

*As per As per BMRCL, this metro line is expected to have a daily ridership of 459,000 per day in 2031 which is set to increase to 575,000 per day in 2041<sup>30</sup>. As this metro line passes through already established saturated markets, not many vacant land parcels are available on this stretch which aren't already earmarked as part of existing IT Parks or SEZ developments for future expansion. Considering the length of the corridor and the high ridership, several markets along this corridor will witness real estate traction. However, many markets along this corridor are already developed and do not have much scope for greenfield developments beyond opportunities for build-to-suit (BTS) office assets as per tenant requirements. The few markets that have the potential to witness high real estate traction are likely to be -*

### a. Bellandur to Marathahalli belt -

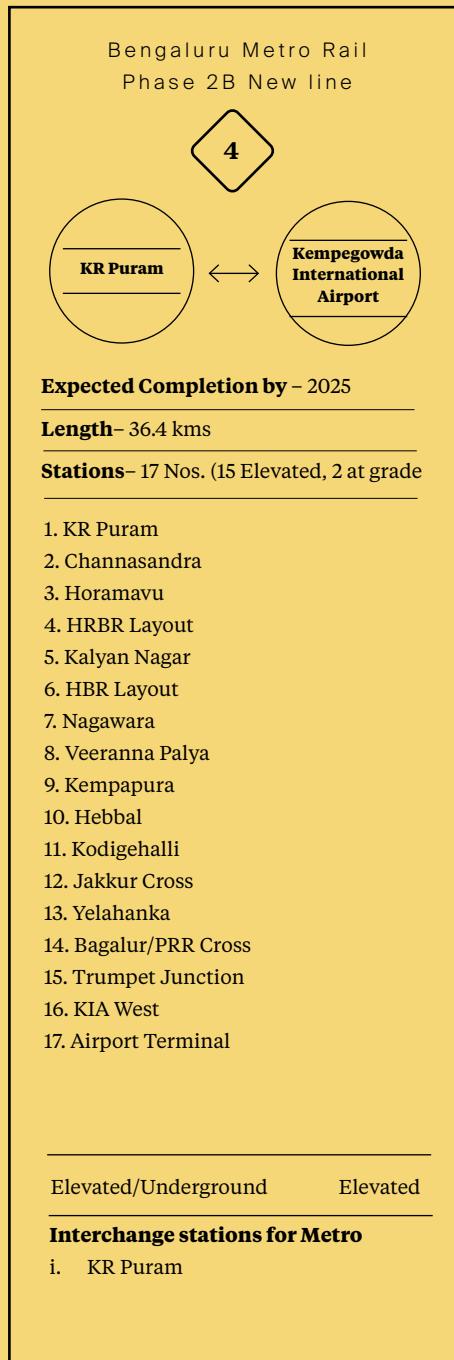
The Bellandur to Marathahalli belt is one of the busiest stretches of the ORR with many IT Parks, SEZs and non SEZ office assets. It takes at least half an hour to get in and out of the tech park complexes during peak hours and commute onwards, which has been a cause of concern for many IT companies situated on this stretch. As a result, business challenges due to reduced business productivity, unforeseen delays and longer journey times leading to frustration and low employee morale have arisen in the past few years. With metro connectivity coming up, the time required to reach KR Puram from Bellandur will reduce by 50 minutes during peak hours (current travel time by road during peak hours is 60 minutes). Metro Line 2A is the first of the projects which will bring public transport connectivity right inside many IT Parks. Walkways are planned from IT Parks to metro stations on the ORR stretch. This is to improve the ridership of metro by saving 5-10 mins of commuters' time. In some cases, basis commercial arrangements, these walkways will be constructed to connect the metro station to private land parcels, which will help both, the metro ridership and footfalls in the private projects. It would also make commute easier for people working here. Metro Line 2A would also connect dense residential catchments on ORR with other parts of the city such as the northern and eastern suburbs. This project will further augment ORR's stature as one of the important office markets

of the city. A leading technology giant has signed an MoU with BMRCL under the innovative financing model to adopt the Bellandur Metro Station which will benefit the uptake of residential inventory in this belt. Similarly, a leading private developer has signed an MoU for maintaining the Kadubeesanahalli Metro Station. In the Bellandur to Marathahalli belt, nearly 13 million sq ft office development potential exists on the private land parcels in existing tech parks.

### b. Mahadevpura to KR Puram belt -

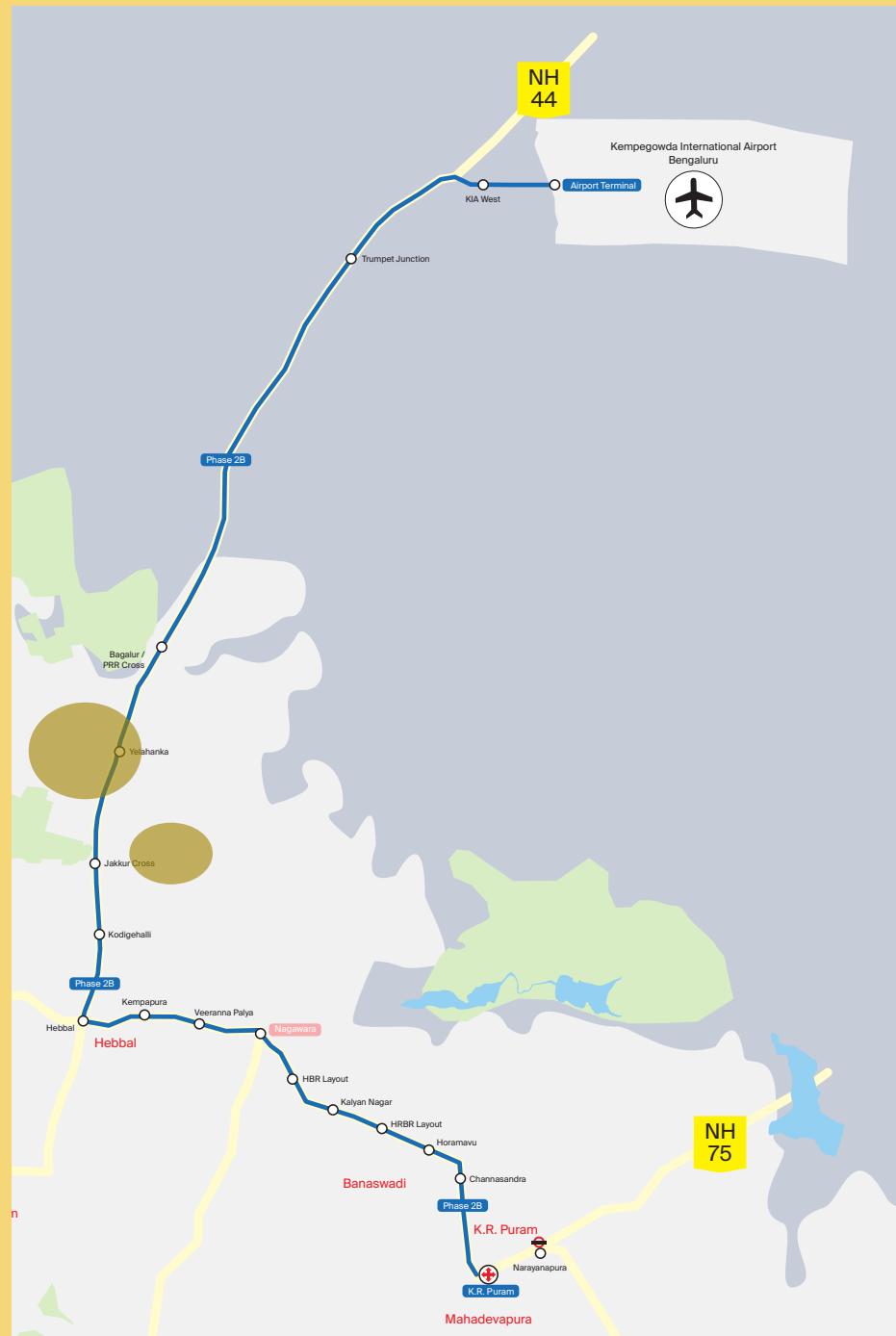
There are large undeveloped land parcels in this belt. However, due to lack of access and isolated stretches in between, this belt hasn't developed as much as the other parts of ORR. The only exception is a large IT Park development with future development potential of 5-6 million sq ft in non SEZ spaces. The Metro Line 2 and 2A will establish connectivity of this region with central and eastern parts of Bengaluru and the Metro Line 2B (KR Puram to ORR) will bring it closer to the northern peripherals. Thus, this belt will benefit immensely from improved connectivity and witness greater real estate traction. Reaching MG Road from Mahadevpura Flyover will also become faster by nearly 25 minutes during peak hours once the metro is operational (current travel time by road during peak hours is 40 minutes).

<sup>30</sup>Detailed Project Report, Silk Board-KR Puram corridor of Bangalore Metro



Source: BMRCL, Knight Frank Research  
All maps are for representational purpose not to scale

The proposed metro corridor Phase 2B measuring about 36.4 kms from KR Puram to Airport Terminal will serve as an alternate transport system. People living in North Bengaluru and along the ORR face a huge challenge due to the long time spent in commuting which brings down their efficiency, also affecting the overall economic efficiency in this corridor. While Phase 2A is being implemented, it is crucial to look into providing connectivity between Kempegowda International Airport Terminal and KR Puram to facilitate hassle free and comfortable movement.



The proposed Phase 2B corridor will be an elevated standard gauge corridor with double line section, except at Yelahanka Air Force Fly Zone and inside the Airport area. At Yelahanka Air Force Fly Zone, the alignment is at-grade, as there is restriction of height from the Air Force authorities. Inside the Airport area, the alignment switches over from elevated to at-grade in KIA Boundary. Alignment starts after Jyothipuram Station of Phase 2 (R1 Extn) as an extended corridor of Phase 2A (Central Silk Board to Jyothipuram). It then turns right and follows Outer Ring Road (ORR) on the left side of the existing flyover joining the ORR median at Kasturinagar. Further alignment will generally follow median of the Outer Ring Road up to Kempapura Station.

After Kempapura Station, the alignment takes a right turn to enter the Hebbal bus depot area where Hebbal Station is located. It reaches NH 44 before Kodigehalli Station and further continues till Trumpet Junction. Before Trumpet Junction Station, the alignment takes a right turn and moves parallel to the railway line for a short length and after crossing the railway line, it takes a right turn to reach the Airport Road median to continue along the road median upto KIAL boundary. The alignment then takes a left turn and continues off the road up to Airport Terminal Station. 17 stations are planned in Phase 2B including the terminal stations.

This long overdue metro line passes through some dense catchments such as Hebbal, Yelahanka, HBR Layout and will be the second longest metro line, once completed. Apart from commercial office spaces in and around Bellary Road and Nagawara, the metro will cater to many residential catchments. Presently, it takes a little less than two hours from Yelahanka to reach Whitefield during peak hours traveling along the Bagalur Road which is a narrow two-lane road. Traveling from Yelahanka to Whitefield via Bellary Road and then turning on to Outer Ring Road, the travel time increases substantially due to traffic signals at almost every junction and high vehicle density.

This metro line will also help people who live in the northern fringes of the city and work in office hubs in central and eastern parts of the city. They can use the metro line interchange at KR Puram and reach their offices in Central or continue the onward journey by interchanging for the Whitefield line to travel east. Currently, one has to travel by private car, bus, cab or rickshaw from home to workplace. This line will also increase footfalls at the malls along the corridor. Students will also benefit as there are several educational institutes along this corridor. Accessibility to the Airport will also become much easier and faster for passengers.

The real benefit of this metro line will accrue once the Phase 2A or ORR Metro (Central Silk Board to KR Puram) is ready. It is Phase 2A which extends to KIA through Phase 2B, passing through the important office markets of ORR. The metro line 2A also provides connectivity to office markets in east via interchange at KR Puram.

## Key impact markets

*This metro corridor is expected to have a daily ridership of 11,14,240 by 2041. Owing to such high ridership and daily movement of population, many markets along this corridor will witness traction. The markets along this corridor which have the potential to witness high real estate traction are likely to be –*

### a. Yelahanka –

While an elevated roadway in the Hebbal to Yelahanka stretch provides connectivity to various employment hubs, the residents in this well-planned township do not have access to an efficient transport system that would provide seamless connectivity within a minimum span of time. With the Phase 2B of metro becoming operational and with a metro station coming up at Yelahanka, the travel time from here to Whitefield will reduce considerably, by 91 minutes (current travel time by road during peak hours is 110 minutes).

### b. The belt between Jakkur to Kogilu Cross –

This belt will see increased traction because many land parcels are held in this belt just before the Yelahanka Air Force Base, which are suited for development of office stock as well as for residential developments. While the stretch between Hebbal and Jakkur Layout and beyond Kogilu witnessed increased real estate development after the airport came up, this stretch of nearly 10 kms has seen less real estate traction which will change once the metro becomes operational. The vacant land parcels near

Jakkur Aerodrome can be utilised for real estate purposes, if the ongoing litigation is settled to allow construction of the elevated metro line which is aligned to come up on the western side of the aerodrome and the Government Flying Training Institute. Proximity to Bellary Road, Hennur Road, Manyata Tech Park and to social infrastructure in the form of educational institutions, health and entertainment centres will increase with the upcoming metro line and add to the liveability quotient of this belt. In the past two years, nearly 2.7 million sq ft of residential space has been launched in this belt and there is scope for more residential options to come up.

## Infrastructure projects likely to be completed between 2025 - 2030

### 1) Bengaluru Metro Rail Phase 3

Apart from Metro Phase 2A and 2B, there was also a plan to extend Bengaluru Metro to ORR West via two metro stations at Hebbal which will establish connectivity between ORR-KIA corridors with this proposed alignment in the western part of the city. Phase 3 is still in planning stage and a public sector engineering consultancy company has been identified to do a pre-feasibility study for the same. More information and a detailed project report is awaited on the same. Phase 3 will have a tentative alignment as below:

Hebbal - JP Nagar (Orange Line) - 30 kms.

Magadi Road Extension - 13 kms.

Both are at a DPR stage as of now with a targeted completion of 2028.

### 2) Peripheral Ring Road (PRR)

The Outer Ring Road (ORR) acts as a bypass for more than 10,000 trucks and has been under tremendous pressure due to significant growth in intra-city traffic. The Peripheral Ring Road is an upcoming project to ease traffic burden on the ORR in Bengaluru. This is a 116 km project planned outside of ORR, of which Phase I comprising 65.5 kms is expected to become operational by 2030. The PRR will be classified as an urban road and will have high demand for free use due to increasing urbanization along its stretches.



All maps are for representational purpose not to scale

The pre-feasibility study of Phase I of PRR is already complete based on BDA suggestions. The PRR will connect half of the western, eastern and southern suburbs of Bengaluru. Phase I of the project stretches from Hosur Road to Tumkur Road and will pass through Sarjapur Road, Hoskote-Anekal Road, Whitefield-Hoskote Road, Old Madras Road, Hennur Road, Bellary Road, Doddaballapur Road and Hesarghatta Road. The construction of this elevated corridor along the identified alignment will include widening of roads, improvement of junctions, pavement improvement and the upgrade of 4-lane carriageways to 8-lane carriageways. This 8-lane road will complete the remaining half of the Nandi Infrastructure Corridor Enterprises (NICE) Road, also known as Bengaluru-Mysuru Infrastructure Corridor.

While land acquisition for the proposed alignment is underway, the BDA has come under the radar of various environmentalists for a previous environment clearance accorded to it in 2014 by the Karnataka State Environment Impact Assessment Authority. This was challenged in the National Green Tribunal (NGT) because of the number of trees that were required to be removed in crucial catchment areas to make way for the alignment. The Supreme Court has upheld NGT's orders for preparing a fresh Environment Impact Assessment (EIA) Report as the proposed alignment passes through agricultural land, reserve forests such as Jarakabande forest and a good number of lakes. BDA will conduct a public consultation on the matter soon. As a result, the proposed completion timeline has now been pushed to 2030.

## Key impact markets

### a. Kogilu –

Kogilu and its surrounding areas have huge vacant land parcels. Yelahanka, which is in proximity to Kogilu has seen massive residential development in past years, but there are no commercial real estate spaces nearby, so occupiers have been maintaining footprint on the Bellary Road closer to Hebbal or Thanisandra. Once the PRR becomes operational, many real estate developers will find it lucrative to build office spaces on this belt as it would be accessible from most regions of North Bengaluru and will also be closer to the airport. A few developers have also launched mid-segment apartment projects and nearly 700 + units are under construction in this location.

### b. Avalahalli –

Avalahalli and the surrounding forest area is currently not well connected to the rest of the city. Except for Yelahanka, there is no habitation nearby. There has been no real estate activity in this location due to the lack of connectivity despite having huge vacant land parcels. This location has huge availability of non-forest use land parcels which are suitable for greenfield developments. The PRR will provide seamless access to this catchment by road and will connect it to other peripheral markets in North and North East parts of Bengaluru. Currently, the real estate market is subdued, and we may not witness traction immediately. However, as the market revives, the attractiveness of this location is likely to improve as there is no dearth of developable land in this catchment. There is scope for both residential and commercial real estate activities to commence in this location once the PRR gets all the final clearances and is ready to roll.

### c. Channasandra –

Channasandra is located in the Kadugodi neighbourhood near the Whitefield-Hoskote Road node of PRR's proposed alignment. Towards the railway line near Kadugodi Milk Federation Society, the PRR intersects and moves towards Channasandra and reaches Soranhunase and Varthur

Lake. Despite being closer to Whitefield, this location never witnessed the kind of real estate traction it should have as all Grade A developers remained concentrated within Whitefield and other outskirts. So far, only local developers have been active in this location and most areas here are agricultural, with some mixed residential pockets in between. In the nearby Nagondanahalli belt, which also comes under the catchment of where the PRR intersects, plotted developments have recently taken off. With land parcels available, residential and commercial developments near the Channasandra main road will benefit the most.

### d. Varthur to Sulikunte belt –

In Varthur, the PRR will pass along mixed residential areas near the Vartur Lake before going further down through agricultural areas. It will intersect SH 35 near Kachamaranahalli and cut across Sarjapur Road in Sulikunte. This entire belt from Varthur to Sulikunte has contiguous land parcel availability for future real estate developments. Varthur has already flourished as a key real estate location in Bengaluru's peripherals, and in the past 1.5 years witnessed numerous mid-segment residential projects take off the ground. In the belt up to Sulikunte, affordable and mid-income housing can take off in the long term, once the PRR enhances road connectivity.

### e. Carmelaram –

Carmelaram is situated near the Sarjapur Main Road and has ample land parcel availability. This location is closer to the ORR and has future potential for greenfield developments. Only a handful of Grade A developers are active in this location and there is scope for mid-segment housing and plotted developments. PRR will catalyze residential construction as connectivity to other peripherals will be established which will enhance its liveability quotient.

### 3) Satellite Town Ring Road (STRR)

The STRR is a 204 km road infrastructure project to improve and augment road connectivity within and in the neighbouring areas of Bengaluru. This project got a fresh lease of life after the original STRR of Government of Karnataka was modified by the National Highways Authority of India (NHAI) under the 'Bharat Mala Pariyojana' when it was declared as National Highway (NH) 948A. As many national highways and state highways pass through Bengaluru, there is heavy commercial traffic movement which should not be passing through the city. But due to a lack of road infrastructure, this traffic has been aggravating the traffic situation on city roads resulting in huge traffic jams. STRR will largely benefit the manufacturing and logistics sectors, making it easy for distribution and transport of goods to the interiors of Karnataka. The proposed six-lane STRR corridor will pass through three districts of Karnataka (Bengaluru Rural, Bengaluru Urban and Ramanagara) and one district of Tamil Nadu (Krishnagiri) and ensure highspeed connectivity to the proposed Bangalore-Chennai Expressway.



All maps are for representational purpose not to scale

The earlier proposed alignment of STRR passed through some built up stretches including tanks, religious structures, burial grounds etc and modifications were proposed to ensure minimal social impact. The STRR will encircle Bengaluru connecting the towns of Dabbaspet, Doddaballapura, Devanahalli, Sulibele, Hoskote, Sarjapur, Attibele, Anekal, Tattekere, Kanakpura, Ramanagara and Magadi. As Bengaluru is an outwardly and radially growing city, this circular development will significantly improve intra-city connectivity too. NHAI is currently

developing bypasses to Kanakpura and Ramanagara towns under different programs to ease congestion on NH 209 and NH 275 respectively. These proposed bypasses are also being integrated with STRR at these locations to ease traffic congestion.

## Key impact markets

### a. Sarjapur to Attibele belt –

The locations along the Sarjapur Main Road mostly have very little scope for real estate traction except via redevelopment of individual buildings. However, as we go further down towards Sarjapur and Attibele, there are a lot of land parcels available. Due to its proximity to the state border, conversion for residential and commercial purposes is not allowed as of now. However, with the STRR coming up, these land parcels will become available for conversion and fuel greenfield developments. Many private developers have land holdings in this belt. This belt is suitable for the logistics sector to expand footprint, as currently it takes nearly 3.7 hours for heavy vehicles to travel from Sarjapur to Dabaspete. With the STRR, travel time will be reduced by 45 minutes as there will be no need to access some of Bengaluru's interiors to reach this location.

### b. Hoskote –

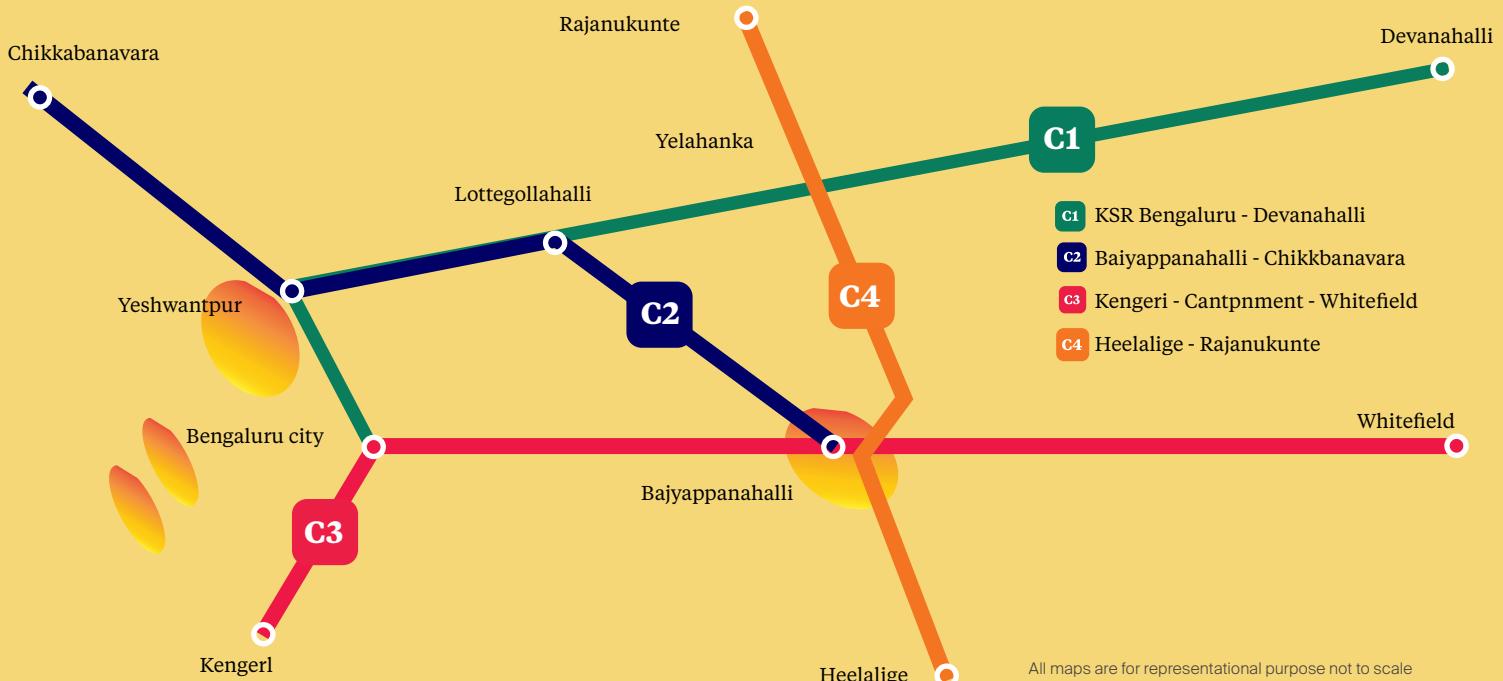
Hoskote, which evolved as a significant industrial area due to the presence of major auto manufacturers & ancillary industries, will benefit from the STRR alignment as it will help in faster movement of fully loaded trucks to Devanahalli and other peripheral belts. Hoskote is classified under an 'industrially developed taluk' and houses several logistics and warehousing units. Currently, fully loaded trucks take approximately 90 minutes to move from Hoskote to Devanahalli, and this time is expected to reduce by 30 minutes once the STRR comes up. The industrial clusters in Hoskote are set to evolve into an organized warehousing market to serve multiple other sectors.

### c. Dabaspete to Peenya belt -

The starting point of this proposed greenfield highway has been pushed to connect NH 207 with a bypass provision in Dabaspete town on the Pune side which will ensure uninterrupted traffic flow contrary to the earlier alignment which passed through the middle of a built-up area. There is also a Multi Modal Logistics Park (MMLP) coming up near Dabaspete which will be connected to the STRR. Dabaspete is also a prominent location with considerable warehousing activity having spread to this part of Nelamangala taluk. It has emerged as a regional hub for distribution to South India and is a favourite for warehousing requirements from food, e-commerce and FMCG sectors. A stretch of nearly 38 kms between Dabaspete and Peenya is set to benefit from this project as it would provide seamless connectivity to establish a distribution network to other satellite towns in Karnataka and Tamil Nadu. The land prices on this belt are low compared to other established locations and suitable for affordable housing construction once connectivity improves.

#### 4) Suburban Rail Network

The Union cabinet cleared the long pending 148-km long suburban rail network project in October 2020. More information is awaited regarding stations, final alignment and timelines. It will, however crisscross the entire city and comprise four corridors – KSR Bengaluru City to Devanahalli, Baiyappanahalli to Chikkabanavara, Kengeri-Cantonment-Whitefield and Heelalige to Rajanukunte. This infrastructure project is aimed at augmenting the capacity of the existing suburban rail network, which is currently in a skeletal form. Installation of more trains with a better frequency, new platforms at existing stations, more depots for maintenance work, elimination of level crossings, walkability upgrade and halt stations are some of the key activities being looked at as part of the execution of this project.



This project will be implemented at a total cost of USD 3.11 Billion (INR 23,093 crore)<sup>34</sup> by setting up a Special Purpose Vehicle (SPV) called Bengaluru Rail Infrastructure Development Entity (B-RIDE) under a state and central government partnership. The Government of Karnataka has accorded approval for a phase wise implementation of this project at a cost of USD 46.46 million (INR 345 crore) at present<sup>35</sup>.

South Western Railways has submitted the Detailed Project Report (DPR) for Bengaluru Suburban Rail as of now. The revised DPR has proposed some modifications in the previous plan for this project. It is proposed to develop necessary infrastructure with an aim to provide seamless integration between Metro, Rail and Transit and Traffic Management Centre (TTMC) at its strategically located transit infrastructure sites

viz. Yeshwantpur, Banashankari, Vijaynagar, Peenya etc. to facilitate inter-modal integration design in Bengaluru. If planned and executed properly, the suburban rail network could dramatically change the way Bengalureans travel. A key catalyst to determine the success of this project will be the planning for integration with the BMTC network and the Namma Metro stations.

Though no formal completion timeline for the phase wise implementation has been made public yet, it is expected that with land acquisition and construction, it will take at least six years, so Bengalureans cannot expect it to be operational before 2026. The corridors once developed are expected to cater to about 1.9 million passengers by 2041<sup>36</sup>.

#### Key impact markets

*The suburban rail network will be the first major low-cost project for citizens providing seamless connectivity to several unconnected or isolated towns around Bengaluru. According to a pre-feasibility study conducted by Rail India Technical and Economic Service (RITES), the ridership for this dedicated rail service will be double the pre-Covid-19 metro daily ridership (4.5 lakh)<sup>37</sup>. It is expected to help decongest the overburdened peripherals and are likely to increase real estate traction and development in the following locations, some of which are already well-developed:*

- a. Yeshwantpur
- b. Kengeri

- c. Baiyappanahalli
- d. Jnana Bharathi

- e. Nayandahalli

34. Karnataka State Budget 2019-20

35. Economic Survey of Karnataka 2019-20

36. Draft Comprehensive Mobility Plan for Bengaluru, March 2020

37. <https://www.thenewsminute.com/article/all-you-need-know-about-bengaluru-suburban-rail-project-134905>

## Summary of Key Impact Markets

S.No.	Key Impact Markets	Location	Upcoming Project	Project Details
1	Kogilu	North	Peripheral Ring Road	Tumkur Road – Hosur Road
2	Avalahalli	North	Peripheral Ring Road	Tumkur Road – Hosur Road
3	Channsandra	East	Peripheral Ring Road	Tumkur Road – Hosur Road
4	Varthur to Sulikunte belt	South-east	Peripheral Ring Road	Tumkur Road – Hosur Road
5	Carmelaram	South-east	Peripheral Ring Road	Tumkur Road – Hosur Road
6	Dabaspete to Peenya belt	North-west	Satellite Town Ring Road	Dabaspete to Magadi
7	Sarjapur to Attibele belt	South-east	Satellite Town Ring Road	Dabaspete to Magadi
8	Hoskote	East	Satellite Town Ring Road	Dabaspete to Magadi
9	Yelahanka	North	Metro Phase 2B	KR Puram - KIA
10	Jakkur to Kogilu Cross belt	North	Metro Phase 2B	KR Puram - KIA
11	Begur	South	Metro Phase 2	RV Road to Bommasandra
12	Electronic City Phase I	South	Metro Phase 2	RV Road to Bommasandra
13	Electronic City Phase II	South	Metro Phase 2	RV Road to Bommasandra
14	Bellandur to Marathahalli belt	South	Metro Phase 2A	Central Silk Board – K R Puram
15	Mahadevpura to KR Puram belt	South	Metro Phase 2A	Central Silk Board – K R Puram
16	Hosur Road and Bannerghatta Main Road	South-west	Metro Phase 2	Gottigere – Nagawara
17	JP Nagar Phase 9th and 10th	South-west	Metro Phase 2	Gottigere – Nagawara
18	Mallasandra to Anjanpura Township belt	South	Metro Phase 2	Yelachenahalli - Anjanapura
19	Whitefield	East	Metro Phase 2	Baiyappanahalli – Whitefield
20	Yeshwantpur	North-west	Suburban Rail Network	Suburban Rail Network corridors
21	Kengeri	South-west	Suburban Rail Network	Suburban Rail Network corridors
22	Baiyappanahalli	East	Suburban Rail Network	Suburban Rail Network corridors
23	Jnana Bharathi	West	Suburban Rail Network	Suburban Rail Network corridors
24	Nayandahalli	West	Suburban Rail Network	Suburban Rail Network corridors

Source: Knight Frank Research

## Glossary

**Air Quality Index (AQI)** — AQI is an index for reporting air quality on a daily basis. It is a measure of how air pollution affects one's health within a short time period.

**Average congestion level** — This refers to the amount of extra time taken up to travel during traffic hours compared to the time taken in uncongested conditions.

**Cost of congestion** — This includes time delays, extra fuel spent, costs due to traffic accidents, vehicle loss, wear and tear as well as environmental issues.

**dB(A) Leq** — This denotes the time weighted average of the level of sound decibels on scale 'A' which is relatable to human hearing.

**Expressway** — An access controlled highway usually having six to eight lanes, especially one that is planned for high-speed traffic. It usually has few, if any, intersections and limited points of access or exit, with a divider between lanes for traffic moving in opposite direction.

**Gross Domestic Product (GDP)** — GDP is a monetary measure of the market value of all the final goods and services produced in a country in a specific time period.

**Gross State Domestic Product (GSDP)** — Gross State Domestic Product (GSDP) is defined as a measure, in monetary terms, of the volume of all goods and services produced within the boundaries of the State during a given period of time, accounted without duplication.

**Leq** — This is energy mean of the noise level over a specific period.

**Literacy rate** — The percentage of population of an area at a particular time, who can read and write with understanding. Here, the denominator is the population aged seven years or more.

**National Highway (NH)** — National Highways are A grade roads with two, four or more lanes connecting major cities and state capitals.

**NITI Aayog** - This is a policy think tank of the Government of India, established with the aim to achieve sustainable development goals with cooperative federalism by fostering the involvement of State Governments of India in the economic policy-making process using a bottom-up approach.

**Passenger Car Units (PCU)** — Passenger Car Unit is a metric used in Transportation Engineering to assess traffic-flow rate or capacity on a highway.

**PM2.5** — Particulate Matter 2.5 (PM2.5), refers to tiny particles or droplets in the air that are two and one half microns or less in width.

**Population density** — Population density is a measurement of population per unit area.

**Public Private Partnership (PPP)** — A public private partnership is a cooperative arrangement between two or more public and private sectors, typically of a long-term nature. It involves an arrangement between a government unit and a business unit that results in better services or improves the city's capacity to operate effectively.

**State Highway (SH)** — State Highways are roads that link important cities, towns and district headquarters within the state and connect them with National Highways or State Highways of neighbouring states.

**Traffic Congestion** — Traffic congestion is defined as a condition in transport that is characterised by slower speeds, longer trip times and increased vehicular queuing.

**Urban Agglomeration (UA)** — An urban agglomeration is a continuous urban spread constituting a town and its adjoining outgrowths (OGs), or two or more physically contiguous towns together with or without outgrowths of such towns. It is a human settlement with high population density and infrastructure of built environment.

## Abbreviations

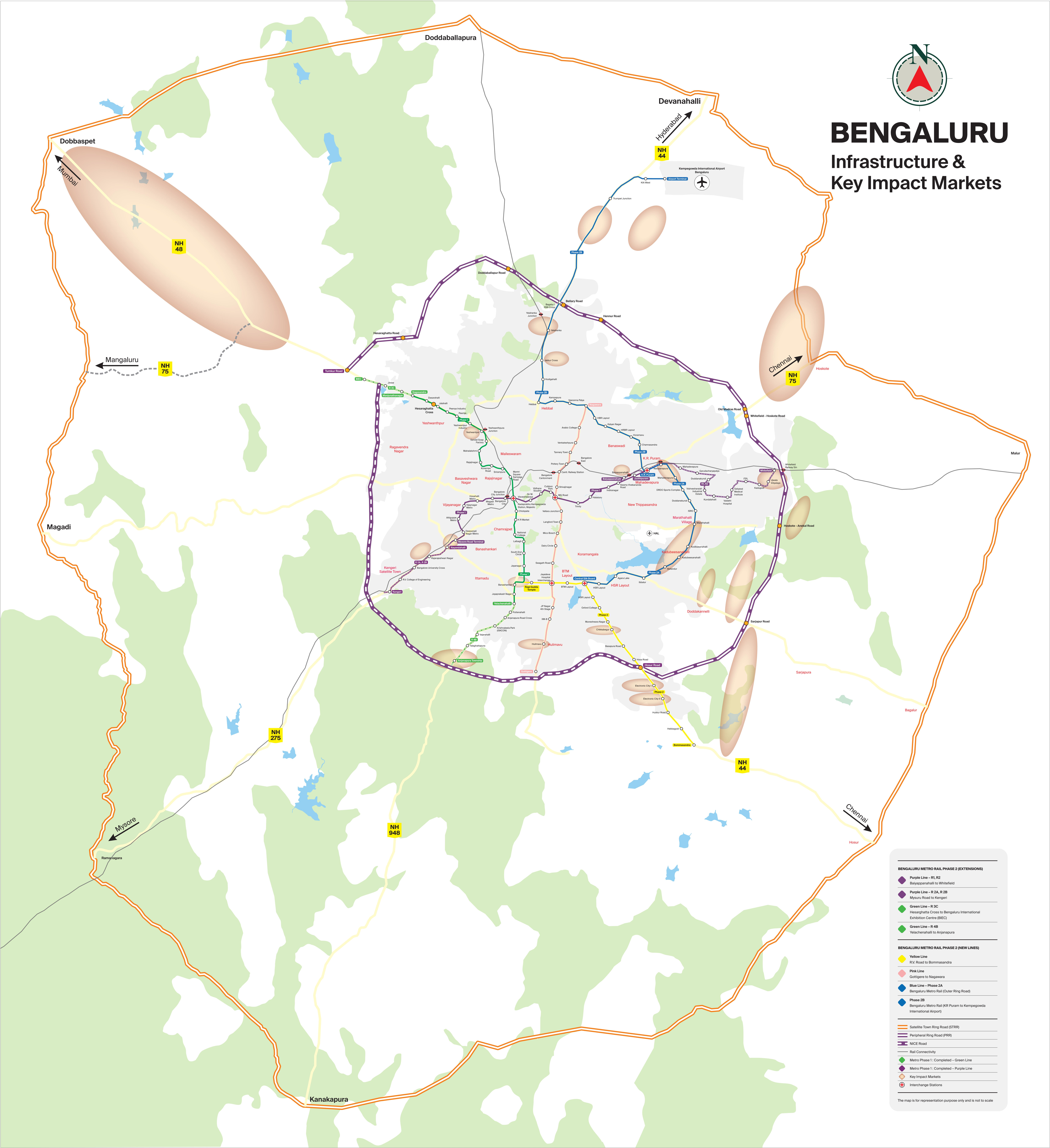
<b>AIIB</b> - Asian Infrastructure Investment Bank	<b>FAR</b> - Floor Area Ratio	<b>NHAI</b> - National Highways Authority of India
<b>ATMS</b> - Advanced Traffic Management System	<b>FSI</b> - Floor Space Index	<b>NICE</b> - Nandi Infrastructure Corridor Enterprises
<b>AVCS</b> - Advanced Vehicle Control Systems	<b>GDP</b> - Gross Domestic Product	<b>NMT</b> - Non-Motorized Transport
<b>BBMP</b> - Bruhat Bengaluru Mahanagar Palike	<b>GoK</b> - Government of Karnataka	<b>NTDPC</b> - National Transport Development Policy Committee
<b>BDA</b> - Bangalore Development Authority	<b>GPS</b> - Global Positioning System	<b>NUTP</b> - National Urban Transportation Policy
<b>BIAAPA</b> - Bangalore International Airport Area Planning Authority	<b>GR</b> - Growth Rate	<b>ORR</b> - Outer Ring Road
<b>BIAL</b> - Bangalore International Airport Limited	<b>GSDP</b> - Gross State Domestic Product	<b>PCU</b> - Passenger Car Units
<b>BMICAPA</b> - Bangalore Mysore Infrastructure Corridor Area Planning Authority	<b>HCV</b> - Heavy Commercial Vehicle	<b>PPP</b> - Public Private Partnership
<b>BMLTA</b> - Bangalore Metropolitan Land Transport Authority	<b>IRR</b> - Intermediate Ring Road	<b>PRR</b> - Peripheral Ring Road
<b>BMR</b> - Bangalore Metropolitan Region	<b>IT/ITeS</b> - Information Technology/ Information Technology enabled Services	<b>PSU</b> - Public Sector Undertaking
<b>BMRCL</b> - Bangalore Metro Rail Corporation Limited	<b>KIA</b> - Kempegowda International Airport	<b>PWD</b> - Public Works Department
<b>BMRDA</b> - Bangalore Metropolitan Region Development Authority	<b>KRDCL</b> - Karnataka Road Development Corporation Limited	<b>RMP</b> - Revised Master Plan
<b>BMTCA</b> - Bengaluru Metropolitan Transport Corporation	<b>KSRTC</b> - Karnataka State Road Transport Corporation	<b>SEZ</b> - Special Economic Zone
<b>BRTS</b> - Bus Rapid Transit System	<b>KTCPA</b> - Karnataka Town and Country Planning Act	<b>SO2</b> - Sulphur Dioxide
<b>BTS</b> - Build-to-suit	<b>KUIDFC</b> - Karnataka Urban Infrastructure Development and Finance Corporation	<b>STPI</b> - Software Technology Parks of India
<b>BUA</b> - Bengaluru Urban Agglomeration	<b>LCV</b> - Light Commercial Vehicle	<b>STR</b> - Satellite Town Ring Road
<b>CAGR</b> - Compounded Annual Growth Rate	<b>LPA</b> - Local Planning Area	<b>SUT</b> - Sustainable Urban Transport
<b>CBD</b> - Central Business District	<b>LTA</b> - Land Transport Authority	<b>TDM</b> - Transportation Demand Management
<b>CMP</b> - Comprehensive Mobility Plan	<b>MLD</b> - Million Litres per Day	<b>TDR</b> - Transferable Development Rights
<b>DPR</b> - Detailed Project Report	<b>MoHUA</b> - Ministry of Housing and Urban Affairs	<b>TMC</b> - Thousand Million Cubic Feet
<b>DULT</b> - Directorate of Urban Land Transport	<b>MoU</b> - Memorandum of Understanding	<b>TOD</b> - Transit Oriented Development
<b>EIA</b> - Environmental Impact Assessment	<b>MoUD</b> - Ministry of Urban Development	<b>TTMC</b> - Traffic and Transit Management Centre
<b>EIB</b> - European Investment Bank	<b>MRTS</b> - Mass Rapid Transit System	<b>UT</b> - Urban Transport
<b>ELU</b> - Existing Land Use	<b>NGT</b> - National Green Tribunal	<b>VKT</b> - Vehicle Kilometres Travelled



# BENGALURU

## Infrastructure & Key Impact Markets

# Infrastructure & Key Impact Markets



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