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# Jobs near metro rail transit in Bengaluru: Enabling an accessible and productive city

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## HIGHLIGHTS

- Bengaluru's public transportation system is struggling to keep up with the city's growing employment opportunities and urban expansion, and severe traffic congestion is hurting workforce productivity and city competitiveness. However, the city can use a transit-oriented development (TOD) strategy to address this.
- This study maps 2023 data on Bengaluru's registered factories, shops, and commercial establishments (location and associated jobs) to assess current job proximity to, and density along, the city's operational and under-construction metro network.
- We find that of the total mapped jobs in the Bengaluru Metropolitan Area, 28 percent are within 500 m of the nearest metro station, 59 percent within 1,000 m, and 85 percent within 2,000 m, considering Phases 1, 2, and 2A-2B of the metro network, which cover 172 km.
- Our study reveals that the lack of suitable properties, an enabling regulatory framework and incentives for redevelopment, and inadequate public infrastructure levels are the main barriers discouraging large businesses from locating near metro stations.
- The government can play a proactive role by setting aspirational benchmarks and prioritizing job densities in Bengaluru's TOD Policy and planning, providing location-efficient incentives, upgrading public infrastructure, leading catalytic TOD projects, and driving coordinated action.

# EXECUTIVE SUMMARY

## Context

**In Bengaluru, urban sprawl and traffic congestion are hampering resource and economic efficiencies and city competitiveness.** Bengaluru, the capital of the southern Indian state of Karnataka, has seen tremendous economic growth over the past few decades, driven by the service sector (PPMSD 2022). Due to government policies and land-market conditions, large economic and employment subcenters have arisen on the city's outskirts, which have poor public transport and other essential infrastructure. The resulting longer work–home commutes, greater private vehicular use, and associated adverse impacts have affected workforce productivity and the city's quality of life (KF 2020). Sprawling automobile-oriented development is also associated with suboptimal land and infrastructure utilization and higher costs of service provision and extension.

**Policies and plans should aim to increase job densities around mass transit, which can improve access to jobs and labor markets and offer high dividends for sustainability and productivity.** To improve mobility and access across the city, the Government of Karnataka (GoK) is expanding metro and suburban rail networks and augmenting the city bus system. In 2022, it also approved Bengaluru's Transit Oriented Development Policy (TODP), aiming to promote compact, higher-density development around transit and a shift to efficient, low-carbon modes such as walking, cycling, and public transport. Research shows that job proximity and density increase transit ridership more effectively than does residential density (Kolko 2011; Raisz and Fitchen 2022). The impending city master plan revision can be used to prioritize job densities in Bengaluru's TOD planning and leverage transit investments to drive economic and sustainable urban development, enhancing the city's competitive edge.

## About this working paper

**This study analyzes current job proximity and densities around the metro rail network and proposes ways to strengthen them through TOD strategies, by understanding the pull factors and challenges large businesses face in locating near metro stations.** It relies on data obtained from the Labour Department, GoK, in January 2023 for registered factories, shops, and commercial establishments. Factories are manufacturing enterprises, whereas shops and commercial establishments belong to the service sector. The dataset excludes other formal jobs such as government or institutional jobs, informal-sector jobs (e.g., home-based or domestic workers), motor transport workers, and gig-economy workers. Geospatial mapping is used to assess the proportion of jobs associated with registered enterprises around metro stations, along operational and under-construction lines (Phases 1, 2, and 2A-2B). The analysis considers 500, 1,000, and 2,000 m access sheds around metro stations per the approved TODP, segmented by metro phase and enterprise sector and size. Moreover, we present only a snapshot because the dataset does not allow for temporal analysis of past years. We focus on the Bengaluru Metropolitan Area (BMA), including the Phase 2B stretch beyond this boundary.

We interviewed stakeholders, online and on-ground, in metro-station and comparable non-metro-station areas to understand the benefits, trade-offs, and market or regulatory challenges businesses face when locating near metro stations. We use insights from global case examples and good practices to inform the way forward for attracting businesses and increasing job densities along Bengaluru's metro network.

## Key findings

**Mapping registered enterprises and associated jobs, we find that the service sector in general and large service and manufacturing enterprises (>100 employees) contribute most of the total mapped jobs (about 4.6 million) within the BMA.** Service enterprises constitute 97 percent of the total mapped enterprises and contribute 88 percent of all jobs in the BMA, with manufacturing enterprises contributing the rest. Notably, large enterprises constitute only 2 percent of all enterprises but contribute 60 percent of all jobs. Most jobs associated with large enterprises (64 percent) and manufacturing enterprises (70 percent) are in the city's suburban and peripheral areas. Thanks largely to the service sector, average job densities are highest in inner-city areas (within the Outer Ring Road) and decrease further away.

**After the ongoing metro phases are completed (totaling 172 km), 28 percent of the total mapped jobs in the BMA will be within 500 m of the nearest metro station, 59 percent within 1,000 m, and 85 percent within 2,000 m.** These proportions are slightly higher for large-enterprise jobs alone, the same for service jobs alone, and slightly lower for manufacturing jobs alone. Some large job clusters in the city remain disconnected from the existing and under-construction metro network, and most jobs lie beyond a comfortable walking distance (500 m) from metro stations, emphasizing the need for feeder services, particularly in the 1–3 km range.

**As transit networks expand and connect more employment clusters, more jobs will become accessible; however, the city should also foster jobs growth around developed mass-transit networks to optimize resource and economic efficiencies.** An additional 193 km of rail transit network (including metro Phase 3 and suburban rail) should be completed by 2030. Additionally, Bengaluru can—strategically and proactively—direct commercial and industrial investments to stimulate TOD and increase job densities along its transit networks in response to market demand.

**Stakeholder interviews reveal that major pull factors for businesses include availability of suitable land parcels (zoning, size, cost), supporting infrastructure and amenities, monetary incentives, and agglomeration and accessibility benefits.** Large industrial estates along arterial roads on the city's outskirts that offer affordable suitably sized plots have attracted manufacturing enterprises. Good connectivity and public infrastructure make central and inner-city areas sought-after locations for commercial and office spaces. Market linkages and agglomeration economics drive certain sizes and types of enterprises to locate near each other, with large establishments anchoring smaller ones around them.

**Although the metro was not a major factor influencing the location choice of manufacturing enterprises, service enterprises, especially those benefiting from enhanced accessibility and catchments, preferred to locate near it.** Anecdotal evidence and on-ground observation suggest that the metro has boosted real estate development nearby and, in particular, the growth of service enterprises, with increased high-end, high-density residential, commercial, or mixed-use developments in industrial and residential station areas.

**Stakeholder interactions reveal that Bengaluru faces three major hurdles to jobs growth along its metro corridors, particularly within the city core.** First, large businesses and employers are unable to locate near metro stations in developed areas because the existing properties are unsuitable. Second, developers struggle to find appropriately sized and valued land parcels for redevelopment. Third, unfavorable development regulations and inadequate infrastructure levels curtail higher-density developments. Although the city's master plan allows a higher floor area ratio (FAR) for properties within 150 m of completed metro stations, the impact zones are not yet notified. Moreover, other building regulations such as plot size, access road widths, setback and ground coverage norms, hinder utilization of the higher FAR incentive.

## Recommendations

**The government can proactively prioritize job densities in Bengaluru's TOD planning-regulatory frameworks and enable redevelopment around transit stations.** The city's Revised Master Plan 2041 (under preparation) should set goals for jobs near transit and try to match global benchmarks. For instance, in Hong Kong, 57 percent of jobs were within 500 m of a transit station, 84 percent within 1,000 m, and 96 percent within 2,000 m (LSE Cities 2013). The plan should identify and prioritize areas served by transit where job densities can be increased through renewal and densification. Public policies can stipulate location-efficient incentives (regulatory, monetary) to encourage companies to locate near transit.

**The government must ensure timely infrastructure delivery and upgrades, secure finance, and institutionalize coordinated action to densify and revitalize station areas.** Apart from conventional funding sources, the government can explore public-private partnerships and value capture financing mechanisms for infrastructure provision or improvements in TOD Zones. It can designate a nodal agency to facilitate interactions between multiple stakeholders and coordinate planning and implementation for jobs growth along transit corridors.

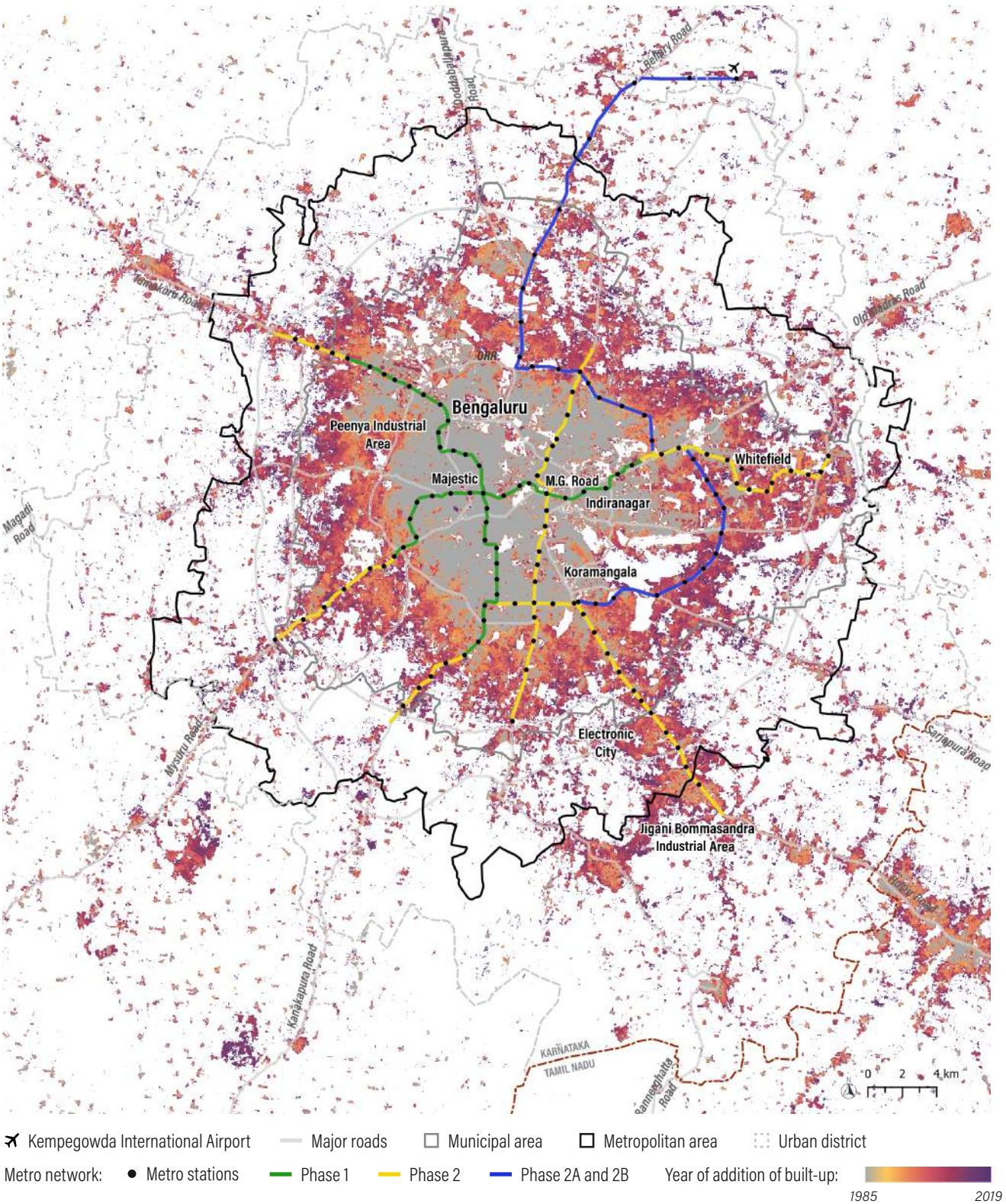
# INTRODUCTION

## Bringing jobs near Bengaluru's mass transit: The need and opportunity

### Growth of Bengaluru's service sector and economic subcenters

Bengaluru, Karnataka's capital, is India's fourth-largest city on the basis of 2023 population estimates (World Population Review 2024), and its metropolitan economy (Haritas 2017), is poised to become the fastest growing in the world (DownToEarth 2018). Bengaluru has a large manufacturing base, including several public-sector undertakings (PSUs). Attracting global businesses and workers since the 1990s, it is now the leading hub of knowledge and service industries, such as information technology and biotechnology. It also has the "strongest start-up ecosystem" in India (ET 2022). The service sector dominates the Bengaluru Urban District's (BUD's) economy, whereas the manufacturing sector's share has steadily declined after economic liberalization, falling from 34 percent in 1991 to 21 percent in 2011 (BDA 2017). Between 2011 and

Figure 1 | **Built-up growth in Bengaluru, 1985–2019**




*Source:* WRI India, using built-up data from World Settlement Footprint (WSF) 1985–2019; digitized "Namma Metro" network from Bangalore Metro Rail Corporation Limited (BMRCL) as on May 2023; administrative boundaries from Bruhat Bengaluru Mahanagara Palike (BBMP), Bangalore Development Authority (BDA), and Karnataka State Remote Sensing Applications Center (KSRSAC) for Bengaluru Urban District (BUD) boundary; and major roads from Open Street Map (OSM) as on May 2023.

2019, services' average share in the district domestic product was 83 percent; industry's, 16 percent; and agriculture's, 1 percent at 2011–12 prices (PPMSD 2022).

This state-supported[1] economic development is typically accommodated in large self-contained PSU townships and industrial estates, followed by business/tech parks, and Special Economic Zones (SEZs) on the city's outskirts, where land is cheaper, plentiful, and less regulated (Heitzman 2004; Nair 2005). These conditions and environmental, industrial, and urban development policies have induced polluting, hazardous, large-scale, and heavy manufacturing industries to gradually move out of central and inner-city areas. Spatially decentralized economic activity and dispersed employment centers have fueled rapid real-estate and population growth on the city's outskirts, which lack adequate public infrastructure (Chanchani et al. 2023) (Figure 1). In contrast, the better-serviced city core (central and inner-city areas) within the Outer Ring Road (ORR) experiences negative population growth and decongestion (see Appendix A).

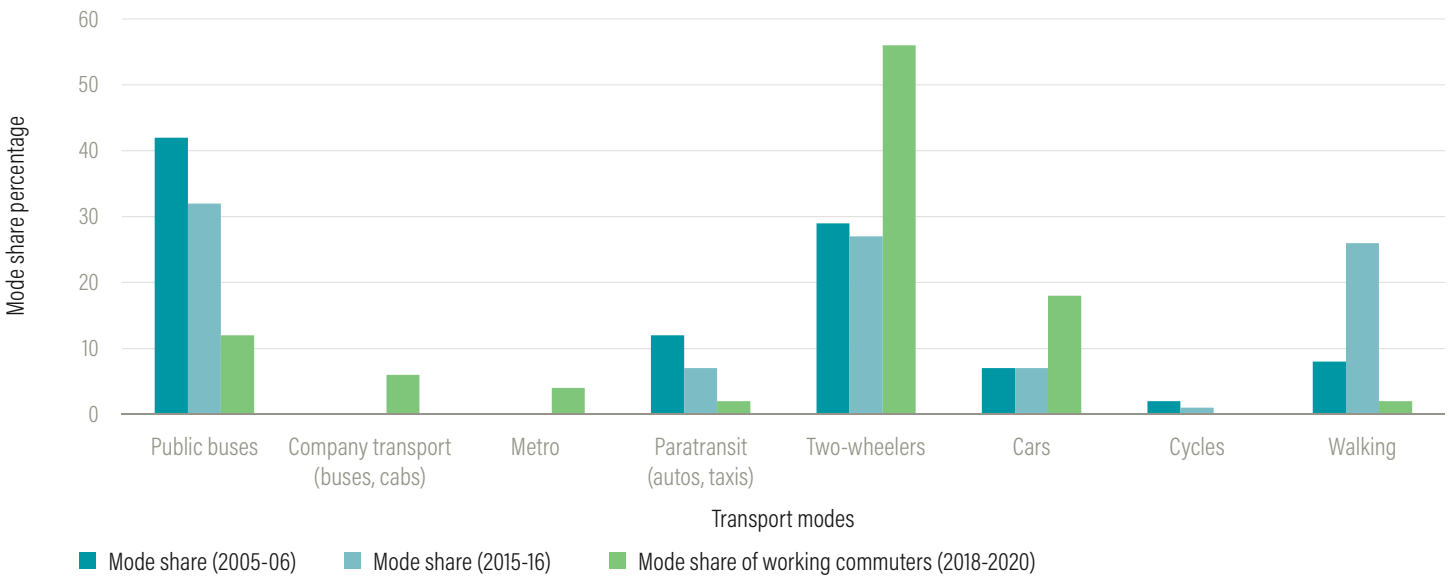
## Adverse impacts of inadequate public transport services and employment and urban sprawl

To keep up with the city's outward-directed growth and connect the core and periphery (housing and job locations), the government extended its road and bus networks and deployed high-frequency bus services (BIG Bus) on trunk routes. However, these efforts lagged behind the city's growing mobility needs, leading the government to plan the metro rail, which was also encouraged by national policy and funding programs. The metro network, however, has been slow to expand.[2]

Sprawling development and inadequate public transport services—particularly in outer, new growth areas[3] —has lengthened work–home commutes and increased dependence on private vehicles. Although some larger establishments offer their employees transport facilities (through company or chartered buses and cab services), higher-income employees tend to use two-wheelers and cars[4] (Figure 2). A 2015 travel survey revealed that 50 percent of daily city trips are for work or business, with medium-to-high-income individuals traveling longer distances to work by two-wheelers (32 percent of work trips) and cars (49 percent of work trips) (ADB 2022).[5]

Consequently, despite an extensive network, bus mode shares have been falling (from 60 percent in 1990 to 32 percent in 2016). The average daily bus ridership fell from about 5 million in 2015 to under 2.8 million in 2023, before approaching 4 million due to the state government's free public bus travel scheme for women. Currently, 72 km of the operational metro network serves about 0.7 million daily trips (Philip 2024), which is considerably lower than estimated. This is partly due to last-mile connectivity issues and fare unaffordability for lower-income groups (Mukherjee et al. 2023).

Figure 2 | **Mode shares in Bengaluru: Overall (2006, 2016) and working commuters (2020)**




*Source:* RITES and KUIDFC 2011; Kumar et al. 2022.

This trend has several known negative externalities[6] that affect workforce productivity, health, and quality of life (Vijayalakshmi and Raj 2020; Chanchani et al. 2023). According to the TomTom Traffic Index 2019, Bengaluru had the world's worst level of traffic congestion, whose social cost is estimated at INR 380 billion annually (US$5.92 billion, about 5 percent of the city's gross domestic product) (TNIE 2018). The Covid-affected years were a disruption, but mobility and development trends in the city have reverted to business as usual.[7]

## Toward a transit-oriented city: Integrating economic development, land use, and transport planning

To address Bengaluru's mobility-related challenges and shift to more efficient and sustainable low-carbon modes, the Government of Karnataka (GoK) is augmenting the city's public transport systems,[8] including expanding metro rail, introducing suburban rail, and upgrading the bus system. Metro Phases 1, 2, and 2A-2B (170 km; operational and under construction), Phase 3 (45 km), and the suburban rail network (148 km; approved) require an estimated INR 870 billion (TMRG 2024). Studies worldwide show that public transportation investments can create thousands of jobs and 5–7 times economic returns, with social and environmental benefits from improved accessibility and a shift to public and active transport modes (APTA n.d.; Chatman and Noland 2014; RTBU 2014; C40 Cities and ITF 2021).

To maximize the benefits from these large investments in public transport infrastructure and drive a more sustainable urban form, the Directorate of Urban Land Transport (DULT) prepared Bengaluru's Transit Oriented Development Policy (TODP), in line with national policy directives.[9] This policy, applicable to the Bengaluru Metropolitan Area (BMA),[10] was approved by the GoK in November 2022. To promote compact, connected development through tighter land use and transport integration, the policy encourages a mix of transit-supportive land uses and higher densities within the TOD Zone,[11] besides measures to improve transit access and parking management. The aim is to achieve reasonable population-to-job ratios and provide basic amenities within the station's neighborhood, use land and infrastructure efficiently, reduce trip lengths, and increase the patronage of sustainable transport modes. The TODP is aligned with Bengaluru's Comprehensive Mobility Plan (CMP) 2020, which aims to increase the motorized mode share of public transport from 48 percent in 2015 to 70 percent by 2031.

## Why prioritize job densities near transit stations?

Workplace proximity to transit and employment density increase ridership more effectively than does residential density, apart from creating agglomerating effects that foster innovation and boost productivity (Raisz and Fitchen 2022). TOD as an urban development approach has been effectively used worldwide to increase job densities around transit stations and improve access to jobs and labor markets, transit ridership, workforce and economic productivity, and city competitiveness. Better accessibility can improve workforce participation, especially among women, who are primarily dependent on, and predominant users of, public transport across Indian cities. TOD can help decouple density from congestion and economic growth from resource use and carbon emissions, offering high dividends for public and environmental health. It can also enhance livability and revitalize station areas to bolster local economic development and revenues for public agencies, through increased transit ridership, land value capture (LVC), and development-related fees and taxes that can be reinvested for public good (see Appendix B for details).

## Harnessing market forces to increase job densities around Bengaluru's transit stations

Research finds that firms and jobs tend to concentrate where access to other firms, jobs, and workers is highest, and transit accessibility drives these positive agglomeration effects. The key locational considerations for manufacturing firms are affordable land and access to large logistics infrastructure, whereas for high-value-added activities, they are access to many similar firms and skilled workers (Salat and Ollivier 2017). Bengaluru's real estate trends appear to support this, and several studies on the land-use impacts of metro rail in the city reveal the trend toward greater commercial, residential, or mixed-use developments near metro stations as accessibility levels and land values rise (Appendix B, Box B-2).

This indicates that service establishments are more likely to locate near metro stations than manufacturing industries, owing to higher market demand and economic viability. The service sector, which contributes most of the city's workforce,[12] is set to grow and create more jobs, following the trend of the past few decades. Bengaluru also continues to lead the office space demand and leasing market in India (BS 2023; BM 2024), and offices typically have the highest number of jobs per unit area of floor space (Drivers Jonas Deloitte 2010; Sandilya 2016). Moreover, it is the personal-vehicle-based work trips by the relatively higher-income knowledge and service workers that need to shift to public transport.

Evidence shows that employment growth around transit stations is not automatic, even if zoning around the stations favors industrial or commercial uses; rather, a more holistic set of strategies and incentives may be needed. The city intends to prepare a revised master plan incorporating its TODP directives. This presents a valuable opportunity to prioritize job densities in Bengaluru's TODP and planning, while rethinking the city's growth strategy and density distribution.

# THE STUDY'S INTENT AND SCOPE

## Aim and objectives

This study presents spatial data analysis on the proximity of formal jobs (i.e., jobs associated with registered enterprises) to Bengaluru's metro network and explores how future jobs growth can be enabled closer to metro stations. We focus on the metro network, assuming it would be the BMA's primary rail transit system.[13] The research's learnings can also be applied to the upcoming phases of the metro and suburban rail system.

The study's key objectives are to understand:

- the spatial job distribution associated with registered enterprises in the BMA, analyzed broadly by sector and size, and assess job proximity and density around metro stations (operational and under construction);
- why businesses chose existing locations and the factors (benefits, trade-offs) they consider when moving closer to the metro;
- the regulatory and market challenges businesses face in locating closer to the metro; and
- how job densities can be increased along the metro.

## Methodology

The study adopts a mixed-methods approach, drawing insights from geospatial data analysis and stakeholder interviews in Bengaluru, apart from secondary research and global case studies.

**Geographic scope:** The study focuses on the BMA, which is under the jurisdiction of the local planning authority, the Bangalore Development Authority (BDA). It includes the municipal corporation area, that is, the Bruhat Bengaluru Mahanagara Palike (BBMP) area, and the planned metro stretch to the international airport (Phase 2B), which lies beyond the BDA boundary (Figure 3).

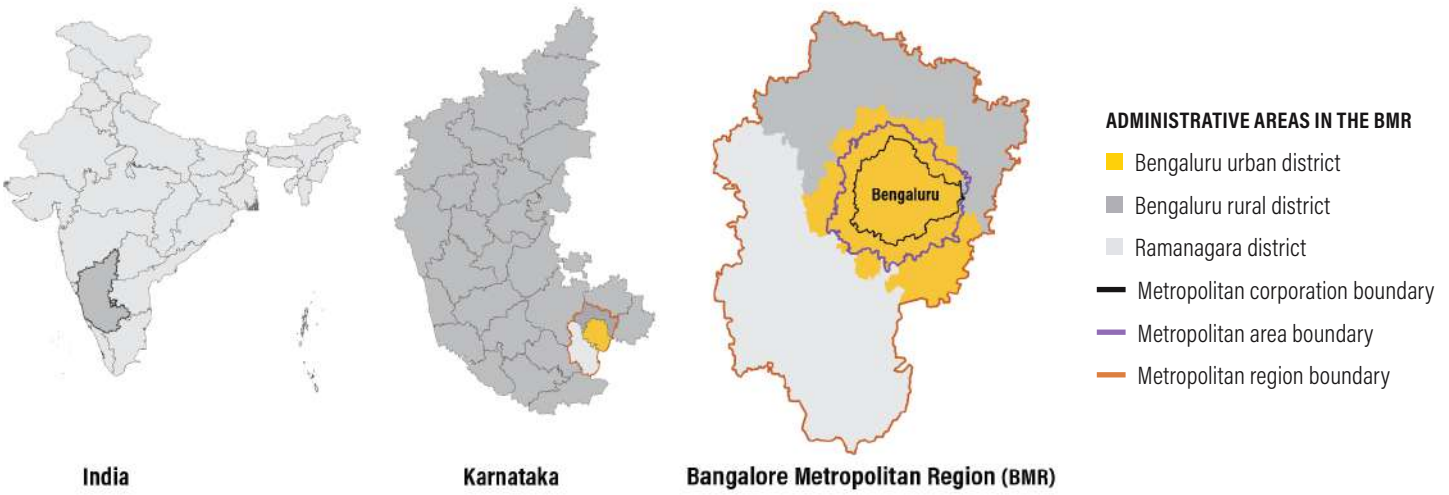
**Data and analysis:** To map the spatial job distribution, we collected January 2023 data on enterprise location, registration year, and associated full- and part-time employee numbers from the Labour Department, GoK (LD–GoK), for factories, shops, and commercial establishments in the BUD.[14] We classified all factories as "manufacturing" enterprises, all shops and commercial establishments as "service" enterprises, and all manufacturing- and service-sector enterprises with over 100 employees as "large" enterprises.[15] We further categorized service enterprises by nature of business using National Industrial Classification (NIC) codes (Appendix C).

We geocoded and mapped the obtained dataset using geographical information system (GIS) software (Appendix D) to analyze job proximity and density relative to metro stations. We used 500, 1,000, and 2,000 m access sheds for this, using criteria specified in Bengaluru's TODP.[16] We analyzed metro Phase 1 (fully operational) and Phases 2 and 2A-2B (under construction), but excluded Phase 3 alignments (awaiting final approval). We prepared heat maps to visualize the distribution of sector-wise job clusters in the BMA (Appendix E).

To understand the factors influencing business location choice and the perceived benefits and challenges of locating near the metro, we gathered qualitative and anecdotal information using on-ground interviews conducted in January–February 2024 in four metro-station areas and four comparable areas unconnected by the metro network. Thirty-nine responses were recorded (4–6 in each area), covering different types and sizes of manufacturing and service enterprises (see Appendix F for details). Further, we interviewed 13 representatives from government; city planning and architecture, real estate development, office space provision, tech, and start-up businesses; international property consultancies; and academia (Appendix G).

We conducted secondary research to understand Bengaluru's policy and regulatory context. We also gathered evidence and lessons from global case examples illustrating good practices for attracting private investments and businesses and for planning and financing TOD and the supporting infrastructure (Appendix H). Our aim is to inform discussions on policy enablers, incentives, and the way forward in Bengaluru.

Figure 3 | **Location of study area**




*Source:* WRI India, using administrative boundaries from BBMP (municipal corporation), BDA (metropolitan area), Bangalore Metropolitan Region Development Authority (metropolitan region), KSRSAC (district boundaries), and Survey of India (India and Karnataka).

## Limitations

- Our findings are based on an analysis of data on registered factories, shops, and commercial establishments[17] and associated jobs. This dataset excludes other formal jobs, such as those in government and defense establishments, academic and research institutions that may be registered as societies or trusts under various acts, and individual practitioners excluded under the Karnataka Shops and Commercial Establishments Act 1961. It also excludes informal jobs in the unorganized sector, for example, gig-economy or home-based workers; beedi-cigar, construction, and motor transport workers; and contract migrant laborers, all of whom are covered under different laws (GoK n.d.), because this information is neither readily available nor easy to compile.
- The dataset's accuracy depends on the concerned government departments' data collection, updating, and verification systems. Apart from a high-level cross-check of overall numbers against other secondary sources of jobs data such as the Annual Survey of Industries (ASI) 2019–20, 2014–15 analysis for the Draft RMP 2031, and the Sixth Economic Census 2013,[18] we did not assess this dataset's accuracy. Although the Seventh Economic Census in Karnataka was completed in 2020, the results have not been published; hence, the updated total number of enterprises and jobs in BUD is unavailable.
- We focused on fixed-route, high-capacity rail transit systems, limiting ourselves to operational or under-construction phases of Bengaluru's metro rail. Other proposed metro lines, the yet-to-be-introduced suburban rail network, and the city bus network were excluded.
- Further, we concentrated on "proximity" to metro stations as the key measure of access. Other aspects such as the adequacy of first- or last-mile infrastructure and services, fare affordability, or safety considerations are peripheral to this study.
- Although housing locations and population densities relative to jobs are important, they are beyond the scope of this study. Moreover, current population data are unavailable because the last census was held in 2011.
- Although the dataset includes the enterprise registration year, it was not used for temporal analyses such as jobs growth in the city or along metro corridors due to potential errors. The dataset presents a snapshot as of January 2023; because data for past years are unavailable, changes such as enterprises that opened, closed, and re-registered due to transfer of ownership, changes in name, or relocation to another address, and the growth or decline in employee numbers over time are not captured.

## JOBS DISTRIBUTION: A SNAPSHOT

This section discusses the results of analyzing job locations in Bengaluru in relation to the metro network using spatial mapping.

**Number and distribution of registered enterprises and jobs in Bengaluru by sector and size.** Based on the Labour Department's datasets, as of January 2023, about 0.2 million registered enterprises (factories, shops, and commercial establishments) employed 4.8 million workers in the BUD, 95 percent of which were within the BMA. Most enterprises and jobs in the BMA are in the service sector (Table 1). Of the BMA's 4.6 million employees, 29 percent are female and the rest male. This ratio is practically unchanged for total service jobs, but females account for 38 percent of total manufacturing jobs, possibly because textile industries employ a largely female workforce (Chakravarthi 2024). Notably, large enterprises (>100 employees) constitute only 2 percent of all enterprises in the BMA but contribute 60 percent of all jobs, and a greater proportion of manufacturing enterprises are large.

Most jobs associated with large enterprises (64 percent) and the manufacturing sector (70 percent) are in the city's suburban and peripheral areas. Although the two major manufacturing-job clusters are located on the city's outskirts, service-job clusters are distributed across inner-city areas, intermediate suburbs, and peripheral areas[19] (Figures 4 and 5; Appendix E).

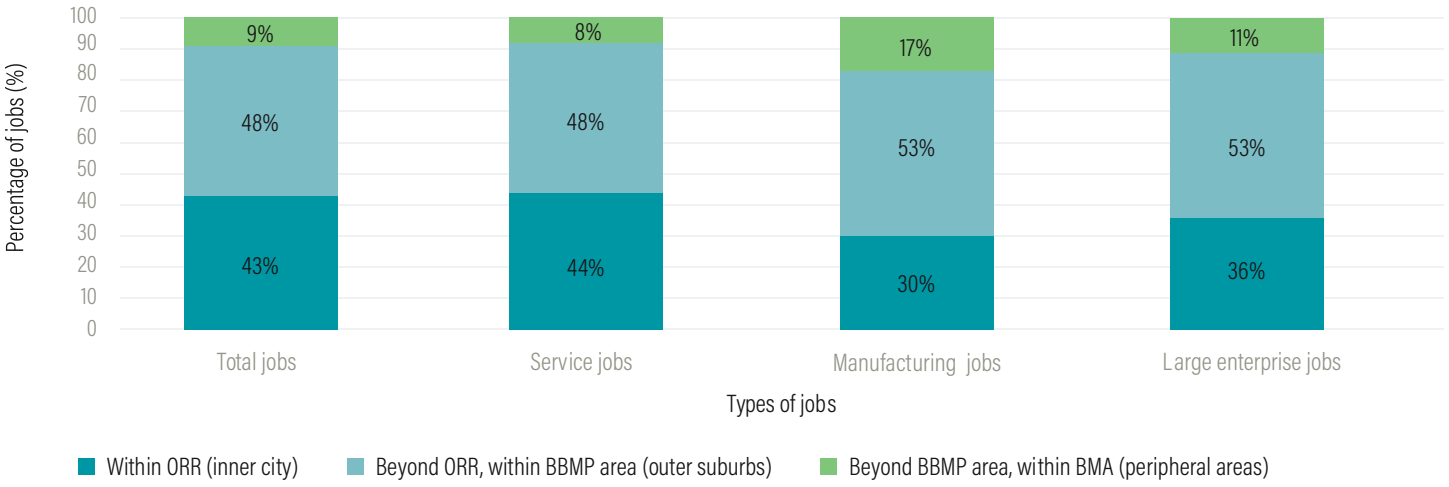
Table 1 | **Share of enterprises and jobs by sector and size**

| | MANUFACTURING-SECTOR | SERVICE-SECTOR | LARGE ENTERPRISES |
|---|---|---|---|
| **Total enterprises and jobs (%)** | **3%** of enterprises | **97%** of enterprises | **2%** of enterprises |
| | **12%** of jobs | **88%** of jobs | **60%** of jobs |
| **Large enterprises and jobs (%)** | **18%** of manufacturing enterprises | **2%** of service enterprises | n/a |
| | **72%** of manufacturing jobs | **59%** of service jobs | |

*Note:* n/a = not applicable.

*Source:* WRI India authors, based on analysis of jobs data from the Labour Department, Government of Karnataka (LD–GoK) as on January 2023.

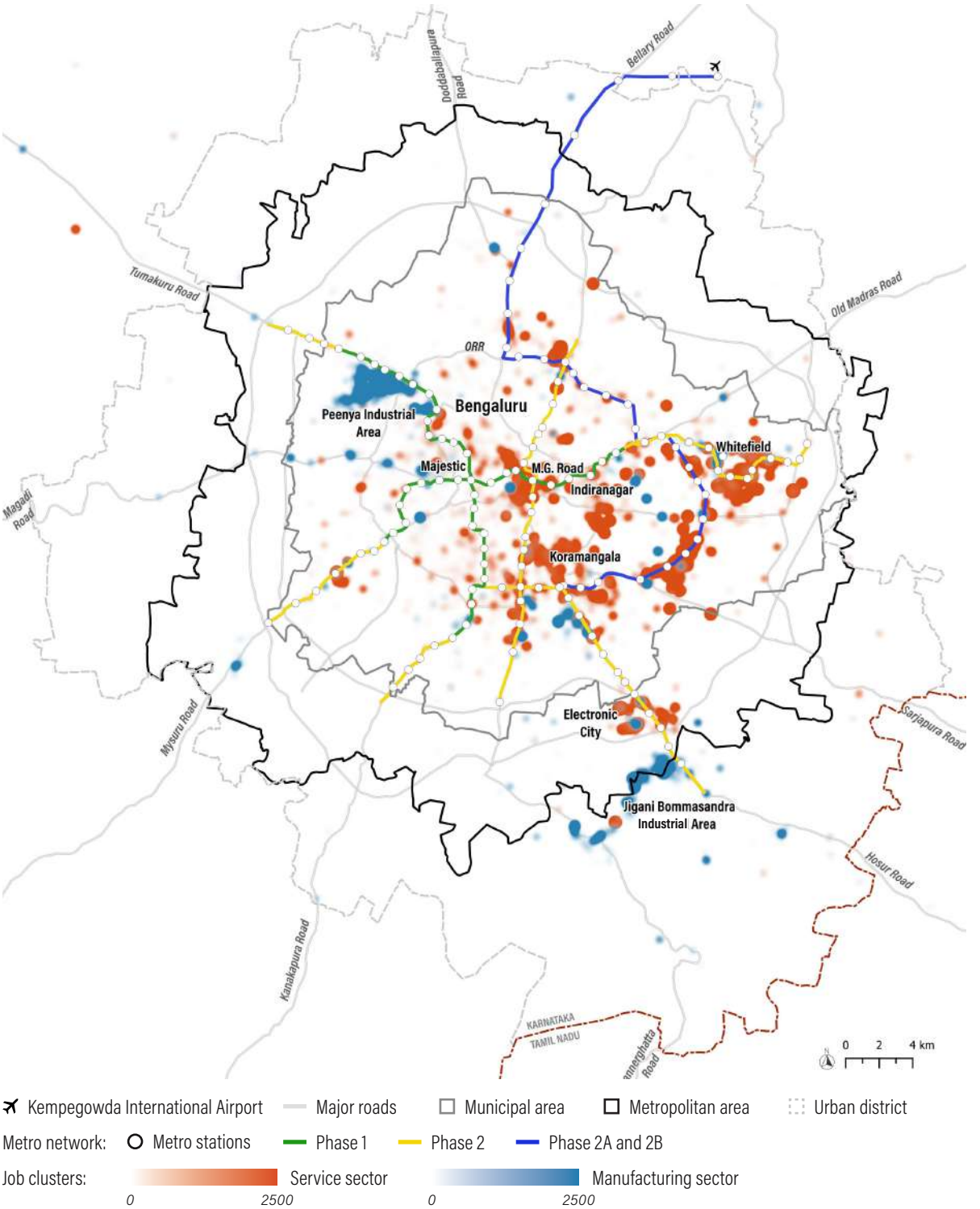
Figure 4 | **Spatial job distribution in Bengaluru**




*Notes:* BBMP = Bruhat Bengaluru Mahanagara Palike; BMA = Bengaluru Metropolitan Area; ORR = Outer Ring Road.

*Source:* WRI India authors, based on analysis of jobs data from LD–GoK as on January 2023.

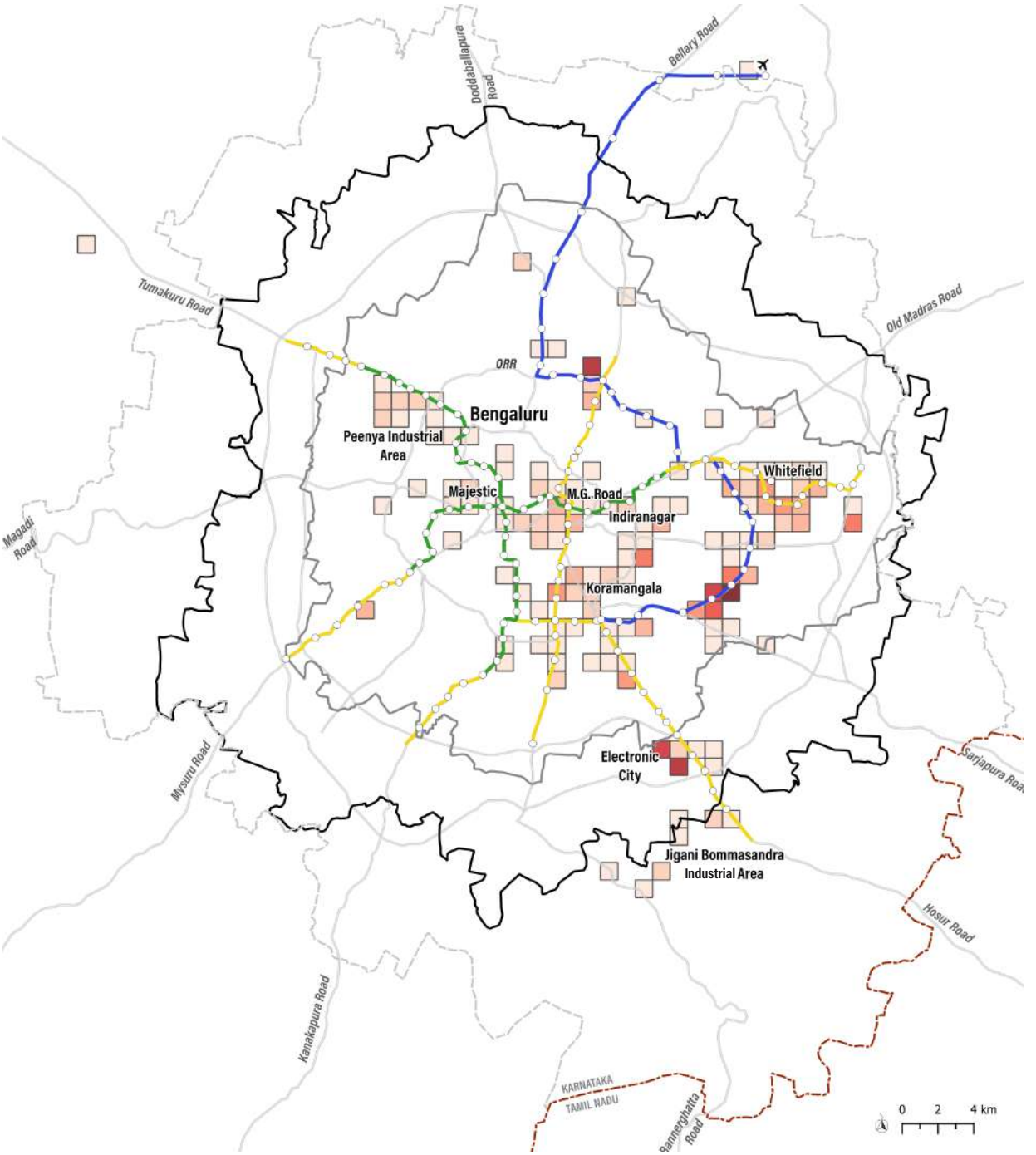
Figure 5 | **Metro network and distribution of manufacturing- and service-job clusters in Bengaluru**




*Notes:* This heat map visualizes sector-wise jobs clusters using a range from 0 to >2,500, which refers to the number of jobs falling within a 500 m radius. Some thriving job clusters between Indiranagar and Koramangala, and along Sarjapur Road, will remain disconnected even after Phases 2 and 2A-2B are operationalized.

*Source:* WRI India, using geocoded sector-wise jobs data from LD–GoK as on January 2023; digitized metro network from BMRCL as on May 2023; administrative boundaries from BBMP (municipal corporation), BDA (metropolitan area), and KSRSAC (urban district); and major roads from OSM as on May 2023.

Figure 6 | **Peak job densities in Bengaluru**




*Note:* The map highlights peak job densities above 10,000 jobs within 1 sq. km. grids; where k = thousand.

*Source:* WRI India, using geocoded jobs data from LD–GoK as on January 2023; digitized metro network from BMRCL as on May 2023; administrative boundaries from BBMP (municipal corporation), BDA (metropolitan area), and KSRSAC (urban district); and major roads from OSM as on May 2023.

**Average job densities are highest in inner-city areas (within the ORR), thanks largely to the service sector, and decrease further away** (Table 2). Interestingly, the highest job densities are seen in hi-tech service clusters in the outer suburbs and peripheries. Peak job densities are about 39,000 jobs/sq. km in the city center near MG Road, although this excludes government (public administration) and other institutional jobs concentrated in the central and inner-city areas. Job densities range from 58,000 to 109,000 jobs/sq. km in hi-tech clusters such as Whitefield, Electronic City, and Bellandur-Kodibeesanahalli areas along the ORR's eastern arc and are about 25,000 jobs/sq. km in the two large manufacturing clusters, the Peenya and Jigani-Bommasandra industrial areas, all of which are on the city's outskirts (Figure 6). This indicates the polycentric pattern of Bengaluru's economic and employment nodes, which differs from the job-dense centers surrounded by residential suburbs characteristic of many Western cities. It is also indicative of the nature of building typologies within manufacturing clusters (flatted factories and sheds) versus hi-tech clusters (office complexes), associated space requirements, and job densities.

Table 2 | **Job densities across Bengaluru by sector and enterprise size**

| UNIT: JOBS/ SQ. KM. | DENSITY OF TOTAL JOBS | DENSITY OF MANUFACTURING JOBS | DENSITY OF SERVICE JOBS | DENSITY OF LARGE-ENTERPRISE JOBS |
|---|---|---|---|---|
| Within ORR (Inner city) | **8,662** | **752** | **7,910** | **4,390** |
| Beyond ORR within BBMP area (Intermediate suburbs) | 4,589 | 628 | 3,961 | 3,036 |
| Beyond BBMP area within BMA (Peripheral areas) | 685 | 163 | 522 | 506 |
| BBMP area | 5,881 | 667 | 5,214 | 3,466 |
| BMA | 3,501 | 436 | 3,064 | 2,110 |

*Note:* BBMP = Bruhat Bengaluru Mahanagara Palike; BMA = Bengaluru Metropolitan Area; ORR = Outer Ring Road. The unit of job density is jobs/sq. km.

*Source:* WRI India authors, based on analysis of jobs data from LD–GoK as on January 2023.

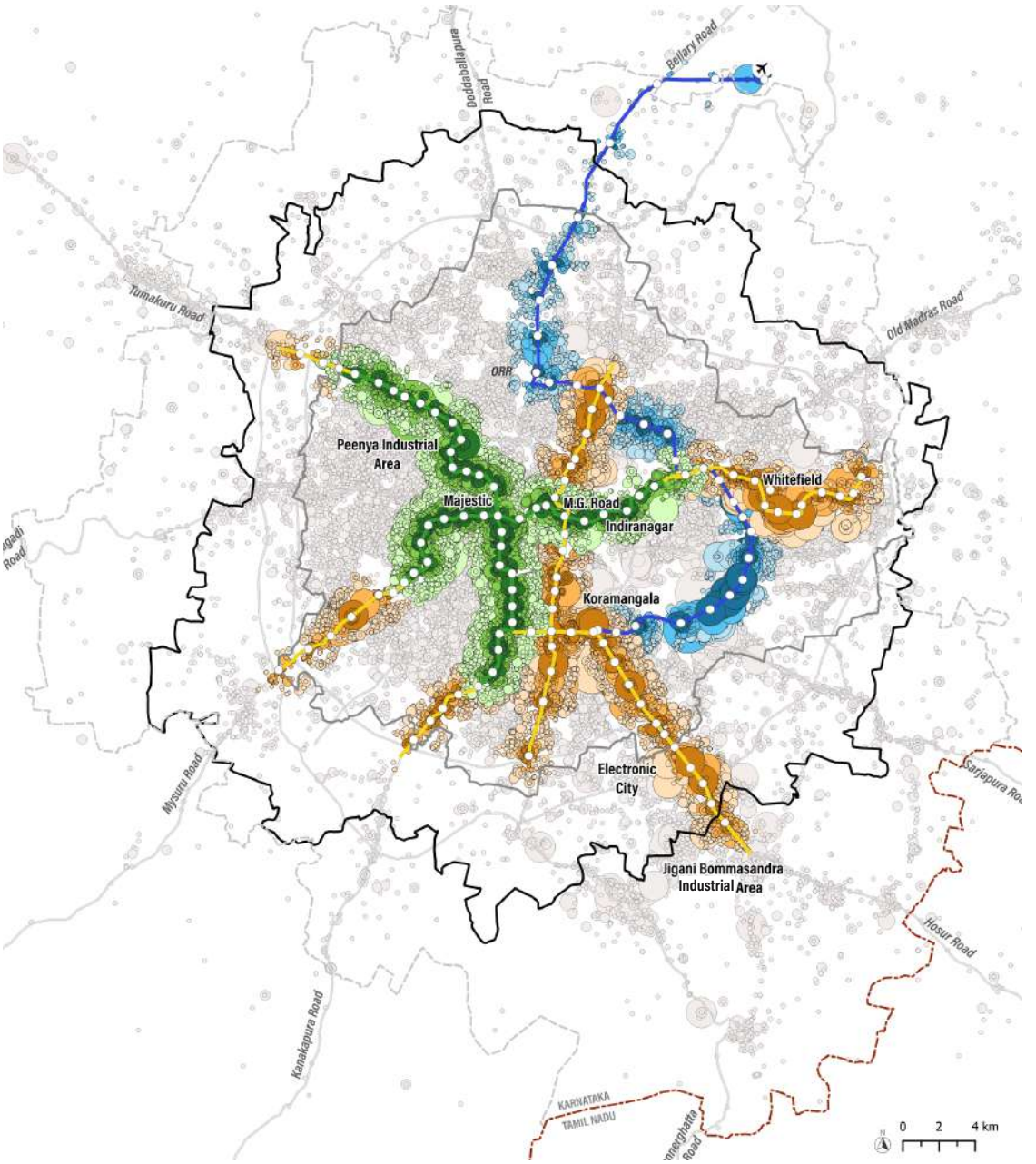
**The ring–radial configuration of major transport networks has created service gaps in the wedges, especially on the outskirts** (Figures 5 and 7). The metro alignments largely follow the arterial road network, to increase the efficiency of these corridors that connect major destinations (e.g., workplaces and institutions) across the city. Another reason is space availability, especially for elevated lines beyond inner-city areas.

**The spatial arrangement of enterprises and associated jobs reveals anticipated patterns.** Some of the largest enterprises are located along arterial roads, and therefore closer to the metro lines, with smaller enterprises both clustered around them and distributed across the city (Figures 7 and 8). This is expected because the city's master plan and zoning regulations permit greater development rights for larger land parcels[20] along wider access roads and some ancillary or mixed use in all land-use categories based on access-road width. This pattern is also indicative of real estate market patterns, agglomeration effects or colocation linkages between large and small enterprises, or smaller enterprises thriving in residential areas. However, although large enterprises are located near metro lines, major employment clusters spread out behind and off arterial roads, with most enterprises (especially small ones) located further away. This could explain why many jobs still lie away from metro stations.

**An analysis of job locations reveals that less than a quarter of all jobs lie within 500 m (a comfortable walking distance)[21] from metro stations and less than half of all jobs lie within 1,000 m (the station influence, or TOD Zone) of the operational and under-construction metro lines** (Figure 9). Of the total mapped jobs in the BMA, only 4 percent currently lie within the 500 m access sheds of operational Phase 1 metro stations, 12 percent within 1,000 m, and 24 percent within 2,000 m. After Phases 2 and 2A-2B are also completed (by 2026), about 21 percent of all jobs in the BMA will lie within 500 m, 47 percent within 1,000 m, and 78 percent within 2,000 m, with large enterprises contributing the majority of jobs.

When analyzed by distance from the closest metro station, these percentages are slightly higher (Figure 10). Of the total jobs in the BMA, 28 percent lie within 500 m of a metro station and 59 percent within 1,000 m, as with total service jobs. The numbers are 22 percent and 52 percent for total manufacturing jobs and 32 percent and 65 percent for total large-enterprise jobs, respectively.

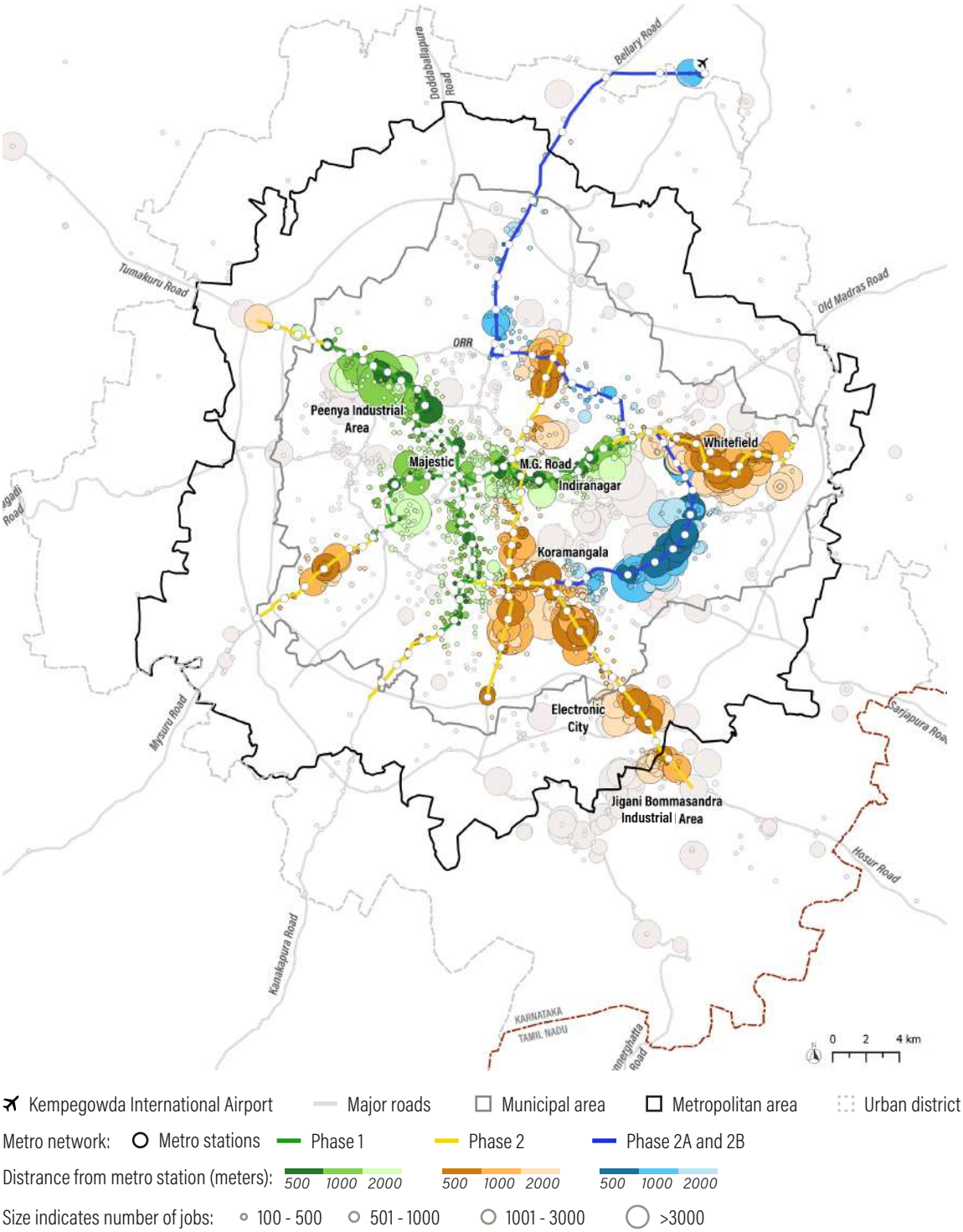
Figure 7 | **Job distribution around metro stations in Bengaluru by phase**




*Note:* The map highlights jobs falling within the access sheds or service areas of 500 m, 1,000 m, and 2,000 m around metro stations. The visualization layers the enterprises and associated jobs based on distance from the metro stations, with the closest appearing on top. Therefore, in many cases, the bubbles of larger enterprises may hide from view the smaller enterprises below them.

*Source:* WRI India, using geocoded jobs data from LD–GoK as on January 2023; digitized metro network from BMRCL as on May 2023; administrative boundaries from BBMP (municipal corporation), BDA (metropolitan area), and KSRSAC (urban district); and major roads from OSM as on May 2023.

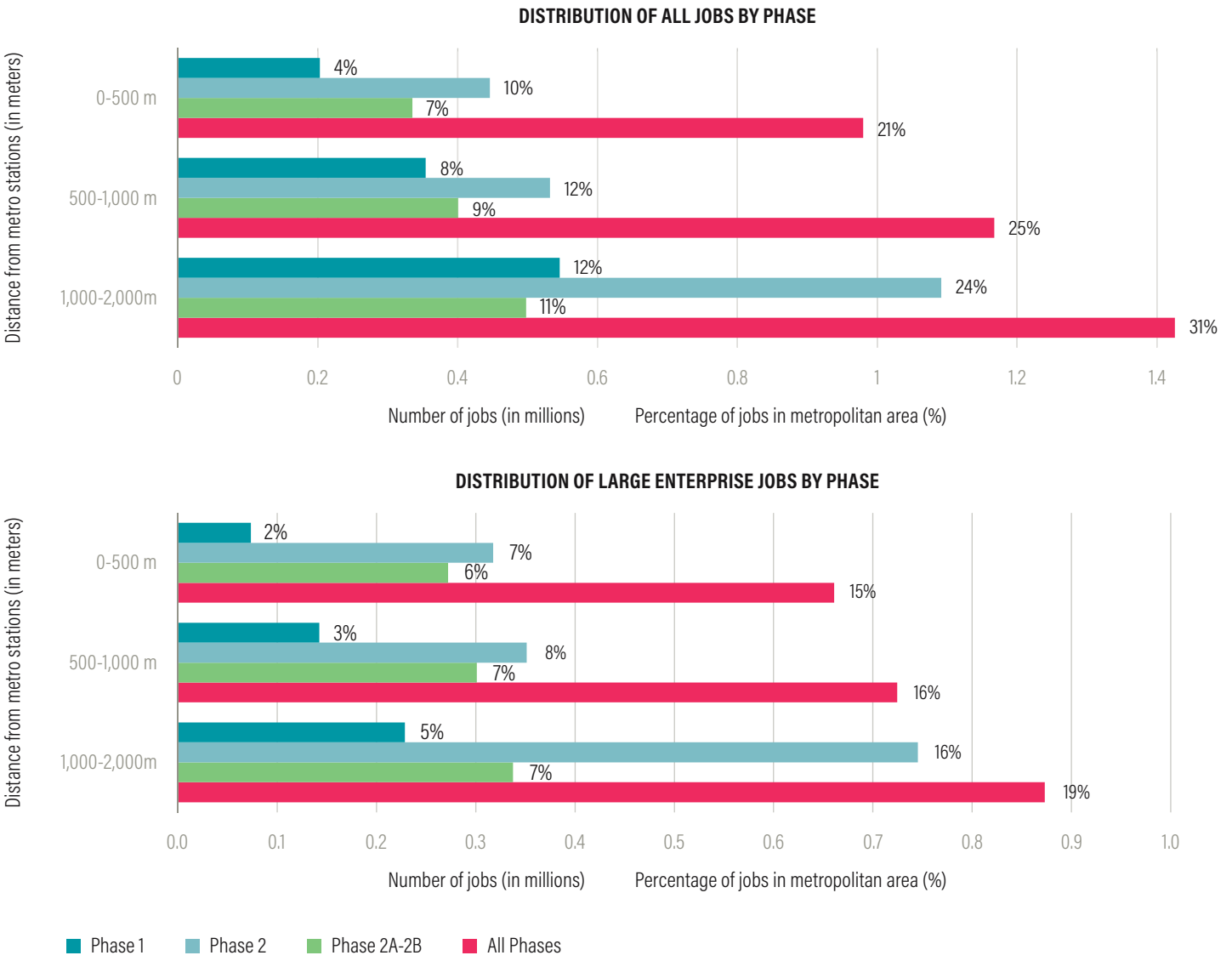
Figure 8 | **Job distribution for large enterprises around metro stations in Bengaluru by phase**




*Note:* The map highlights jobs falling within the access sheds or service areas of 500 m, 1,000 m, and 2,000 m around metro stations. The visualization layers the enterprises and associated jobs based on distance from the metro stations, with the closest appearing on top. Therefore, in many cases, the bubbles of larger enterprises may hide from view the smaller enterprises below them.

*Source:* WRI India, using geocoded jobs data for large enterprises (>100 employees) from LD–GoK as on January 2023; digitized metro network from BMRCL as on May 2023; administrative boundaries from BBMP (municipal corporation), BDA (metropolitan area), and KSRSAC (urban district); and major roads from OSM as on May 2023.

Figure 9 | **Job distribution within 2,000 m of metro stations in Bengaluru by phase**




**TIMELINE OF METRO OPERATIONALIZATION**

**Phase 1**

- Oct 20, 2011: Baiyyappanahalli–MG Road (Purple Line) – 6.7 km
- Mar 1, 2014: Sampige Road–Peenya Industry (Green Line) – 9.9 km
- May 1, 2015: Peenya Industry–Nagasandra (Green Line) – 2.5 km
- Nov 16, 2015: Mysore Road–Magadi Road (Purple Line) – 6.4 km
- Apr 30, 2016: MG Road–Magadi Road (Purple Line) – 4.8 km
- Jun 19, 2017: Sampige Road–Yelachenahalli (Green Line) – 12 km

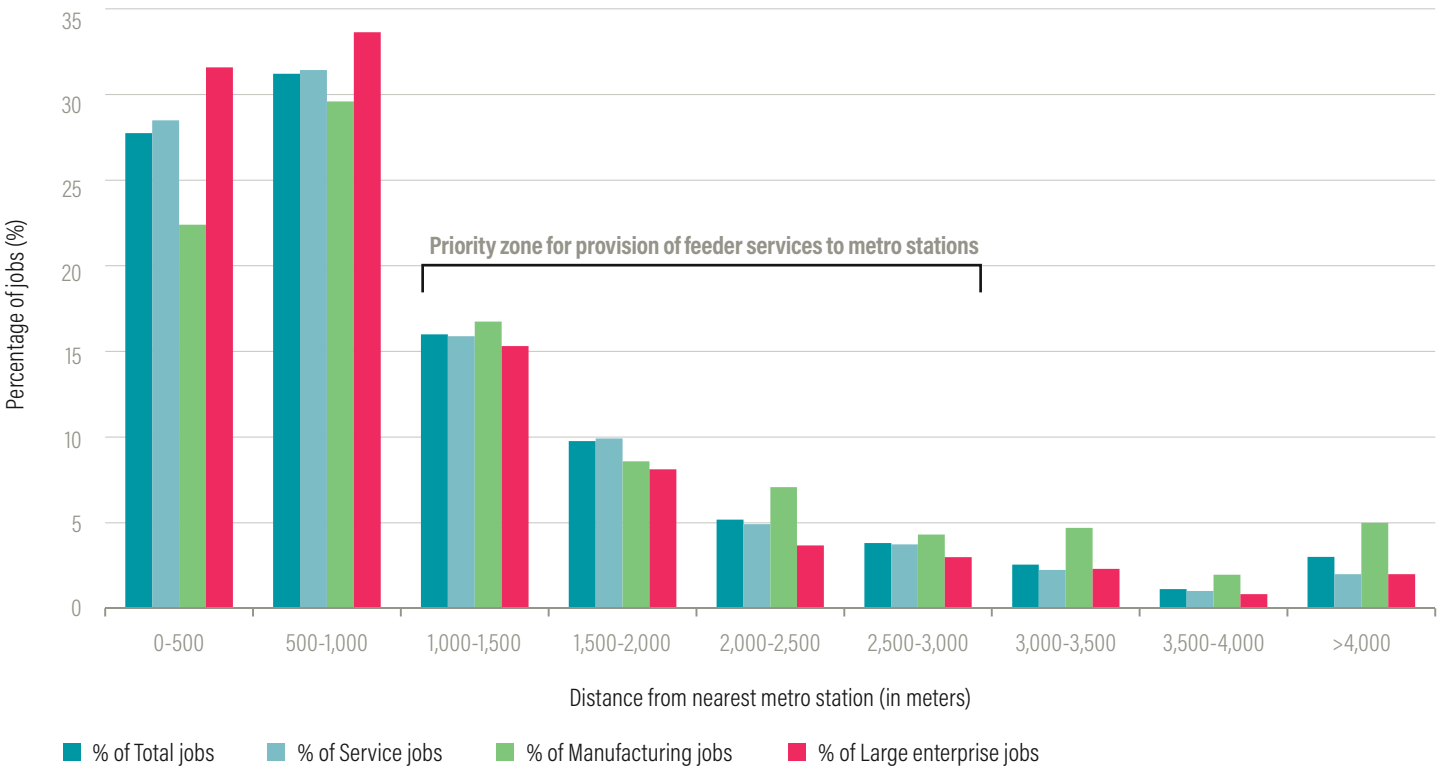
**Phase 2**

- Jan 15, 20121: Yelachenahalli–Silk Institute (Green Line extension) – 5.8 km
- Aug 30, 2021: Mysore Road–Kengeri (Purple Line extension) – 7.5 km
- Mar 26, 2023: KR Puram–Kadugodi (Purple Line extension) – 13 km
- Oct 9, 2023: Baiyyappanahalli–KR Puram (Purple Line extension) – 2.2 km
- Oct 9, 2023: Kengeri–Challaghatta (Purple Line extension) – 2.1 km

*Note:* The figure shows the number and percentage (%) of jobs falling within the access sheds or service areas of 0–500 m, 500–1,000 m, and 1,000–2,000 m around metro stations. Within each distance category, the percentage of jobs for "all phases" is less than the total percentage of jobs for each phase. This is because in "all phases" each job is counted only once in a category, prioritized by distance from the station, and any duplicate counts of distance from adjoining stations are removed.

*Source:* WRI India authors, based on geospatial analysis of jobs data from LD–GoK as on January 2023; digitized metro network from BMRCL as on May 2023; and timeline of metro operationalization from TMRG (2024).

Figure 10 | **Distribution of different categories of jobs by distance from nearest metro station**




*Note:* The figure shows the percentage of different types of jobs (%) by distance from the nearest metro station, considering all metro stations along Phases 1, 2, and 2A-2B.

*Source:* WRI India authors, based on analysis of jobs data from LD–GoK as on January 2023 and digitized metro network from BMRCL as on May 2023.

**Metro line corridors with the highest job densities are not yet operational** (Table 3). This phasing is indicative of the intent to connect the city core and high-population-density areas initially, but also of the lag in extending the network to connect high-density job clusters on the outskirts. Phase 2A, flanked by large businesses, tech parks, and commercial and office complexes along the ORR's eastern arc, has the highest job densities within its access sheds. Phase 2, which connects other hi-tech employment hubs such as Whitefield, Electronic City, and Nagawara, has the second-highest job density, followed by Phase 1, which passes through the city's central business district (CBD). Presently, Phase 2B (connected to the international airport beyond the northern BMA boundary) has the lowest job densities within its access sheds, as a significant portion of the metro line passes through suburban greenfield areas.

Bellandur and Kadubeesanahalli metro stations along Phase 2A have the highest job densities, at over 60,000/sq. km and 76,000/sq. km, respectively. About 16 other stations along Phases 1, 2, and 2A have job densities between 20,000/ and 41,000/sq. km (Figure 11). This variation is expected given that metro lines pass through different localities and development contexts across the city. Station-area job densities are not yet strongly correlated with current metro ridership numbers, emphasizing that several other factors influence this relationship (see Appendix I for details).

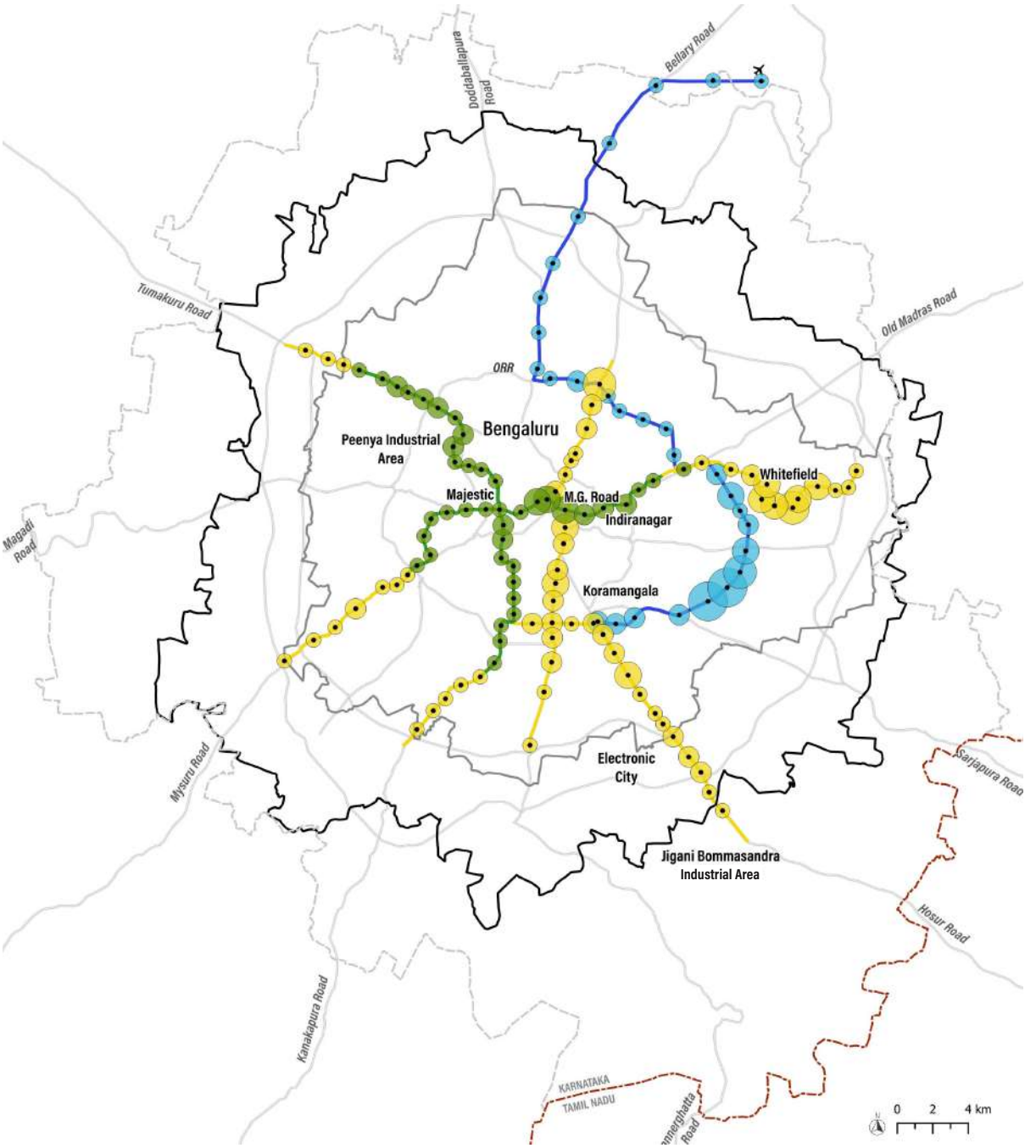
Table 3 | **Job densities within access sheds by phase**

| UNIT: JOBS/ SQ. KM. | 0-500 M | 500-1,000 M | 1,000-2,000 M |
|---|---|---|---|
| **Phase 1** | 11,692 | 14,800 | 7,814 |
| **Phase 2** | 19,097 | 20,133 | 8,391 |
| **Phase 2A** | 56,321 | 22,664 | 10,356 |
| **Phase 2B** | 9,434 | 16,103 | 5,471 |

*Note:* The unit for job density is jobs/sq. km.

*Source:* WRI India authors, based on analysis of jobs data from LD–GoK as on January 2023, by metro phase.

Figure 11 | **Job densities within 1,000 m of metro stations in Bengaluru**




*Note:* A 1,000 m radius (aerial distance) was taken to compute job densities per square kilometer around each individual metro station without overlap with adjoining stations.

*Source:* WRI India, using geocoded jobs data from LD–GoK as on January 2023; digitized metro network from BMRCL as on May 2023; administrative boundaries from BBMP (municipal corporation), BDA (metropolitan area), and KSRSAC (urban district); and major roads from OSM as on May 2023.

**As transit networks expand and connect more employment clusters, more jobs will become accessible via transit.** Job-proximity numbers will improve if government and institutional jobs are also counted and after metro Phase 3 and suburban rail lines are operationalized (by 2028), taking the city's total rail transit network to over 360 km. However, several sections of the suburban and metro rail networks run parallel to, or alongside, each other for some distance (Appendix J).

**Continuing with a "development-oriented transit" strategy alone—transit infrastructure only following development in distant, dispersed locations—is resource-intensive and expensive.** In addition, Bengaluru can direct future commercial and industrial investments as a trigger for TOD and increase job densities along its existing metro corridors. To an extent, this has been happening independently and incrementally through market response, but it should be enabled more strategically and proactively going forward.

## PULL FACTORS FOR BUSINESSES

This section uses stakeholder interviews to examine the locational considerations for businesses and the benefits or trade-offs in locating near the metro. Major factors influencing location choice include conducive development contexts and land uses, available transport infrastructure and facilities, market-related location advantages, and costs (see Appendix G for details).

**Incentives and infrastructure, along with the availability of suitably sized land parcels, have shaped Bengaluru's industrial and commercial market.** Well-planned, well-developed, and well-connected industrial and urban areas attract enterprises. Good city and regional transport connectivity improves market or ecosystem linkages and catchments in addition to accessibility for employees and customers. Adequate, economically priced real estate is another key consideration for enterprises.

Large industrial areas such as Peenya and Jigani-Bommasandra, located on the outskirts along arterial roads (highways) connecting the city to the larger region, have attracted manufacturing enterprises. Factories tend to locate and move outward because they need more space and affordable land is available in the city's peripheries.

Good connectivity (by road, bus, and in some cases metro) and public infrastructure levels make the CBD and prime inner-city neighborhoods (e.g., Indiranagar and Koramangala, with thriving real estate markets) the most desired locations for offices and commercial establishments. SEZs (e.g., Electronic City, Whitefield, and hi-tech zones along the ORR and airport route), which are planned away from the city center, have also attracted businesses. SEZs are special zones with business infrastructure, tax exemptions, subsidized rents, and government-backed incentive schemes. A key factor here is lower land and rental values, although external public infrastructure is lacking. Large service enterprises need Grade-A buildings with sizable, column-less floor plates[22] and adequate parking. Consequently, commercial property developers also prefer larger land parcels that can be developed easily at lower costs.

**The metro has little impact on the location choice of manufacturing enterprises, but service enterprises benefiting from enhanced catchments and accessibility prefer to locate near it** (Figure 10). Manufacturing businesses usually do not depend on the metro for customers. Moreover, the metro is often unaffordable or does not meet their employees' travel needs. Most factory workers and staff live nearby or in the surrounding areas (up to 8 km). They either walk or use public buses, intermediate or informal transport (private buses, tempos, shared autos), or personal vehicles to commute to work. However, some large service enterprises located along main roads and closer to the metro station reported that nearly 50 percent of their staff and trainees used the metro to commute, indicating that distance to the workplace or metro station, nature of the enterprise, and worker class (blue or white collar and income) are factors influencing mode choice.

For offices, educational or coaching institutes, and other retail businesses (especially those relying on high footfalls and volumes),[23] walkable access to and from a metro station and bus stops is an important location consideration. This is less important for businesses offering high-end products or services, because most of their clientele rely on personal vehicles; therefore, adequate parking is a bigger consideration.

**Large enterprises act as anchors for smaller enterprises, spurring real estate demand and development of micro-markets nearby** (Figure 7). Market linkages and agglomeration economics drive certain sizes and types of enterprises to locate near each other. For instance, small and medium enterprises try and locate near large enterprise, which are their suppliers or clients (demand-supply chains). Certain competing and complementary businesses try and locate within an area to tap into a specific or common customer base. For example, automobile component manufacturing units locate near larger automobile manufacturing industries, and commercial

enterprises that supply raw materials or market the final products, such as hardware stores and automobile showrooms, also come up close by. Another example is the commercial stretch near Mantri Square Mall and the metro station in Malleshwaram, which has gradually emerged as the jewelry–wedding shopping destination for the area as a market response to the increase in property values and footfalls in the areas, especially of high-end clientele.

For eateries and retail and lifestyle stores, connection to specific micro-markets with local, zonal, or city-level catchments is an important consideration. They prefer to locate within well-developed commercial clusters or streets where other brands are present, giving customers a range of options and experiences. Commercial land uses along main roads providing access and visibility are particularly important for retail businesses.

**Offices and retail businesses also prefer locating in mixed-use, livable neighborhoods, which aligns well with TOD principles.** For offices and coaching institutes, well-established residential areas with schools and colleges nearby serve as catchments for employees, faculty, and students, and such areas also provide customers for retail businesses. Employers also consider housing choices, markets, and amenities that make the area livable for employees. Malls and eateries benefit from nearby office spaces, providing meal and shopping options, or spillover spaces for meetings and socializing.

Good ambience is important for bed-and-breakfast or boutique hotels and homestays, upmarket lifestyle stores, and eateries. They prefer quiet and green inner, residential streets to main or busy commercial streets. Many of these enterprises use premises that are remodeled residential properties. Although smaller service establishments may have fewer employees, they serve many customers and in that sense are both transit dependent and supportive.

**Anecdotal evidence and on-ground observation support research findings suggesting that the metro has boosted real estate development nearby, especially the growth of service enterprises.** Unlike older industrial estates in inner-city areas, larger industrial areas such as Peenya and Jigani-Bommasandra on the city's outskirts have not yet seen major land-use changes (i.e., higher-end, higher-density commercial, residential, or mixed-use developments) (Appendix B, Box B-1). Slowly but surely, however, similar trends are emerging in response to market forces as some manufacturing enterprises wind down or move out further to industrial areas in satellite towns such as Nelamangala, Hosur, or Bidadi. This is particularly true when enterprises have space constraints, business is not very lucrative, or property owners wish to cash in on their land assets. In urban areas too, commercial development has intensified, with offices, coworking spaces, coaching institutes, shops, eateries, and lodging facilities emerging around metro stations. However, as shown above, several factors come into play, and challenges remain for jobs growth around metro stations.

Table 4 | **Real or perceived benefits and challenges for businesses in locating near metro stations**

| BENEFITS | CHALLENGES |
|---|---|
| ▪ Improved citywide accessibility enhances workforce productivity, enlarges catchments, and increases footfalls, benefiting businesses, including street vendors.<br>▪ Lower travel time, costs, and stress than other modes; easier commutes.<br>▪ The metro's service hours (5 AM to 11 PM) and frequency make it a safe, reliable transport mode. Staff and students can attend work shifts or classes, and customers in malls, eateries, or pubs can avoid drinking and driving.<br>▪ Enterprises save on transport and housing costs for employees, effectively reducing their occupancy costs. | ▪ Suitable properties are often unavailable or unaffordable due to higher commercialization and property values near metro stations.<br>▪ Increased street vending and parking demand around metro stations lead to haphazard spillover into nearby streets. This, together with overground metro infrastructure, shrinks road and footpath space, adversely affecting commercial frontage and visibility.<br>▪ Blockage of light, privacy, noise, and safety issues from the constant vibration for enterprises near metro lines. Businesses suffer, especially during metro construction.<br>▪ Inadequate, poor-quality footpaths or feeder services hamper access to metro stations. |

*Source:* Authors, based on stakeholder interviews (see Appendix F for details).

# CHALLENGES FOR JOBS GROWTH AROUND METRO

This section assesses the challenges businesses face in locating near metro stations. Given the pull factors for different kinds of businesses and the trends noted in the preceding section, the focus is on the challenges facing service enterprises. Presently, Bengaluru faces the following three major hurdles to jobs growth along its metro corridors, particularly in the central and inner-city areas.

## Challenges businesses face when leasing properties

**Despite good metro connectivity and great demand for commercial and office spaces, the city core lacks suitable properties for companies.** Large corporates mention the lack of Grade-A buildings in inner-city areas that meet their space, structural, and fire safety requirements. Coworking and managed office space providers know that built environments with facilities and aesthetics that appeal to a young workforce, natural lighting, and soundproofing enhance productivity. However, buildings in older, developed areas often do not meet current demands.

**Issues with legal compliance.** Formal businesses need documentation of water and electricity connections and ownership proof, which owners of old buildings may lack. If new buildings have violated development norms, no-objection or occupancy certificates would be unavailable, locking such properties out of the lease/rental market. Further, the government lacks updated ownership data that can ease service provisioning and development.

**Higher property prices near metro stations tend to impact smaller businesses more than large ones.** Businesses would locate near metro stations, or continue to remain near them, if locational advantages and benefits outweighed the costs. This is particularly true for larger established enterprises that have been in a certain location for a long time and acquired properties at more affordable rates or leases. Medium- to small-scale businesses also prefer locating near the metro. They form an important client base for commercial/office leasing, given Bengaluru's "start-up capital" status; however, discouraged by the rising property values near metro stations, they would rather locate farther away.

## Redevelopment challenges

**The city core has good metro connectivity but limited land for commercial development.** Developed inner-city areas within the ORR are packed with buildings unsuitable for large-scale commercial or global businesses. In some areas, land around metro stations is unavailable for commercial development because it is occupied by public institutions and defense establishments. Thus, private developers build in the suburbs, and/or away from metro stations, where land is available.

**Market saturation and community resistance to greater commercialization in metro-station areas also pose a challenge for businesses seeking to locate there.** Areas around metro stations may already be highly commercialized. Community tolerance to land-use changes and commercial proliferation in residential areas may also be low, Indiranagar and Koramangala being examples (BM 2018; TNIE 2019), due to the associated poorly managed civic issues such as growing traffic congestion, air and noise pollution, parking, and waste disposal. This has made it difficult for businesses to find suitable properties in desired locations.

**Present zoning regulations hinder higher-density development around metro stations.** A 2009 amendment to the master plan allowed a maximum floor area ratio (FAR) of 4 for all permissible uses within a 150 m radius of completed metro stations; however, the impact zone boundaries have not been notified. Moreover, FAR utilization is curtailed by regulations pertaining to plot size and access-road width, among others. High parking requirements reduce the salable floor area, discouraging the development of large office or commercial spaces. Further, setback requirements and caps on the maximum ground coverage restrict construction of large floor plates, especially on smaller plots (<1,000 sq. m), and caps on building heights in air funnel zones limit development and FAR consumption. Moreover, higher-density development also needs commensurate supporting infrastructure, requiring land contribution for road widening, open spaces, and civic amenities, which is more feasible on larger (>4,000 sq. m based on the thresholds in the current master plan).

**Higher-density redevelopment requires substantial land parcels, and transaction costs for land assembly can be high, especially in inner-city areas.** The higher FAR incentive has been effective in developing areas with higher market demand and development potential and easy access to larger land parcels. It is, however, legally difficult to utilize in smaller plots along narrow access roads in developed areas (Figure 12). Joint property development agreements and plot amalgamations carry the risk of disagreement among multiple owners. In areas that have developed organically, establishing ownership—a prerequisite for a transfer or sale—could be difficult, making project approvals time-consuming and expensive. Admittedly, substantial land-use transformations take a long time; however, it is clear that mass transit and higher FAR incentives, although necessary, are insufficient to attract large enterprises and densify metro corridors.

Figure 12 | **Small plots hamper FAR incentive utilization**


| | BEFORE AMALGAMATION | AFTER AMALGAMATION |
|---|---|---|
| **Plot size** | 121+121 | 242 |
| **Built-up** | 312 | 625 |
| **FAR achieved** | 1.3 | 2.6 |

**Indiranagar metro station, Bengaluru:** 66 percent of plots <250 sq. m and most roads <12 m wide.

*Note:* FAR = floor area ratio. sq. m = square meters. m = meters.

*Source:* Dhindaw et al. 2021.

## Inadequate public infrastructure

**Public infrastructure levels do not support the maximum permissible FAR around metro stations.** Although inner-city areas have the best public infrastructure in the city, it is dilapidated and expensive to upgrade. Retrofitting can be particularly difficult in organically developed dense areas with narrow roads and abutting buildings. In outer suburbs and peripheral areas, public infrastructure is poor or absent (Figure 13),[24] constraining high-density developments. Yet, builders continue to build there because the lower land costs outweigh the costs of private service provisioning, which buyers and occupants eventually bear. The state's SEZs policy puts the onus for infrastructure development on developers; however, public agencies still need to provide external trunk infrastructure and services.

Figure 13 | **Low service levels for water supply and drainage beyond Bengaluru's inner-city areas**


*Note:* FAR = Although infrastructure provision has improved since 2011, it has not matched the rapid urbanization and growth on the outskirts.

*Source:* WRI India authors, based on 2011 Census data.

# THE WAY FORWARD

Based on our research findings and learnings from global good practice examples, this section outlines broad recommendations for enabling jobs growth around metro stations. Integrating economic, land-use, and transport planning and improving access to jobs and labor markets via high-quality transit can generate wide-ranging economic, social, and environmental benefits, as outlined in Appendix B. The government can play a proactive role in enabling, incentivizing, and leading development by creating conditions that can attract large businesses to metro corridors, as detailed below.

## Prioritizing job densities in Bengaluru's planning–regulatory frameworks

**The city's master plan, which needs to integrate land use with the comprehensive mobility plan, can set aspirational goals for job densities around transit.** The Draft Bengaluru TODP of 2019 outlined three broad goals related to sustainable transport mode shares, the proportion of city population to be accommodated near transit stations, and population densities along transit corridors,[25] which the CMP 2020 also refers to. Although the Bengaluru TODP approved in 2022 lacks such targets, a key objective is to achieve a high mode share for public transport through strategies such as encouraging an optimal mix of compatible, transit-supportive uses and higher population and job densities near transit stations. The TODP is binding on all the concerned planning authorities, urban local bodies, public transport, infrastructure, and utility agencies in the BMA, which entails integrating the policy's principles and provisions into the local planning areas' master plans. The Revised Master Plan for Bengaluru (RMP 2041; yet to be prepared) is a valuable opportunity to set ambitious targets and embed a TOD-based city growth strategy for achieving them. Although population and job densities vary across any network, potential or minimum density guidelines (at the corridor, zone, and scheme levels) could be specified, based on the typology of station areas. For instance, Bengaluru could aim to match Hong Kong, where over three-fourths of the population and jobs are within 1,000 m of a transit station, with a network of under 210 km and peak central city job densities of about 120,000 jobs per sq. km. Ninety percent of motorized trips in the city are by public transport (Salat and Ollivier 2017).

**Achieving the desired goals entails bringing transit near jobs and vice versa.** Transit networks should be strategically extended to connect existing and emerging economic subcenters in the metropolitan area and beyond. Our findings point to the market demand: service enterprises tend to locate in livable mixed-use neighborhoods and cluster near the metro, and manufacturing enterprises tend to move to industrial areas in the city's periphery and satellite towns in the region. This corroborates other research and confirms the need for rationalizing transit-network and station-location planning. It suggests that future metro alignments and stations should respond to and capture disconnected high-density service-job clusters, for example, between Indiranagar-Koramangala-Dairy Circle and Sarjapur Road. However, predominantly manufacturing-job clusters in nearby towns such as Nelamangala, Bidadi, Attibele, or Hosur outside the BMA may benefit more from connection to the suburban rail network, which would improve access for a regional workforce and goods movement.

The master plan should also identify and prioritize well-connected areas served by mass transit for job-density increase, including existing and emerging clusters and new locations. Examples of such areas are larger sites of old or defunct industries; select unutilized, underutilized, or dilapidated portions of industrial estates; PSU townships; public-owned properties or defense establishments; newer SEZs; and greenfield areas leading to, and around, the international airport.[26] This, however, requires an assessment of TOD Zone typologies (considering existing job densities and other local characteristics), public transport accessibility and TOD readiness levels, and a city-scale comprehensive redevelopment program and phasing strategy.[27] A place-based economic geography and TOD approach can help strategize job-density distribution along transit networks and strengthen the city's polycentric model of economic development.

**Contextual TOD plans and differential regulations are needed to guide jobs growth along transit.** RMP 2041 should help prepare corridor- and zone-level TODPs that consider the unique context (development potential and carrying capacity) of each station area or cluster. These plans would include, among others, strategies for land-use zoning, environmental and circulation networks, multimodal integration, parking management, affordable housing, public amenities, and urban and landscape design. Designating and planning certain TOD Zones as "urban or employment centers and innovation districts" can create more space for industrial or commercial enterprises and emerging start-ups in a regulated manner. For example, Arlington, United States, developed sector plans for transit corridors, prioritizing infrastructure and amenity improvements in station areas to support higher job densities and housing, and revitalize struggling commercial areas. Johannesburg, in South Africa, tapped into the local entrepreneurial ecosystem by supporting start-ups and smaller businesses around station areas, accelerating economic growth along the transit corridor (Appendix H, Figures H-1 and H-2). Differential and flexible development regulations for TOD Zones that help achieve TOD objectives while responding to different contexts and needs, such as balancing market demand and community goals, should be incorporated into the RMP. For instance, they should help preserve heritage and eco-sensitive areas or traditional economies/markets where needed and control the number and nature of enterprises that can come up, particularly in brownfield areas, where contextually appropriate redevelopment is vital. Regulations should also speak to TODP principles for inclusive development (jobs and affordable housing across socioeconomic classes), horizontal and vertical mix of uses, and zoning restrictions for warehouses, heavy manufacturing, or hazardous industries in certain areas.

**Location-efficient incentives can help achieve TOD objectives and city-level accessibility targets.** They also encourage a paradigm shift from "distant–disconnected–dispersed" to "compact–connected–coordinated" development, supported by transit and allied infrastructure. The TODP promotes strategic and optimal densification in TOD Zones through higher FAR incentives holistically aligned with the city's growth strategy. Other policies can stipulate that new economic zones, or projects over a certain size, or those receiving government subsidies should be accessible by public transit. For example, the Danish Planning Act 2007 requires most new offices with an area over 1,500 sq. m to be located within 600 m of a railway station (Salat and Ollivier 2017). By offering additional development rights or fee/tax cuts preferentially to businesses locating in economically depressed areas or near transit and providing equivalent access, affordable housing, or other public amenities, location-efficient incentives can create opportunities and livable environments for low-income workers. Integrating economic development, affordable housing, and TOD policies is crucial. Figure H-3 in Appendix H highlights examples of location-efficient financial incentives used in the United States.

## Enabling higher-density development around transit

Densifying and revitalizing metro-station areas would require enabling regulatory frameworks, apart from infrastructure upgrades and placemaking. Targeted local actions can help attract businesses and talent locate in these areas. The compliance requirements of most international companies sometimes preclude retrofit and adaptive reuse of buildings, necessitating redevelopment.

**TOD regulations should incorporate enabling provisions and incentives for land assembly/amalgamation and development, considering development-related, monetary, legal, and procedural aspects.** Regulations should also be suitably rationalized to allow utilization of the higher FAR incentives, while providing or augmenting supporting infrastructure and amenities, by relaxing setback and ground coverage norms without compromising on light, ventilation, and fire safety aspects. Bengaluru's parking and TOD policies call for lowering parking requirements in TOD Zones and making part of it shared, including for large industrial and business parks. The government must also ensure timely development of public infrastructure in station areas to match demand, according to the TOD Zone Plans. In India, the city of Ahmedabad has used Town Planning Schemes and Local Area Plans to facilitate planned and serviced development in greenfield and brownfield contexts (Appendix H, Figure H-4).

**High-quality walking and cycling infrastructure and multimodal integration at station hubs[28] is essential for improving safe access to transit and other destinations in the TOD Zone (within 1 km), apart from enhancing the public realm.** Large industrial and business parks can have direct walkway connections to nearby metro stations, which is being implemented in a few locations in Bengaluru as a part of joint station development schemes.[29] Market areas and "priority streets"[30] can be identified for pedestrianization or traffic calming and, with other major streets in the station area, improved based on the TenderSure design guidelines, as has been done in the CBD. Organized street-vending and parking zones would aid informal-sector integration,[31] improve public safety, and ease movement for all road users. However, right pricing and limiting on- and off-street parking is key to encouraging a shift to public and active transport modes.

Interventions in the public realm should focus on "placemaking" (Moreira 2021), which supports local economic development, businesses, and social life, boosting real estate values and demand and aiding neighborhood revitalization and livability. Placemaking in prime locales or densely developed inner-city areas may require underground metro lines, which would free up and enhance public space at the ground level and mitigate issues related to visibility and aesthetics, privacy, blockage of light, and noise pollution for businesses along the route. For instance, in Portland, United States, the streetcar network and placemaking strategies have successfully transformed neighborhoods into high-density, mixed-use areas (Appendix H, Figure H-5).

**With the lion's share of the mapped jobs currently lying beyond a 500 m walk from metro stations, safe, efficient, and affordable feeder services (particularly in the 1–3 km range) are crucial for improving accessibility between workplaces and transit.** Providing reliable public bus services and enabling the private sector to deliver other shared mobility services will be key to bridging the first- and last-mile connectivity gaps. Public agencies; industry, trade, and company associations; and large businesses can offer options such as smaller electric buses[32] and autos, carpooling, or bicycle sharing for transit access. Low-cost but reliable bus and shared auto services are especially needed in industrial areas for factory workers and staff.

**Public agencies can explore various funding mechanisms for service and infrastructure upgrades around metro stations.** Apart from conventional revenue sources, the GoK is considering various transit-induced LVC financing instruments such as betterment levies or a cess,[33] premium FAR, and parking charges. It is, however, unclear how LVC revenues will be shared and utilized among concerned agencies. TOD Zones should be designated "Benefit Districts" so that part of the revenue generated is ring-fenced to transit-system and station-area improvements, as done in several other cities (Salat and Ollivier 2017). Another option for infrastructure delivery is public-private partnerships (PPPs), which provide better efficiency and risk-reward sharing than traditional methods relying solely on public provision. For example, Sydney, Australia, used PPP to put in place a light rail line to enhance access to the CBD (Appendix H, Figure H-6).

To boost its non-farebox revenues, Bangalore Metro Rail Corporation Limited (BMRCL) is renting space on its premises for retail and advertising, leasing other properties to commercial ventures, and jointly developing stations with corporates under PPP schemes. Development and self-utilization of its properties can also help BMRCL save on rental costs (Dhindaw et al. 2021). Apart from LVC, these rail-plus-property development models provide an excellent opportunity to increase job densities near metro stations. Transit or other public agencies owning land parcels nearby can develop them as catalytic or lighthouse TOD projects.

## Institutional arrangement for coordinated action

In 2022, the GoK passed the Bengaluru Metropolitan Land Transport Authority (BMLTA) Bill to constitute an authority with statutory powers for regulating and coordinating urban mobility initiatives in the BMA and driving land use–transport integrated planning in coordination with the planning authority. The DULT has been made responsible for delineating TOD Zones and preparing TOD Zone Plans, to be taken up in accordance with the TODP in a phased manner (DULT 2022a).

TOD-led revitalization of areas along the metro affects the interests of multiple stakeholders, including public agencies, citizens, landowners, developers, the business community, potential investors, and financing institutions. To ensure that all parties' needs are considered, the government should adopt an inclusive planning approach. For example, it can designate an anchor agency (e.g., the DULT or BMLTA) to coordinate planning and implementation activities related to constructing transit lines, preparing TOD plans, upgrading infrastructure, and easing access to land for public and private developers. It can also institute a robust, time-bound appraisal and approval process for TOD projects and schemes by updating government databases and establishing streamlined, tech-enabled single-window clearance systems.

Further, the agency can encourage collaboration among stakeholders for transit-oriented property development and jobs growth near stations. These efforts can include promotion of emerging and small-scale local economies.

## Knowledge gaps and future research

Our study looks at a subset of formal jobs in Bengaluru to assess job proximity relative to its metro network and examines how policy and planning can bring large employers closer to the metro. Future research could cover job accessibility via all modes of public mass transport—metro, suburban rail, and bus networks (current and proposed)—disaggregated through a gender lens. Additionally, data on government, institutional, and informal-sector jobs could be included to provide a more complete picture.

Our analysis is limited to broadly classifying enterprises by sector (manufacturing and service sectors) and size (large and small). Future assessments can focus on certain types of enterprises and their location choices relative to mass transit, for instance, labor-intensive or other manufacturing; traditional, modern, or social-amenity-related services; large- or small-footprint enterprises; and those with full-time or part-time contractual workers. Such analysis can help tailor mass transit and location preferences by enterprise type across regions, particularly in relation to the crucial housing–workplace nexus in the city.

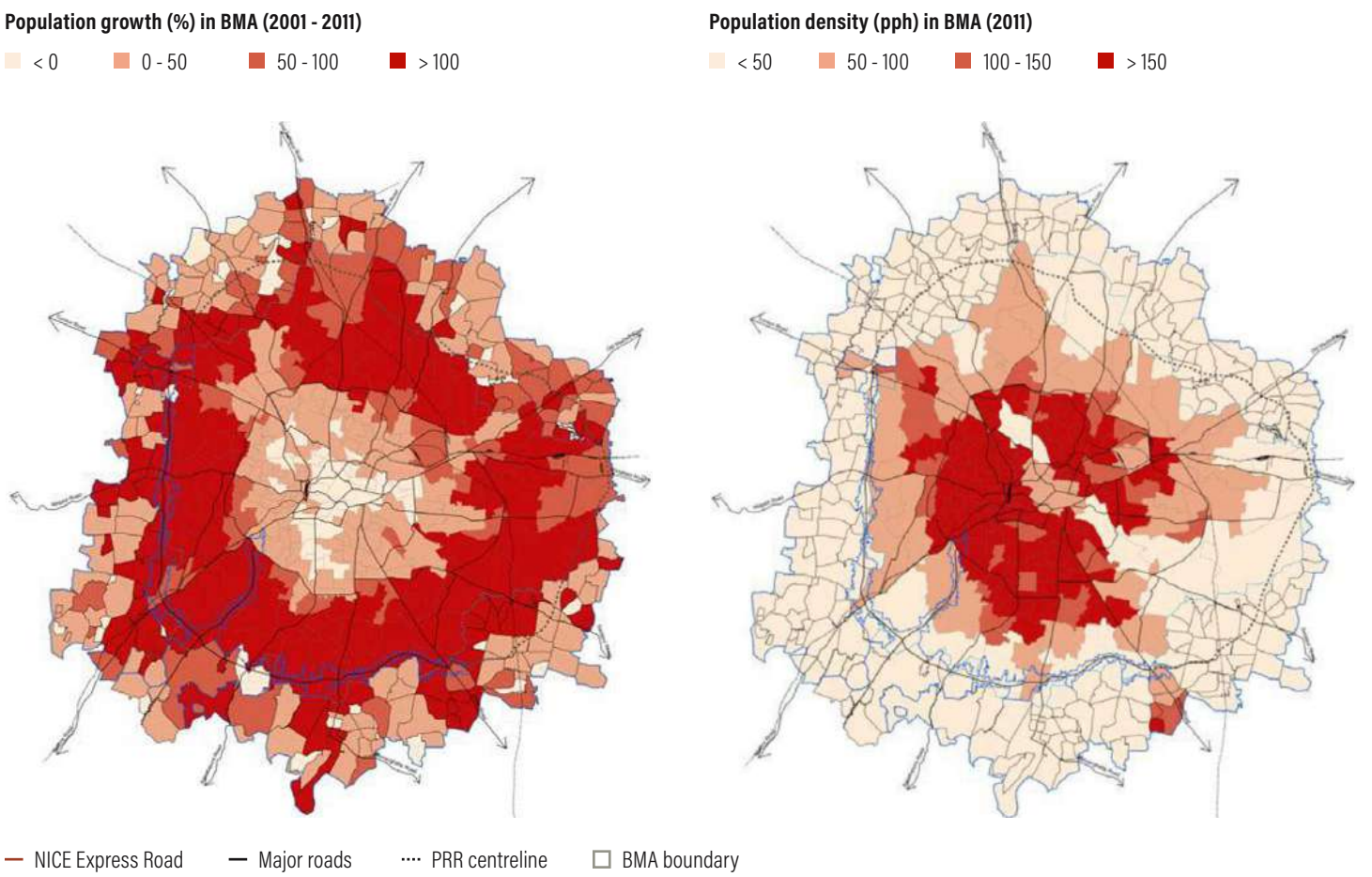
Going forward, a combined analysis of population and job densities across the city can be undertaken to inform not just the planning and phasing of transit networks but also TOD typologies and strategies in Bengaluru. Future studies can explore linkages across formal and informal jobs and associated development, which is integral to cities such as Bengaluru in the Global South, because TOD policies should also address the informal sector's issues.

With suitable time-series data, spatiotemporal analysis can explain how job locations and densities evolve as the metro and other transit networks expand in Bengaluru. This can also help examine the impact of policies, incentives, and transport infrastructure (roads and transit) on shaping the city's economic geography over time.

# APPENDIX A. POPULATION GROWTH RATE AND DENSITY IN BENGALURU

In the 2001–11 decade, the city core saw negative population growth, while most areas beyond the Outer Ring Road (ORR) recorded significant positive growth rates of over 100 percent. By 2011, the population within the ORR was almost the same as that beyond it in the Bengaluru Metropolitan Area (BMA), although inner-city areas still had the highest population densities of over 150 persons per hectare (pph) (BDA 2017) (Figure A-1).

Figure A-1 | **Population growth and densities in Bengaluru, 2011**




*Note:* pph = persons per hectare; NICE = Nandi Infrastructure Corridor Enterprises; PRR = Peripheral Ring Road; BMA = Bengaluru Metropolitan Area.

*Source:* Census of India Handbooks and Master Plan Analysis, 2014-15, cited in BDA (2017).

# APPENDIX B. BENEFITS OF INCREASING JOB DENSITIES NEAR TRANSIT THROUGH TRANSIT-ORIENTED DEVELOPMENT

## Research and evidence from literature review

Several studies point to the high economic, social, and environmental costs of urban sprawl and the benefits of compact growth and public-transport-oriented cities (Litman 2015; NCE 2018; OECD 2018; Mahendra and Seto 2019; Zubicaray et al. 2021).

An increase in density around transit is known to be positively associated with an increase in transit ridership and a decrease in vehicle kilometers traveled (Frank 1994; Circella et al. 2014; PSRC 2015; Litman and Steele 2024). Workplace proximity to transit and employment density increase ridership more effectively than does residential density (Kolko 2011; Raisz and Fitchen 2022). Ridership gains from higher density are substantial, especially when jobs are concentrated within a quarter mile (400 m) of a transit station and housing is concentrated within a half mile (800 m) (Cervero and Guerra 2011).

Density also fuels productivity. Studies show that when job growth is clustered around transit, it creates agglomerating effects that foster innovation, increase economic productivity, and boost a region's competitiveness, more than when job growth is dispersed (Crescimano et al. 2012; Shearer et al. 2019; Raisz and Fitchen 2022). A doubling of job densities was found to enhance economic productivity by 5–10 percent in metropolitan areas (Salat and Ollivier 2017).

Growth in the most well-connected and accessible areas generates the largest increases in national productivity. For instance, Inner London, with the highest concentration of jobs, generated 66 percent of the city's total gross value added (GVA) in 2021 (Centre for London 2023). Inner London's GVA per hour worked is nearly 1.9 times higher than the United Kingdom's average (ONS 2021). Productivity per job in the "Square Mile" is twice that of Greater London and triple that of the United Kingdom.

Canary Wharf in central London is a good example of what high job densities supported by public transport can enable. In this case, derelict port land was transformed into a thriving business district with over 150,000 very high-value jobs, where over 85 percent of the people working in the area use public transport. So, although jobs and GVA increase, per capita fuel consumption and emissions decrease. Enabling the shift to public transport, however, requires a bundle of strategies, aligned government and company policies, and disincentives and incentives to work together (WRI India 2022).

Several world cities that have adopted transit-oriented development and compact growth strategies have managed to accommodate a substantial proportion of jobs and population near transit. Data from 2013 show that in London, 67 percent of jobs and 53 percent of residents were within 1 km of a transit station. In New York, these numbers were 58 percent and 48 percent, respectively. Peak job densities in these city centers were about 150,000 jobs/sq. km (LSE Cities 2013).

Hong Kong is a standout example, where 84 percent of jobs and 75 percent of residents were within 1 km of a transit station, with a network length of only 210 km. The city has one of the highest levels of transit use (90 percent of motorized trips) and one of the lowest levels of car ownership (56 cars per 1,000 people, compared to an average of 404 in OECD countries). Hong Kong's GVA per capita increased by 50 percent between 1993 and 2011, while fuel consumption and carbon emissions per capita decreased by 10 percent. Moreover, the transit agency's rail-plus-property development model brought in HK$140 billion in revenues between 1980 and 2005 and unlocked land for 600,000 public housing units (Salat and Ollivier 2017).

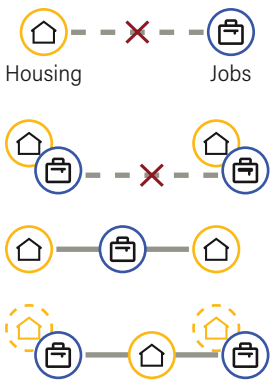
Improving access to job opportunities through high-quality transit and pedestrian and cycling infrastructure can in turn enhance worker productivity (Deb and Kidwai 2020) and, potentially, workforce participation (Sanchez 1998), especially among women, who are primarily dependent on, and predominant users of, public transport across Indian cities (Shah et al. 2017; Tayal and Mehta 2021; WB 2022). Together, these effects can trigger revitalization of station neighborhoods and further increase densities along transit corridors, which in turn could translate to revenue growth for public transport providers through increased ridership and land value capture and for other public agencies through taxes and fees, which can be a sustainable source of finance for reinvestment in public goods and services.

A recent study that estimated the gains from increasing floor area ratio provisions around metro stations in Bengaluru found a positive impact on population and job densities, metro ridership, property values and taxes, and jobs and wages, along with a reduction in travel times and emissions (ADB 2022).

## Box B-1 | Job accessibility via transit

Past studies in Bengaluru suggest that if access to jobs by public transport is poor, people tend to locate near their workplaces or use personal vehicles (Sudhakaran et al. 2017; Sridhar 2020), leading to four possible scenarios (see Figure B-1-1).

FIGURE B-1-1 | **Configurations of jobs, housing, and transit connections**




**No transit between jobs and housing locations:** Increased use of personal vehicles and associated adverse impacts. Those who cannot afford personal vehicles lose out on job opportunities.

**People move closer to where jobs are:** Without transit connecting jobs, people have poor access to other job opportunities.

**Transit between jobs and housing locations:** Reduced use of personal vehicles for daily work commutes, making the city safer, healthier, and more productive.

**High-density job and housing locations connected by transit:** Commuters can reside anywhere along the corridor and be connected to more job opportunities.

*Source:* WRI India authors.

## Box B-2 | Real estate trends in Bengaluru's metro-station areas

As Phase 1 metro lines were approved and progressively operationalized since 2011, areas along these lines, particularly well-planned central and inner-city neighborhoods, have seen a surge in real estate development and values. Although property prices and rents increase year on year across the city, the uptick has been higher near metro stations. Commercial development has increased, with older buildings being retrofitted or redeveloped into larger, higher-end residential or commercial properties, replacing smaller, modest residences or shops that catered to the middle classes. Similarly, older industrial estates have also been transforming due to market forces and real estate demand, further catalyzed by the metro system. A case in point is the mill land behind KSR City Railway Station and Yeshwanthpur Industrial Suburb, where factories have been winding down and relocating to peripheral industrial areas, with property owners looking to capitalize on the value of their land assets. These larger land parcels are being redeveloped as office, commercial, or residential complexes and mixed-use developments, especially along arterial and main roads and around metro stations.

*Source:* EMBARQ India 2013; Setia 2014; Chava et al. 2018; Dhindaw et al. 2021; DULT 2022b; MOI 2023.

# APPENDIX C. SECTOR-WISE CLASSIFICATION OF JOBS IN BENGALURU

Based on the nature of their business, service enterprises were further categorized using the National Industrial Classification (NIC) codes and clubbed under three broad subgroups:

- **Technology, finance, and other professional services:** This subgroup includes information, communications, finance, insurance, professional, scientific-technical, and administrative services. It does not include public administration or academic institutions, and individual practitioners.
- **Social amenity and utility services:** This subgroup includes private training and coaching institutes, social work, healthcare, hospitality and recreation facilities, and private service providers for water, sewerage, and waste management, electricity, gas and air conditioning, transportation, and storage facilities.
- **Other services:** This subgroup includes trade, repair, construction, real estate, and other miscellaneous services.

To clarify, the administrative component of a real estate or interior design company is accounted for under "Other Services" and not as an administrative service under "Technology, Financial and Other Professional Services"; and the employee count does not include contracted construction workers. Similarly, miscellaneous services include shared mobility service providers such as Ola and Uber, but only the administrative component and not the drivers associated with these platforms. Miscellaneous services also include enterprises engaged in some form of small-scale manufacturing activity (representing about 1 percent of the total service enterprises in the district and associated jobs).

# APPENDIX D. GEOSPATIAL MAPPING METHODOLOGY FOR BENGALURU URBAN DISTRICT JOBS DATA

## Input data

We received the initial sheets of factories, shops, and commercial establishments data from the Labour Department, Government of Karnataka (LD–GoK), in January 2023.

## Cleaning and processing

The preliminary cleaning of the dataset involved removing duplicate entries and reducing the number of categories based on the nature of the business of the enterprises. We used National Industrial Classification (NIC) 2008 division codes to reduce the 494 categories into 11 classes. We further combined these 11 classes into 4 classes for broader analysis and mapping.

As the factories dataset comprises manufacturing units, we categorized all the 3,900 unique "nature of manufacturing process" entries as "manufacturing sectors." However, the 464 unique "business nature" entries in the shops and establishment dataset are mostly service-oriented establishments. We categorized the business nature of this dataset as follows:

- We categorized the cleaned data with 464 unique business natures into 96 NIC 2008 divisional codes by matching the keywords of "business nature" with the two-digit NIC classification codes.
- Further, we grouped the 96 divisional classifications into 18 "broad activities" per the NIC 2008 manual (guidelines) by matching the keywords of "business nature."
- We reduced the 18 "broad activities" categories to 11 categories by clubbing activities with similar "business nature."
- Finally, we categorized establishments with "business nature" not matching, or unlisted in, the NIC 2008 manual (divisional codes) as "other service activities not elsewhere classified" in the reclassified categories.

We then geocoded the processed dataset using cleaned addresses, which returned the coordinates (latitude, longitude) of each enterprise.

## Quality check for geocoded data

We used a combination of mapped data and spreadsheets to assess the quality of the geocoded addresses. We used random sampling and Postal Index Number (PIN) code matching to filter out the locations to be manually checked and modified. We extracted and compared PIN codes from the cleaned input addresses and application programming interface (API)-returned addresses, which led to three classes:

- TRUE: PIN codes matched.
- FALSE: PIN codes did not match.
- N/A: One or both addresses did not have any PIN code.

We assumed the FALSE category while reducing the number of coordinates to be manually checked, as follows:

- *Neighborhood name matching.* We filtered out addresses containing the following neighborhood names in the cleaned addresses: Whitefield, Jayanagar, Banashankari, Indiranagar, Peenya, JP Nagar, Halasuru, Attiguppe, Baiyappanahalli, and MG Road. We then matched these names in the API-returned addresses, which resulted in two classes:
  - TRUE: Area names matched.
  - FALSE: Area names did not match.

  Disclaimer: Some area names have different boundaries from those reported by Google; for example, JP Nagar 7th phase and Arekere, Whitefield, and Kadugodi. Therefore, some addresses that were correctly geocoded may come under the FALSE category.
- *Stratified sampling based on the number of employees.* We selected factories (with over 200 employees) and shops and commercial establishments (with over 500 employees). Then we used a combination of PIN code and neighborhood name matching to further reduce the sample size for manual checks.

## Accuracy assessment

We took samples from the following areas for accuracy assessment: Whitefield, Koramangala, Peenya, Indiranagar, and Bellandur/Varthur. We filtered the samples spatially using the query AND and the operator ILIKE in Quantum Geographic Information System (QGIS). For example, the following query would return features with employee count greater than 200 and cleaned address having the string "whitefield" irrespective of the case: "Total No">=200 AND "cleaned_ad" ILIKE "%whitefield%".

Extrapolating the accuracy numbers for the entire dataset (all factories, shops, and commercial establishments) at the neighborhood level:

- Factories: 6,000/6,921 = 86.6 percent
- Shops and establishments = 175,512/213,416 = 82.2 percent

Extrapolating the accuracy numbers for the entire dataset for employee count greater than 200 (factories) and employee count greater than 500 (shops and establishments) at the neighborhood level:

- Factories: 649/662 = 98 percent
- Shops and establishments = 1,017/1,089 = 93.4 percent

## Definition of service areas

We defined service areas or access sheds to analyze how many jobs are accessible from the metro network based on the TOD Zone classifications, per the Bengaluru TOD Policy 2022.

### TOD subzones

- **Core TOD Zone:** A distance of up to 500 m from the metro station. This assumes a walking speed of 5 kmph.
- **Standard TOD Zone:** A distance of up to 1,000 m from the metro station. This assumes a cycling speed of 10 kmph.
- **Feeder Bus Zone:** A distance of up to 2,000 m from the metro station. This assumes a service time of 6 minutes and hence a speed of 20 kmph.

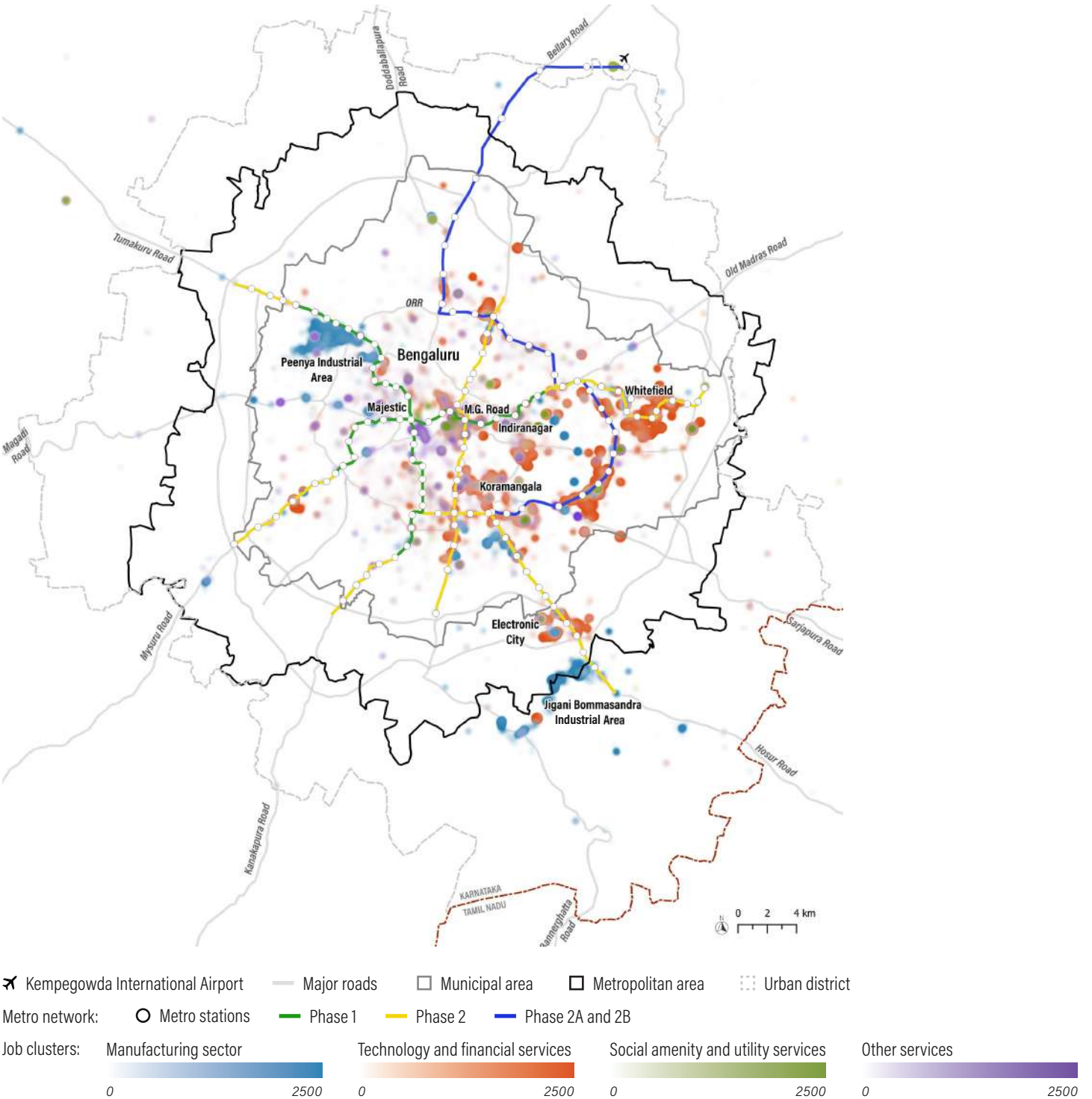
We used the above definitions to generate three access sheds around metro stations, corresponding to 500 m, 1,000 m, and 2,000 m, respectively.

## Data caveats and limitations

- The database used in this study does not cover all the economic sectors. For example, Agriculture, Forest and Fishing, and Mining are a few sectors not currently included in this dataset.
- The geocoding of the establishments depends on the quality of the input addresses and the tool used for geocoding. Some establishments are not geocoded at the exact location and might have neighborhood-level accuracy.
- Derivation of statistics might vary depending on the processing algorithm and platform.

# APPENDIX E. JOB CLUSTERS IN BENGALURU BY SECTOR

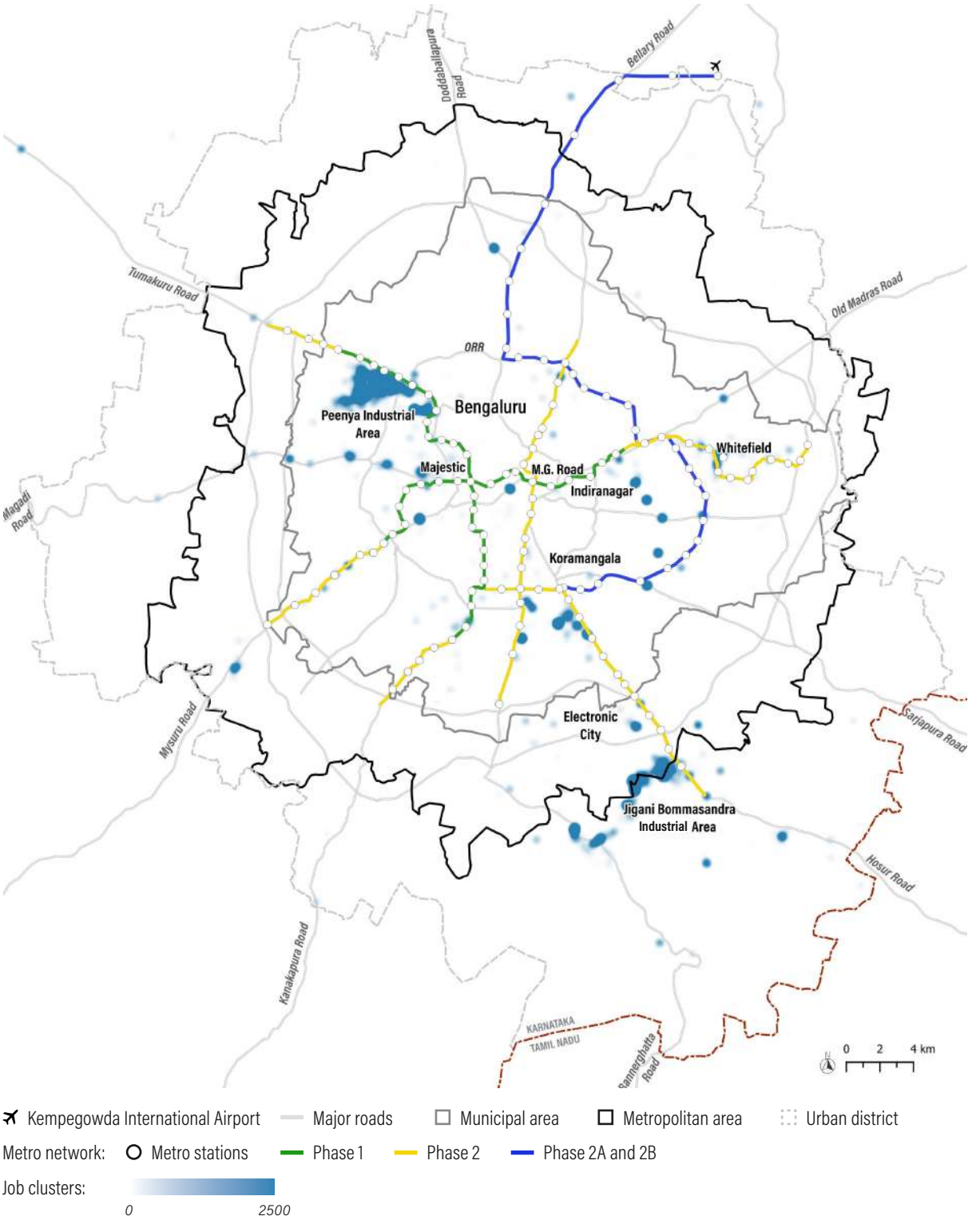
Figure E-1 | **Job clusters in Bengaluru: Sector subclassification**




*Note:* The heat map visualizes sector-wise job clusters using a range from 0 to >2,500, which refers to the number of jobs falling within a 500 m radius.

*Source:* WRI India, using geocoded sector-wise jobs data from LD–GoK as on January 2023; digitized metro network from BMRCL as on May 2023; administrative boundaries from BBMP (municipal corporation), BDA (metropolitan area), and KSRSAC (urban district); and major roads from OSM as on May 2023.

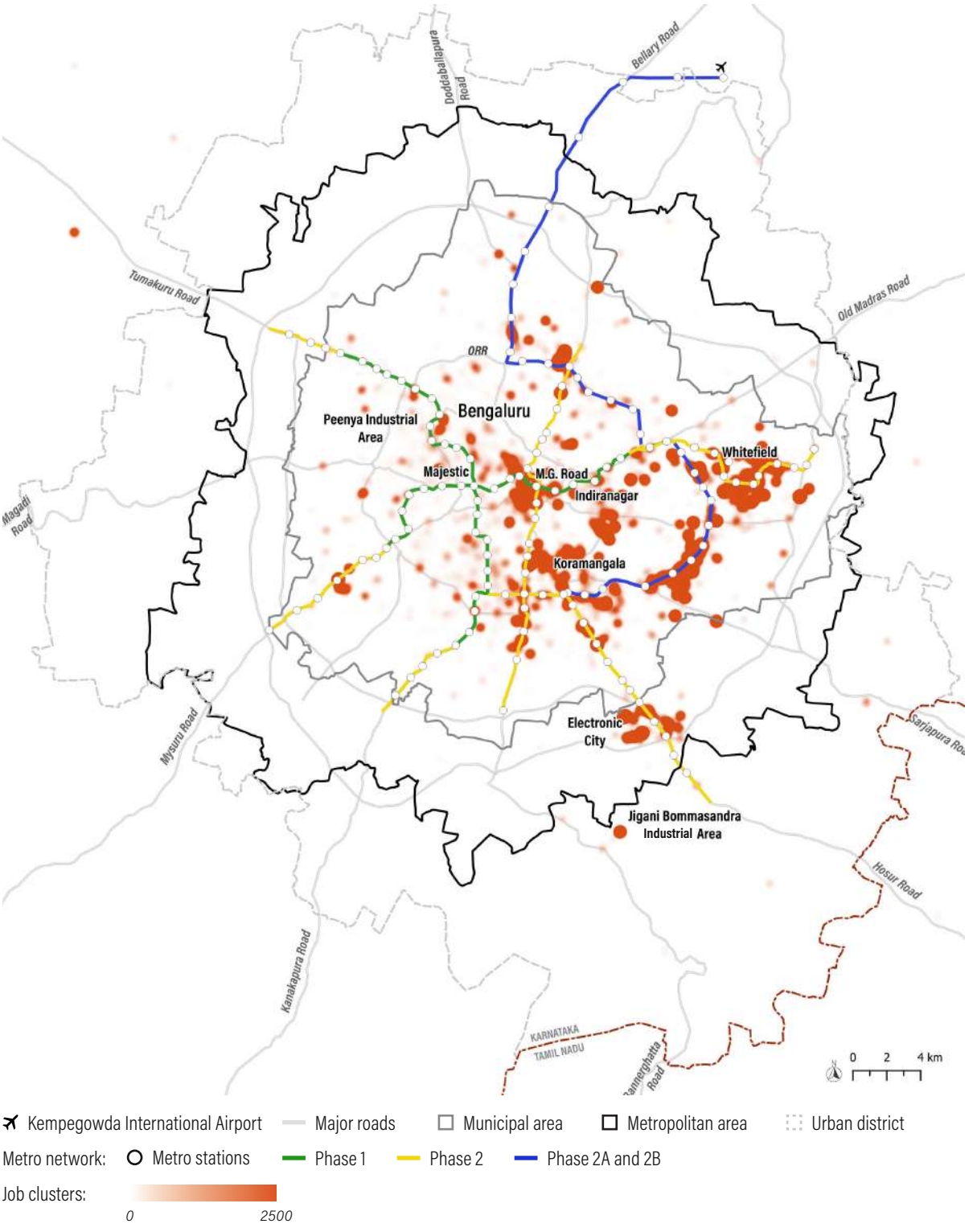
Figure E-2 | **Job clusters for the manufacturing sector in Bengaluru**




*Note:* The heat map visualizes sector-wise job clusters using a range from 0 to >2,500, which refers to the number of jobs falling within a 500 m radius.

*Source:* WRI India, using geocoded sector-wise jobs data from LD–GoK as on January 2023; digitized metro network from BMRCL as on May 2023; administrative boundaries from BBMP (municipal corporation), BDA (metropolitan area), and KSRSAC (urban district); and major roads from OSM as on May 2023..

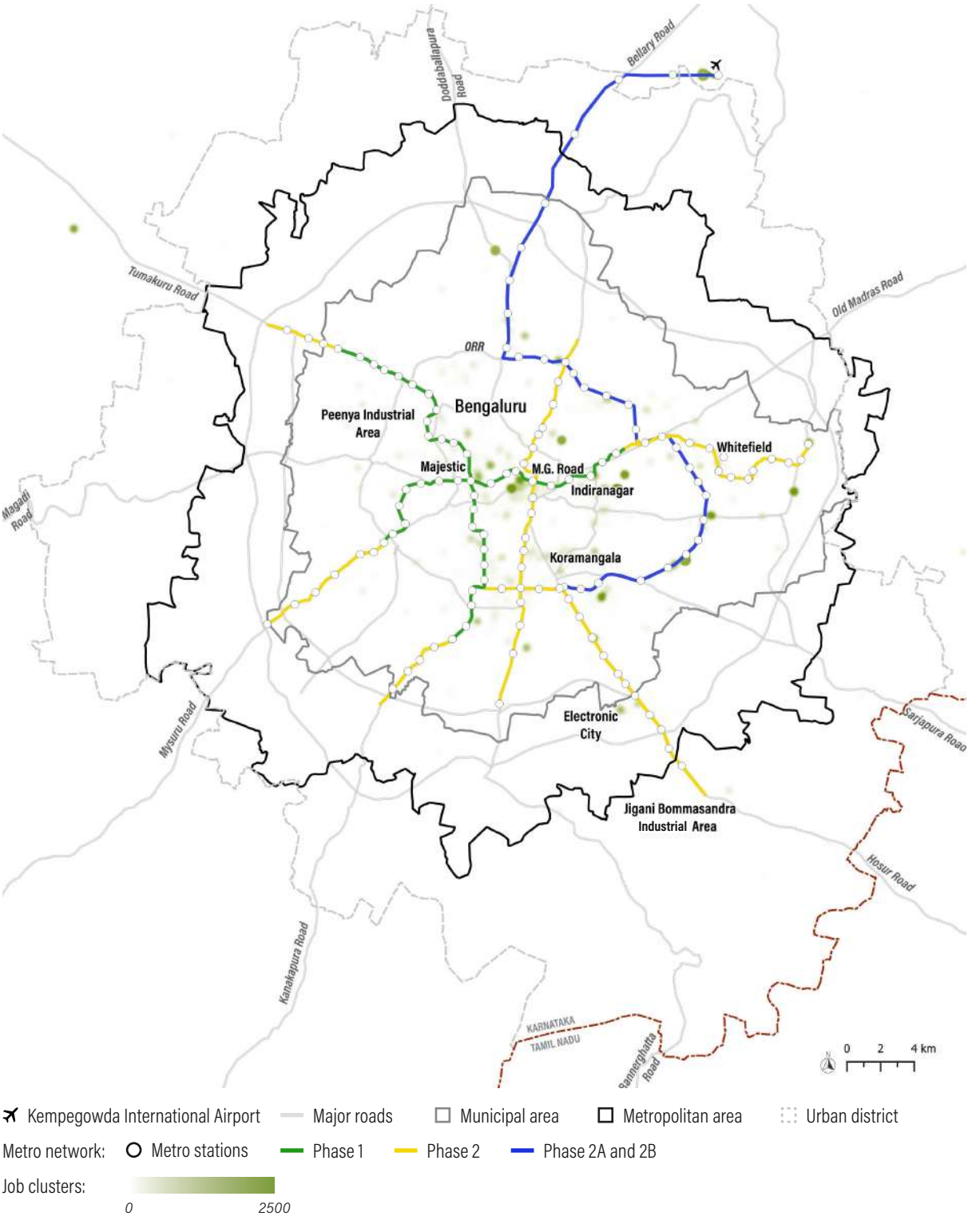
Figure E-3 | **Job clusters for technological, financial, and other professional services in Bengaluru**




*Note:* The heat map visualizes sector-wise job clusters using a range from 0 to >2,500, which refers to the number of jobs falling within a 500 m radius.

*Source:* WRI India, using geocoded sector-wise jobs data from LD–GoK as on January 2023; digitized metro network from BMRCL as on May 2023; administrative boundaries from BBMP (municipal corporation), BDA (metropolitan area), and KSRSAC (urban district); and major roads from OSM as on May 2023..

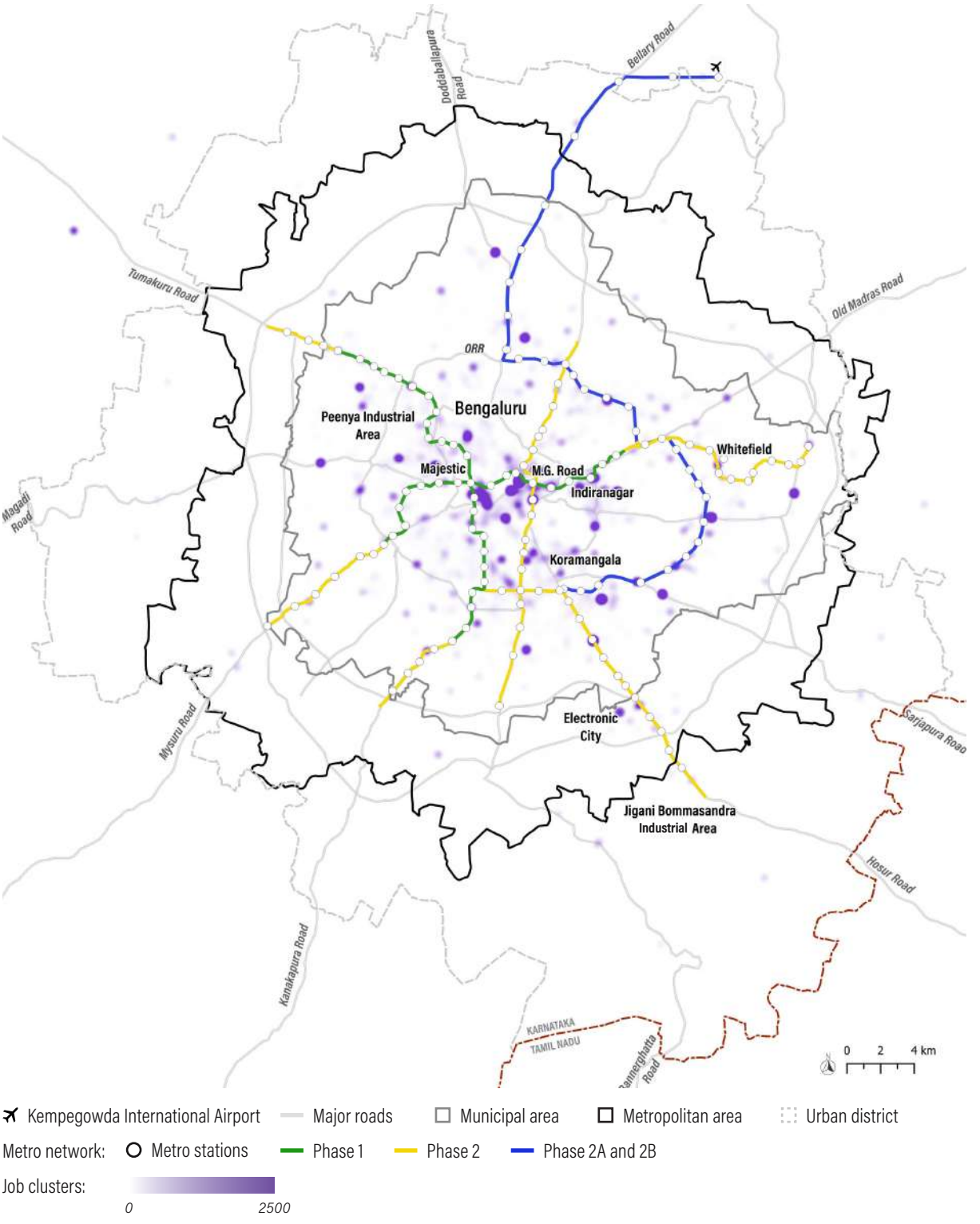
Figure E-4 | **Job clusters for social amenity and utility services in Bengaluru**




*Note:* The heat map visualizes sector-wise job clusters using a range from 0 to >2,500, which refers to the number of jobs falling within a 500 m radius.

*Source:* WRI India, using geocoded sector-wise jobs data from LD–GoK as on January 2023; digitized metro network from BMRCL as on May 2023; administrative boundaries from BBMP (municipal corporation), BDA (metropolitan area), and KSRSAC (urban district); and major roads from OSM as on May 2023.

Figure E-5 | **Job clusters for other services in Bengaluru**

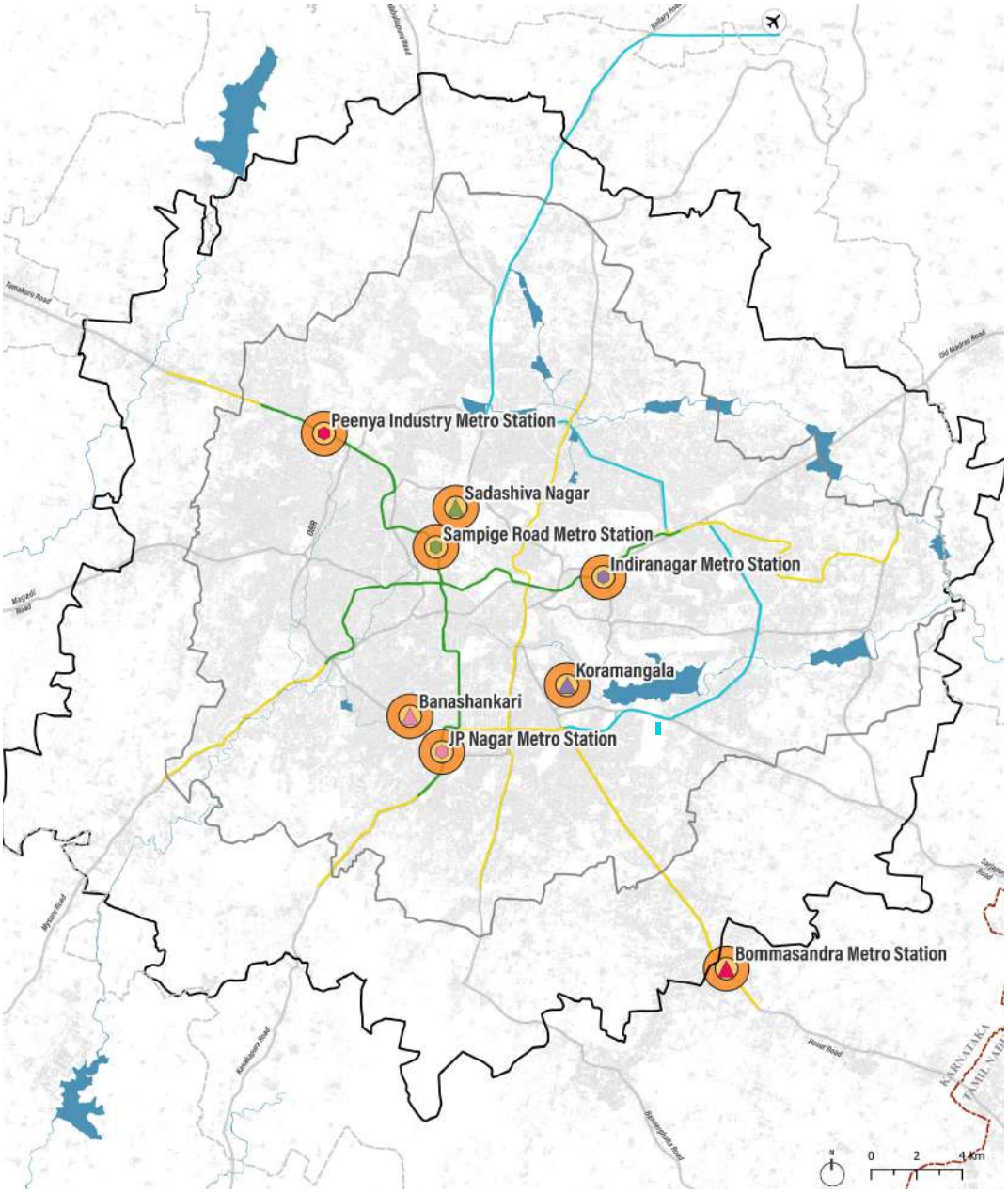



*Note:* The heat map visualizes sector-wise job clusters using a range from 0 to >2,500, which refers to the number of jobs falling within a 500 m radius.

*Source:* WRI India, using geocoded sector-wise jobs data from LD–GoK as on January 2023; digitized metro network from BMRCL as on May 2023; administrative boundaries from BBMP (municipal corporation), BDA (metropolitan area), and KSRSAC (urban district); and major roads from OSM as on May 2023.

# APPENDIX F. INTERVIEW FINDINGS FROM METRO-STATION AND NON-METRO-STATION AREAS

Figure F-1 | **Metro-station and non-metro-station area pairs**




Kempegowda International Airport  Major roads  Municipal area  Metropolitan area  Urban district

Metro network: Phase 1  Phase 2  Phase 2A and 2B  Waterbodies  Settlements  Buffer (meters): 500  1,000

Areas: Koramangala  Banashankari  Bommasandra  Sadashiva Nagar

Metro stations: Indiranagar  JP Nagar  Peenya Industry  Sampige Road

*Source:* WRI India, using built-up data from World Settlement Footprint 2019; digitized metro network from BMRCL as on May 2023; administrative boundaries from BBMP (municipal corporation), BDA (metropolitan area), and KSRSAC (urban district); and major roads from OSM as on May 2023

This section describes the predominant nature of the four paired areas and summarizes the on-ground interview findings (see Figure F-1 and Tables F-1 and F-2).

## Interview questions

1. Jobs/employees associated with your enterprise (approximate values or a range will do)
2. Year of establishment at this location
3. What factors influenced location choice for your enterprise?
    a. commercial/industrial land use of plot
    b. conducive market/business environment and catchments
    c. availability of required space or facilities
    d. affordable property prices or rents
    e. metro
    f. other reasons
4. Is this an ideal location for the enterprise? If not, where would you ideally locate in the city—any other considerations or requirements (other than mentioned above)?
5. Do you own/lease/rent the property?
6. In your view, what benefits does the metro give your enterprise or employees, and conversely, what challenges does it pose?
7. Please share a guesstimate, if possible, on what percentage of your staff/visitors/customers may use the metro once it becomes operational?
8. How have the surroundings and real estate market changed since the metro was approved and construction began (land/building uses, property prices/rents, type, and scale of development, etc.)?

Table F-1 | **Industrial areas: Manufacturing enterprises**

| | METRO-STATION AREA: PEENYA INDUSTRY (SIX INTERVIEWS) | UPCOMING METRO-STATION AREA: BOMMASANDRA (SIX INTERVIEWS) |
|---|---|---|
| **Metro-station details** | Metro station is along Phase 1 Green Line, operationalized in 2014–15 | Metro station is along Phase 2 Yellow Line, expected to be operationalized by 2024 end |
| **Details of area** | ▪ Peenya Industrial Complex is the biggest and oldest industrial area in Southeast Asia.<br>▪ Developed in the early 1970s by the Karnataka Industrial Areas Development Board (KIADB) and the Karnataka Small Scale Industries Development Corporation (KSSIDC).<br>▪ Spread over 40 sq. km, the area currently houses over 10,000 industries and 500,000 workers, the majority being micro, small, and medium enterprises (MSMEs) in the manufacturing sector.<br>▪ Connected to the city through Tumkur Road (NH4) and the Outer Ring Road (ORR); served by public buses and the metro line along Tumkur Road. | ▪ Bommasandra Industrial Area is one of the oldest in Karnataka state.<br>▪ Developed in the late 1970s by KIADB and partly by KSSIDC.<br>▪ Spread over 10 sq. km, the area currently houses over 5,000 industrial units with 500,000–600,000 workers, the majority being MSMEs in the manufacturing sector.<br>▪ Connected to the city through Hosur Road (NH7) and NICE Road; served by public buses, and the upcoming metro line along Hosur Road. |
| **Average employee numbers for type of enterprise** | ▪ Wholesale shop: 5<br>▪ Small–medium enterprises: 15–50+<br>▪ Large enterprise: 450+<br>▪ Training institute: 40 staff, 200+ students | ▪ Medium–large enterprises: 50–200+<br>▪ Large hi-tech enterprise: 1,400+ |
| **Year of establishment** | ▪ Most enterprises were established 5–8 years ago, after metro line operationalization.<br>▪ Medium-sized enterprises were established 15 years ago, relocated from Yeshwanthpur Industrial Suburb.<br>▪ Large enterprises along the highway were established 48 years ago, soon after the area was developed. | ▪ Medium-sized enterprises were established 2 years ago, and most others about 15 years ago.<br>▪ Large enterprises along the highway were established 40 years ago, soon after the area was developed. |

| | | |
|---|---|---|
| **Property owned/ leased/ rented?** | ▪ Most enterprises owned or rented the property. | ▪ Most enterprises owned the property. |
| **Factors influencing location choice** | ▪ Planned, well-developed industrial areas and land uses for factories; commercial land uses along the highway providing access and visibility for enterprises such as shops and training institutes.<br>▪ City/regional connectivity via arterial roads, public buses, and now the metro, improving market or ecosystem linkages and accessibility for commuters.<br>▪ Adequate space and suitable facilities at affordable costs. Most enterprises acquired their plots/properties several years ago at more affordable rates/long-term leases.<br>▪ The metro was not a major location consideration, particularly for enterprises located on inner streets and those that were set up long before it came into the picture. Besides, their suppliers and clients do not use the metro, and most workers and staff live nearby or in surrounding areas (3–8 km). They either walk, use public buses, informal transport (private buses/ tempos/ shared autos), or personal vehicles to commute to work. | |
| | ▪ Specific customer base and catchment (local/city/regional).<br>▪ Personal convenience (near residence) for the shop or safety (near police station) for the training institute. | ▪ Proximity to other industries within an area or to other industrial areas (demand-supply chains). For example, locational advantage of being near Hosur, another large industrial hub. |
| **Ideal location or relocation, and why?** | ▪ Yes; good, established location, and most enterprises did not want to relocate because staff had also moved closer over time.<br>▪ One enterprise preferred to move out to upcoming industrial areas in surrounding satellite towns such as Nelamangala, where a larger, more affordable space may be available.<br>▪ Training institute also has a large 100-acre campus in Nelamangala. | ▪ Yes, good location. |
| **Benefits of operating or locating near a metro station** | ▪ Improved city-level connectivity and accessibility helps enlarge the employee catchment, with the majority managing their own transportation. | |
| | ▪ For large enterprises and training institutes, the metro has helped reduce travel time and stress, easing the commutes of nearly 50% of their staff and students who use it.<br>▪ The metro's service timings (5 AM to 11 PM) and frequency make it a safe and reliable transport mode, enabling people to attend work shifts or classes on time.<br>▪ The metro helps ease the burden on enterprises of constructing housing quarters or hostels for their staff or students. | ▪ Employees who shift to the metro would benefit from time and cost savings in comparison with other travel modes used currently.<br>▪ Estimated that at least 50% of the staff and visitors/customers who travel from the city would use the metro once it becomes operational. (Currently some enterprises provide company bus or cab services and are willing to provide metro passes instead.) |
| **Challenges of operating or locating near a metro station** | ▪ The metro often does not meet the travel needs of factory workers and staff, and fares are also higher than public buses or informal shared paratransit or unaffordable for this income group.<br>▪ Some commuters may shift to the metro; however, end-mile connectivity (good walking/cycling infrastructure) and feeder services are lacking. | |
| | ▪ Property prices and lease/rents are higher closer to the metro.<br>▪ Despite the metro, traffic congestion and parking demand in the area continue to grow, especially along the highway during peak hours.<br>▪ Blockage of sunlight for enterprises near the elevated metro line. | |

| | |
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| **Real estate changes (land uses, prices, type/scale of development)** | ▪ Property values and lease/rents have gone up in the area, especially near the highway and station.<br>▪ No significant change in land use or nature of development observed, especially on inner streets.<br>▪ Manufacturing enterprises are slowly capitalizing (cashing in) on their land assets and shifting to peripheral industrial areas or nearby satellite towns, especially enterprises having space constraints or where manufacturing activity is not as lucrative, making it economically and logistically more viable to move out.<br>▪ Commercial development has increased along the highway and around the metro stations. Some higher-end commercial/ residential development is coming up in Bommasandra and in Peenya, and the demand for warehouses has gone up. |
| **Suggestions** | ▪ Connecting surrounding residential areas, rather than industrial areas, by the metro could increase ridership.<br>▪ The area needs better bus and shared-auto services to cater to the travel needs of factory workers and staff. Smaller electric buses and autos should also be introduced as free or low-cost feeder services, besides good-quality footpaths and safe crossings across the highway to access the metro station. |

*Source:* WRI India authors.

Table F-2 | **Urban areas: Service enterprises**

| | METRO-STATION AREAS: INDIRANAGAR, MANTRI SQUARE (MALLESHWARAM), JP NAGAR (15 INTERVIEWS) | NON-METRO-STATION AREAS: KORAMANGALA, SADASHIVA NAGAR, BANASHANKARI (12 INTERVIEWS) |
|---|---|---|
| **Metro-station details** | Metro stations are along Phase 1 Purple and Green Lines, operationalized progressively between 2011 and 2017. | No metro stations |
| **Details of area** | ▪ Inner-city areas located within the Outer Ring Road (ORR) toward the east, north, and south. | |
| | ▪ Connected to the city through major arterial roads: Old Madras Road (NH7), Platform Road, and Kanakapura Road (NH 209); served by public buses and the metro. | ▪ Connected to the city through major arterial roads: Hosur Road (NH4), Sankey Road, ORR; served by public buses. |
| **Average employee numbers for type of enterprise** | ▪ Offices: 10–70<br>▪ Coaching institute: 500<br>▪ Retail/lifestyle stores: 3–37<br>▪ Eateries: 15–18<br>▪ Bed-and-breakfast (B&Bs) hotels/ homestays: 4–6 | ▪ Offices: 15–40<br>▪ Coworking spaces: 85–400<br>▪ Retail/lifestyle stores: 3–14<br>▪ Eateries (and those attached to lifestyle stores): 30–40<br>▪ Medical facility: 60 |
| | *Note:* Although employee numbers for retail/lifestyle stores and amenities, eateries, and budget stays are lower than for offices/coworking spaces and coaching institutes, they cater to large volumes of customers. | |
| **Year of establishment** | ▪ About half the enterprises were established before or around the same time as the metro lines became operational in the areas (9–70 years ago).<br>▪ The other half were established after the metro began operating (1 month to 8 years ago). | ▪ About half the enterprises were established 12–25 years ago.<br>▪ The other half were established between 6 months and 5 years ago. |
| **Property owned/ leased/ rented?** | ▪ Most enterprises were renting or leasing. Some could afford to continue in the location only because they had a long-term lease. | |
| | ▪ A couple of the owned properties were earlier residential bungalows that were retrofitted or redeveloped into homestays or B&Bs. | |

| | | |
|---|---|---|
| **Factors influencing location choice** | ▪ Prime inner-city upmarket neighborhoods, with established or thriving real estate markets.<br>▪ Well-developed areas with a mix of uses providing the local customer base and catchment (for each other).<br>▪ Employee-centric considerations for office locations included self-sufficient "live–work–play" neighborhoods, with allied services, amenities, and good ambience (peaceful, green).<br>▪ Commercial land use along main roads providing access, visibility, and connection to specific micro-markets (jewelry-wedding, food and beverage, fast-moving consumer goods) was an important consideration for retail outlets.<br>▪ For eateries, retail and lifestyle stores, or facilities, locating within mature commercial clusters and streets, where other brands are also present and customers have a range of options and experiences to choose from, was a major factor.<br>▪ The metro was not a major consideration for some businesses offering high-end products or services, because most of their clientele used personal vehicles; therefore, adequate parking supply was a bigger consideration.<br>▪ Other factors included adequate space/floorplates, availability of on-/off-street parking and good walkable footpaths, or personal convenience (residence nearby). | |
| | ▪ Area well connected by road, bus, and now metro services.<br>▪ Local customer base, with public transport systems extending the catchment area and market or ecosystem linkages.<br>▪ Walkable access to the metro station and bus stops was a major factor, particularly for offices, coaching institutes, B&Bs, and homestays.<br>▪ Good ambience was an important consideration, particularly for B&Bs and homestays, some lifestyle stores, and eateries. Therefore, they preferred to locate on inner, residential streets that were quieter and greener rather than on main commercial roads that were busy and noisy. Many such enterprises were remodeled or redeveloped from residential properties. | ▪ Specific location advantages such as along the airport route or business and ecosystem linkages in particular parts of the city were major factors for offices and coworking spaces.<br>▪ Because these areas are disconnected by the metro network and bus service levels are also inadequate (or poor in some cases), most office staff stay in an 8 km range and rely on personal vehicles to commute.<br>▪ In areas where other key considerations are met or conditions are favorable, the metro is seen as a desirable but not essential factor determining the location choice of certain enterprises.<br>▪ One enterprise pointed out that metro connectivity was a crucial consideration when selecting event venues for hosting large exhibitions with high numbers of visitors. |
| **Ideal location or looking to relocate, and why?** | ▪ Yes, most enterprises were satisfied and did not want to relocate.<br>▪ In case of relocation in the future, they would choose a similar area and within a walkable distance from a metro station.<br>▪ Though leases and rentals have gone up, enterprises weigh the cost versus benefits and would not relocate if other important considerations are met and continuing in the location remains economically viable. This is particularly true for larger or established businesses that have been in a certain location for a long time and acquired their properties at affordable prices or leases. | ▪ Most felt it was a good location, though the lack of adequate parking was a challenge or concern for some.<br>▪ Some said that prime central areas where most other big players in the business were present would be a more favorable location for them, or that relocation would depend on the business strategy.<br>▪ Newer enterprises felt that their customer base would grow over time as awareness of their presence grew and they were better established.<br>▪ A few businesses that rely on high volumes pointed out that they had opened branches in Indiranagar or Jayanagar given the high demand in these areas, and they did better business on account of the good metro and bus connectivity. |
| **Benefits of operating or moving near a metro station** | ▪ Improved city-level connectivity and accessibility, enlarging the catchment.<br>▪ The metro has brought in people from far-off areas, increasing the floating population and footfall volumes in the station areas, which has benefited businesses, including street vendors.<br>▪ Reduced travel times and eased commutes for many employees, students, visitors, or customers. | ▪ Relocating near metro stations would help both businesses and employees on account of accessibility benefits. It would be easier to attract and retain clients and talent. |

| | | |
|---|---|---|
| | ▪ The metro's service timings (5 AM to 11 PM) and frequency make it a safe and reliable transport mode, enabling people to attend work shifts or classes on time, and catering to customers of malls, eateries, and pubs that remain open late at night. | |
| **Challenges of operating or moving near a metro station** | ▪ Property values and lease/rents are higher closer to the metro.<br>▪ Buildings near the metro line may also experience privacy, noise, and safety concerns from the constant vibration and shocks. | |
| | ▪ Greater commercialization in station areas has led to greater traffic congestion, air and noise pollution, and waste disposal issues.<br>▪ Street-vending activity, intermediate public transport (IPT), and parking demand has also grown, leading to spillover effects on nearby streets. Together with the metro infrastructure, this has eaten into and shrunk road and footpath space, adversely affecting commercial frontage and visibility. | ▪ Market saturation in commercial areas or streets around metro stations and difficulty in finding suitable properties in desirable locations.<br>▪ Community resistance to land-use changes and greater commercialization in residential areas.<br>▪ Highly commercialized areas near metro stations can be noisy and chaotic and may not provide a conducive business environment. In London and New York, the subway is underground. The urban design and ambience of commercial areas and streets add to its value and experience, unlike here in Bengaluru (and other Indian cities), where the metro is largely built overground.<br>▪ For small retailers around and along the metro, business may take a hit, especially during the construction phase.<br>▪ Certain enterprises catering to high-end customers would still need adequate parking supply. |
| **Real estate changes (land uses, prices, type/scale of development)** | ▪ With the operationalization of the metro lines and the progressive expansion of the network, station areas have seen a surge in real estate development and values, apart from the lull in Covid-affected years.<br>▪ Although property prices and rents increase year on year across the city, the uptick has been higher near metro stations.<br>▪ Older buildings are being remodeled or redeveloped into larger, higher-end residential or commercial properties (through land-use conversion), replacing smaller, modest houses or shops that catered to the middle classes.<br>▪ Commercial development has boomed, with offices, coworking spaces, retail outlets, eateries, and other allied services are springing up around metro stations and along major roads in the station areas.<br>▪ For instance, Indiranagar is now a "happening" neighborhood that draws people from across the city, and in Malleshwaram, the stretch near the metro station has emerged as a wedding shopping destination for the neighborhood and the larger catchment area. | ▪ Given that these are well-developed and prime inner-city areas, property values have soared over time, and real estate is very expensive.<br>▪ All areas have seen an increase in commercial development to different extents. Although it has been more balanced in Sadashiva Nagar and Banashankari, Koramangala has seen massive commercialization, in turn leading to several civic concerns. Areas and pockets with active, strong, and influential resident welfare associations have managed to keep commercialization at bay. |
| **Suggestions** | ▪ Organize space for physical multimodal integration at and around the metro station for walking, cycling, IPT stands, and parking and vending zones. | ▪ Ideally, the metro rail agency should conduct regular safety audits and checks for buildings along the metro line. |

*Source:* WRI India authors.

# APPENDIX G. LIST OF KEY INFORMANTS AND INTERVIEWEES

J. Thomas. Land development, Bengaluru, January 4, 2020

J. Suma and M. Swamy. Development control and town planning, Bengaluru, January 11, 2020

A. Naik. Commercial development and architecture, Bengaluru, January 17, 2020

Aishwarya and Karthik. Last-mile services and metro, Bengaluru, January 21, 2020

R. Nair. Location preferences of start-up firms and developers, Bengaluru, January 27, 2020

M. Dey. Commercial development, Bengaluru, February 11, 2020

B. Rodrigues. Office space provider, Bengaluru, February 11, 2020

G. Burman. Location preferences of IT firms, Bengaluru, February 14, 2020

P. Subramanya. Typology and location of office spaces, Bengaluru, February 17, 2020

K.S. Girish. Location preferences of international businesses, Bengaluru, March 5, 2020

M. Salimath. Collaboration between academic institutions and local economies, Bengaluru, March 17, 2021

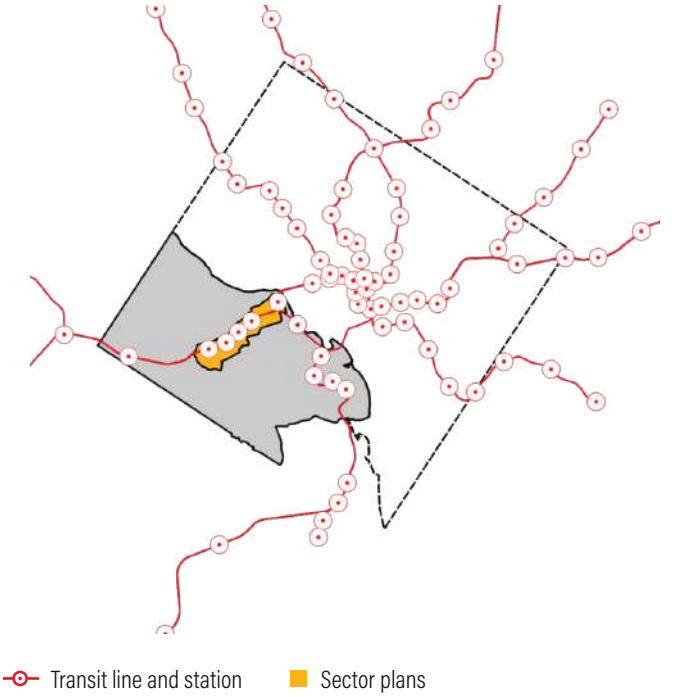
S. Ujjni. Location preferences of innovation hubs, Bengaluru, April 30, 2021

# APPENDIX H. GLOBAL GOOD PRACTICES AND CASE EXAMPLES

Figure H-1 | **Managing growth through densification around transit**

**Arlington, United States:** In the 1960s, the city witnessed a surge of jobs and population growth. **Sector Plans** devised for the Rosslyn-Ballston Corridor:

- Prioritized improving infrastructure/amenities in transit station areas to support higher densities of jobs and housing and revitalize struggling commercial areas.
- **Outcomes** – Growth between 1970 and 2018:
  - Retail space: 3.7x
  - Office space and jobs: 4.2x
  - Housing units: 4.8x
  - 40% residents take public transport to work; 16% do not own a car; average commute time lower than the region's average

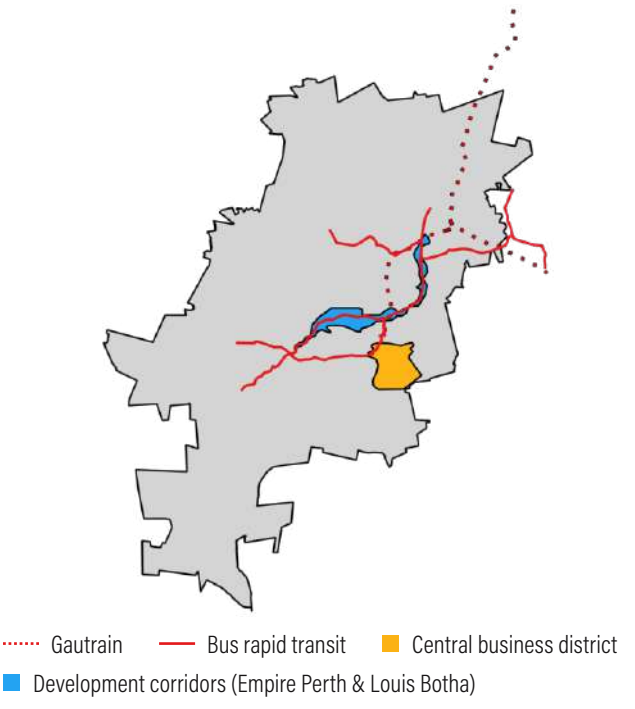



*Source:* WRI India authors, based on Arlington, Virginia (n.d.).

Figure H-2 | **Creating the environment for future employers**

**Johannesburg, South Africa:** The city tapped into the local entrepreneurial spirit of its citizens to support **micro businesses** or **start-ups** that play a positive role in accelerating economic growth in station areas.

- In the Louis-Botha development corridor, residents have opened house shops.




*Source:* WRI India authors, based on JDA (2016).

Figure H-3 | **Providing location-efficient financial incentives**

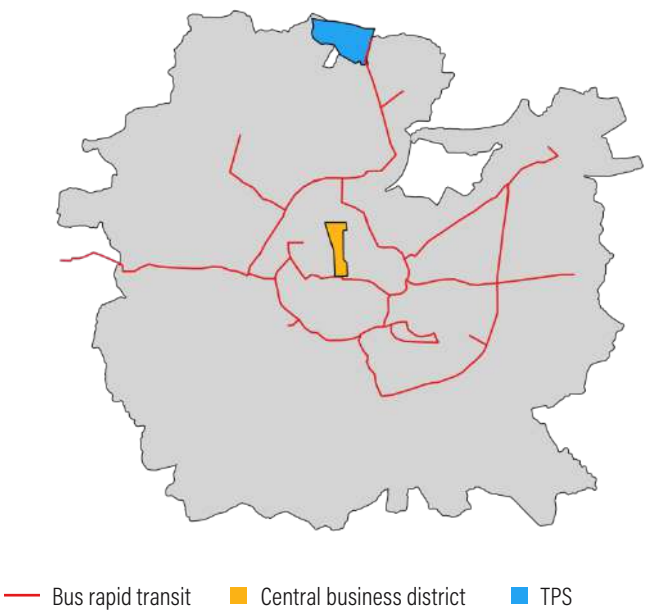
- **United States:** The **Tax Cuts and Jobs Act (2017)** creates "Opportunity Zones" to spur economic growth and job creation in distressed areas. It provides a federal tax incentive to encourage those with unrealized capital gains to invest in low-income communities.
- **Maryland, United States:** The **Smart Growth Areas Act (1997)** states that projects located outside "Priority Funding Areas" (that are served or planned to be served by water and sewer infrastructure) would not be eligible for state infrastructure aid or economic development incentives.
- **Illinois, United States:** The **Business Location Efficiency Incentive Act (2005)** gives additional corporate income tax credit where the job site is accessible by public transport or close to affordable workforce housing.
- **New Jersey, United States:** The **Urban Transit Hub Tax Credit Act (2008)** subsidizes redevelopment within a half-mile of train stations.
- **California, United States:** The state's **Infrastructure and Economic Development Bank** has application standards that strongly favor transit-oriented, higher-density projects. Using a scoring system, the loan program gives preference to projects located in or adjoining developed areas and areas with high unemployment rates or low household incomes.
- **New York, United States:** The New York City Industrial Development Agency's **Uniform Tax Exemption** Policy includes real estate tax discounts for commercial development projects in the Hudson Yards precinct, which is well connected by public transport.

*Source:* WRI India authors, based on Salat and Ollivier (2017), Good Jobs First (n.d.), and TPC (n.d.).

Figure H-4 | **Planning for regeneration and urban extension**

**Ahmedabad, India:** The city has used two statutory mechanisms to facilitate development in greenfield and brownfield contexts.

- **Town Planning Schemes (TPS):** For provision of planned and serviced land for development in outer, new-growth areas.
- **Local Area Plans (LAP):** For regenerating inner-city areas with infrastructure upgrades.
- **Outcomes –**
  - Since 1978, 76 TPSs implemented, 83 prepared, and 48 under preparation. Land procured for low-income housing (33,000+ units) and public infrastructure, with cost recovery mechanisms.
  - LAP being prepared for 70 km of transit corridors, improving TOD indicators.

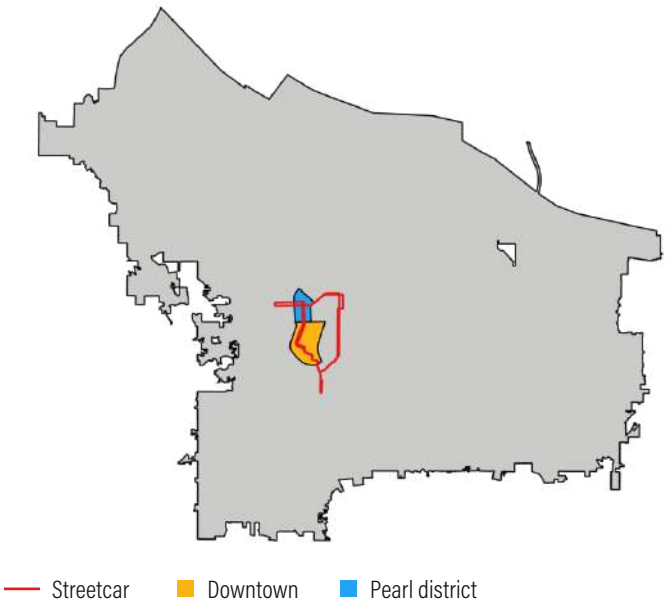



*Source:* WRI India authors, based on AUDA (n.d.), HCP (2015), and Mahadevia et al. (2018).

Figure H-5 | **Attracting private investments along mass transit**

**Portland, United States:** The streetcar network has catalyzed regeneration of neighborhoods into high-density mixed-use districts (e.g., Pearl District). The following steps were taken to attract private investments in the area:

- **City level:** Adopted an "urban growth boundary" to limit development and focus it around transit.
- **Local level:** Implemented "placemaking," i.e., walkable streets, attractive public spaces, cultural facilities, recycling old buildings to maintain character, etc.
- **Outcomes –**
  - Generated investment of $1.3 billion along line
  - Growth in retail space, housing units (30% affordable), jobs, transit ridership, and assessed tax value.

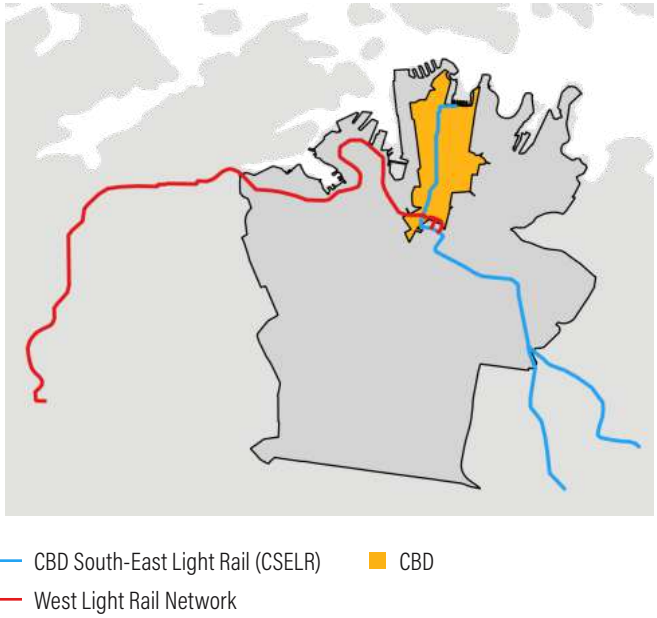



*Source:* WRI India authors, based on Steuteville (2016).

Figure H-6 | **Financing infrastructure through PPP**

**Sydney, Australia:** To enhance access to the Central Business Disrict (CBD), the city implemented a 12 km light rail transit line:

- **PPP model:** Estimated to offset 4% of the $2.1 billion project cost.
- **Responsibilities of private consortium:** Include design, construction, service relocations, operation, and maintenance of the CSELR project.




*Note:* PPP = public-private partnership.

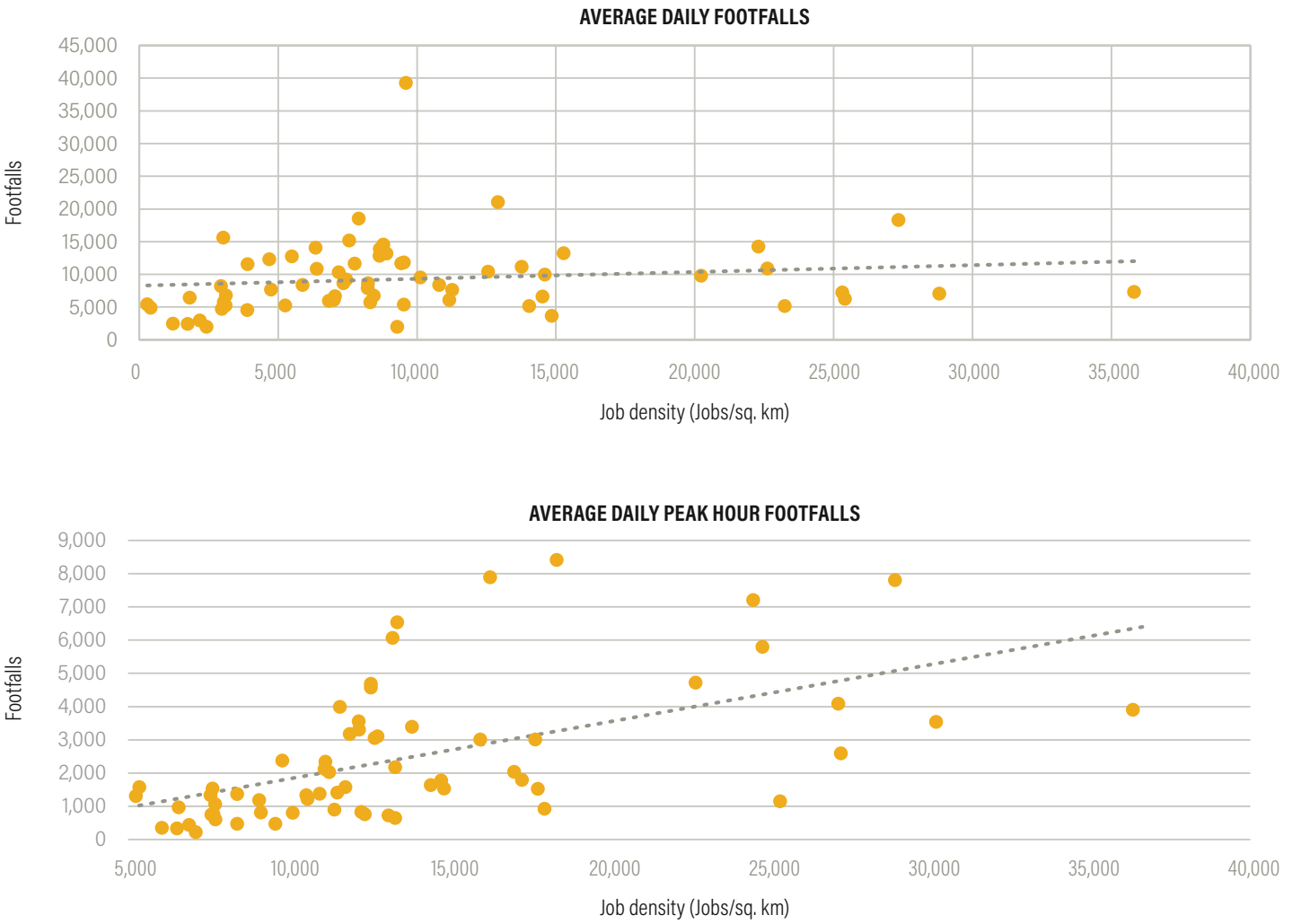
*Source:* WRI India authors, based on NSW Government (2015).

# APPENDIX I. STATION-AREA JOB DENSITIES AND METRO RIDERSHIP

Metro ridership data were sourced from Bangalore Metro Rail Corporation Limited (BMRCL) for the week between May 13 and 17, 2024. The average daily footfall (exit data) and average peak hour footfall (exit data for 8 AM to 11 AM) for the week were computed for each operational metro station. A comparison of station-area job densities with these ridership numbers shows a 14 percent correlation with the average daily footfall and a 55 percent correlation with the average peak hour footfall, which is not a strong correlation.

This points to the fact that several other factors also come into play, such as first- and last-mile access to the metro (including housing locations of employees, quality of access infrastructure, and availability of feeder services), metro fare affordability, types of enterprises, company transport policies, incentives and availability, and parking availability at workplaces and metro stations. A multipronged and holistic set of strategies—as outlined in the Bengaluru TOD and Parking Policies—are needed to enable the shift to active and public transport modes and increase transit ridership.

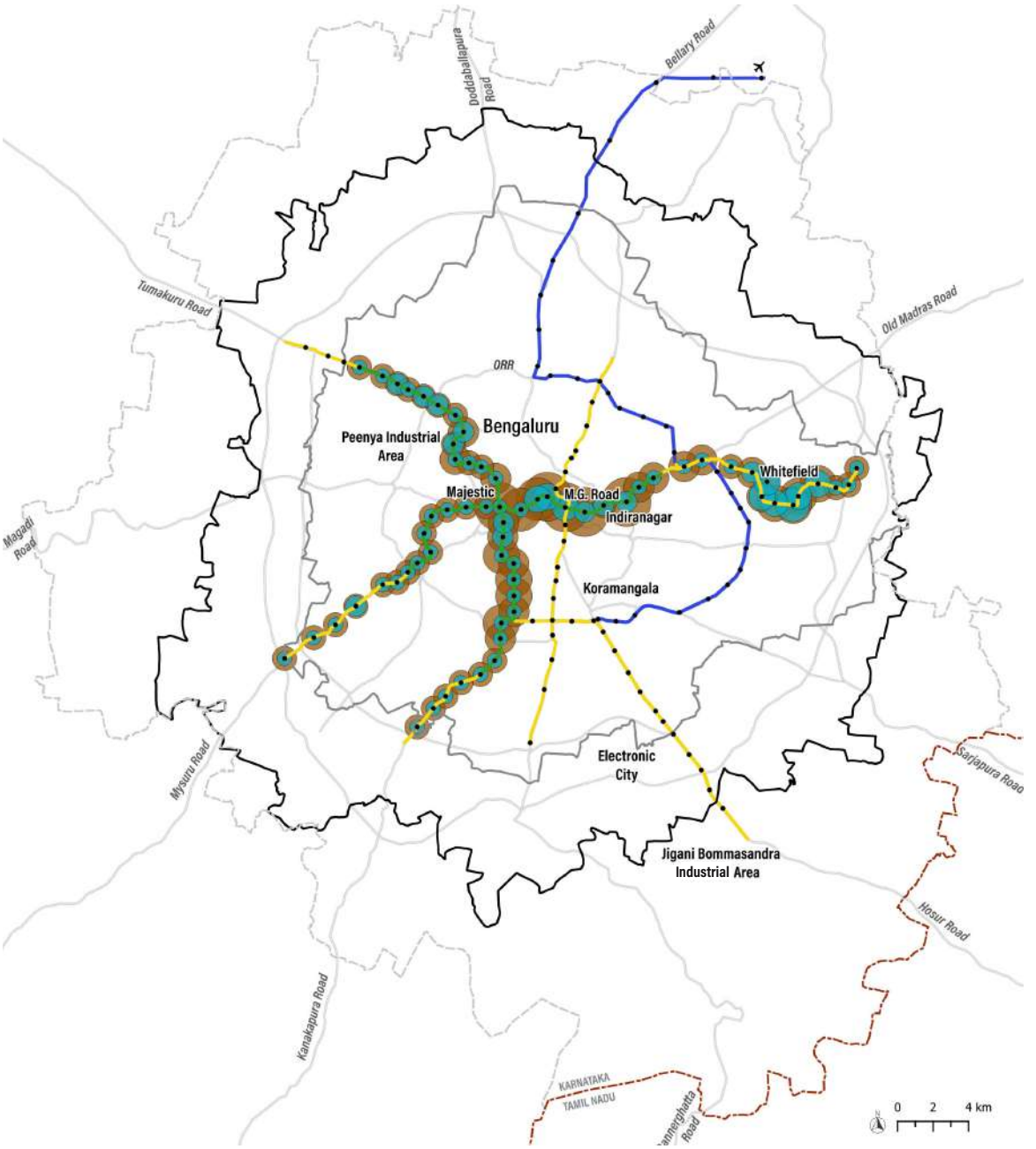
Figure I-1 | **Correlation between job density and metro ridership (average daily and average peak hour footfalls) in Bengaluru**




*Note:* A 1,000 m radius (aerial distance) was taken to compute job densities per square kilometer around each individual metro station without overlaps with adjoining stations.

*Source:* WRI India authors' analysis, using geocoded jobs data from LD–GoK as on January 2023, average peak hour (8–11 AM) footfalls data from BMRCL for the week between May 13 and 17, 2024, for operational metro stations, and digitized BMRCL metro network as on May 2023.

Figure I-2 | **Job density and average peak hour footfalls around operational metro stations in Bengaluru**

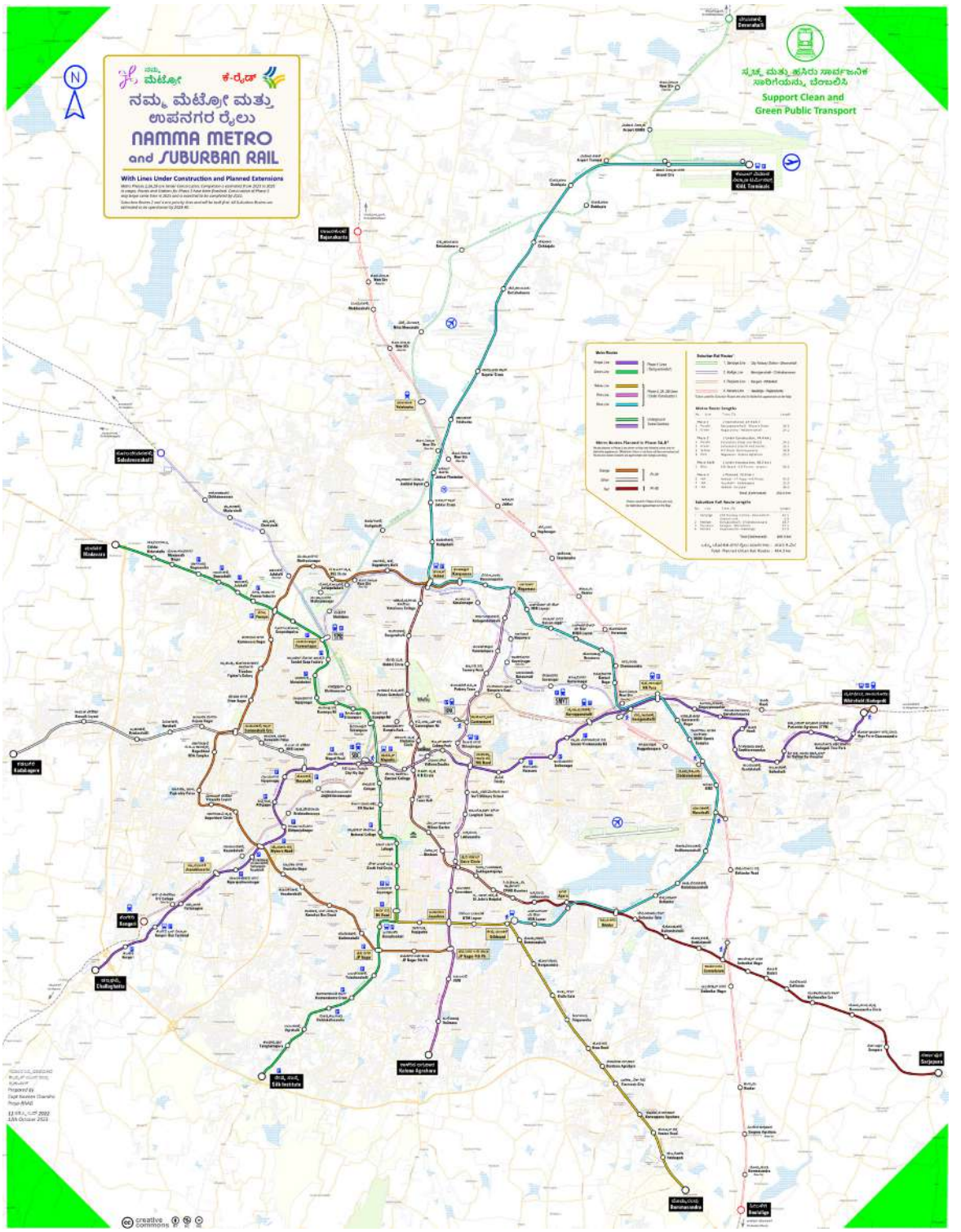



*Note:* A 1,000 m radius (aerial distance) was taken to compute job densities per square kilometer around each individual metro station without overlaps with adjoining stations.

*Source:* WRI India, using geocoded jobs data from LD–GoK as on January 2023; digitized metro network from BMRCL as on May 2023; administrative boundaries from BBMP (municipal corporation), BDA (metropolitan area), and KSRSAC (urban district); and major roads from OSM as on May 2023.

# APPENDIX J. METRO AND SUBURBAN RAIL MAP

Figure J-1 | **Metro and suburban rail network in Bengaluru: Operational, approved, and proposed**




*Source:* Chandra 2023.

# LIST OF ABBREVIATIONS

**BBMP** Bruhat Bengaluru Mahanagara Palike

**BDA** Bangalore Development Authority

**BMRCL** Bangalore Metro Rail Corporation Limited

**BMA** Bengaluru Metropolitan Area

**BUD** Bengaluru Urban District

**CBD** central business district

**FAR** floor area ratio

**GIS** geographic information system

**INR** Indian National Rupee

**KSRSAC** Karnataka State Remote Sensing Applications Center

**LD-GoK** Labour Department, Government of Karnataka

**ORR** Outer Ring Road

**PPP** public-private partnerships

**PSU** public-sector undertaking

**RMP** Revised Master Plan

**SEZ** Special Economic Zone

**TOD** transit-oriented development

**TODP** Transit-Oriented Development Policy

**US** United States

**USD** U.S. dollar

**WRI** World Resources Institute

# ENDNOTES

1. These supporting policies include the pioneering Karnataka Information Technology Policy in 1997 and others since then such as the SEZ, i4 (IT, ITES, Innovation, and Incentives), Biotech, and Start-Up policies.

2. Approved in 2006, Phase 1 of Bengaluru's 42 km metro network was progressively operationalized between 2011 and 2017. By the end of 2023, another 31 km of the 72 km Phase 2 network was also operationalized, and the rest is under construction, along with 56 km in Phase 2A-2B.

3. The provision of public bus services has not matched the pace of development and demand, with the outer suburbs and peripheries having poorer network coverage and frequencies than inner-city areas (WSA 2009; UMTC 2011). Meanwhile, metro rail networks have been slow to expand; about 72 km was progressively operationalized between 2011 and 2023.

4. Behavioral choice models from a 2011 study found that with increasing income, IT employees (in a services-oriented economy) are more likely to choose two-wheelers and cars for commuting, whereas public-sector employees (in a traditional manufacturing economy) are more likely to choose public buses or walk to work (Sabapathy et al. 2012). A survey of travel behavior in six gated communities located in suburban locations in Bengaluru found that 64 percent of work trips were made by car, followed by 15 percent on two-wheelers, and 10 percent by company buses, with 71 percent of work trips being single vehicle occupancy (EMBARQ India 2014). Another survey at RMZ Ecospace (Tech Park) on ORR revealed that of the 3,793 vehicles/hour entering the campus, 90 percent were taxis, private cars, and two-wheelers, and 3 percent were buses or vans (WRI India 2016).

5. The average distance for the lowest-income individuals was about 7.7 km versus about 25 km for the highest-income individuals. The average work trip mode share of low-to-moderate-income individuals was 42 percent by bus and 40 percent by two-wheeler, whereas for medium-to-high-income individuals it was 49 percent by car and 32 percent by two-wheeler (ADB 2022).

6. Negative externalities associated with increasing motorization rates and vehicular use include growing congestion, road crashes, fuel consumption, emissions, and air pollution. Recent WRI India analysis for the Bengaluru Climate Action and Resilience Plan 2023 estimated that the transport sector is the highest contributor to air pollution (>50 percent) and the second-highest contributor to greenhouse gas (GHG) emissions (21 percent) in the city.

7. With employees returning to workplaces, office space demand and leasing has seen a strong revival, with Bengaluru remaining the foremost market. The rates of new vehicle registrations and congestion levels are also climbing up again (Khan 2021; Shaikh 2022; Philip 2023).

8. The term public transport refers to all publicly provided rail- and bus-based transport systems, including city buses. The terms *mass transit* and *transit* specifically refer to mass rapid transit systems such as the metro rail, suburban rail, or bus rapid transit, but exclude city buses.

9. The National Urban Transport Policy 2014, National TOD Policy 2017, Metro Rail Policy 2017, and Value Capture Finance Policy 2017 provide an overarching framework for promoting, planning, and financing transit and TOD.

10. Master planning area under the BDA and Bangalore-Mysore Infrastructure Corridor Area Planning Authority (BMICAPA).

11. High-capacity and high-quality rail-based mass rapid transit systems can support higher-density development and service a larger number of trips. Their speed and comfort can attract private vehicle users.

12. According to the Draft Revised Master Plan for Bengaluru (BDA 2017), manufacturing industries accounted for about 9 percent (0.5 million) of the total estimated employment (5.5 million) in the BUD, based on 2014 figures. According to 2023 data obtained from the Labour Department, GoK, of the 4.8 million jobs in BUD, factories accounted for about 14 percent, whereas shops and commercial establishments accounted for the rest. This database does not include government and other nongovernment institutional jobs.

13. Phases 1 to 3 of the metro rail network have 184 stations along 215 km, with future phases and extensions also falling largely within the metropolitan area. Phase 1 of the suburban rail network has 64 stations along 148 km, which also fall largely within the metropolitan area. However, in Phase 2 (452 km), the suburban rail network is proposed to be extended to connect smaller cities and towns in the metropolitan region. The metro rail system is thus intended to serve as the main urban transit system and the suburban rail system more as a regional transit system (TMRG 2024).

14. The Department of Factories, Boilers, Industrial Safety and Health collects and maintains data for factories and boilers under the provisions of The Factories Act, 1948 and The Karnataka Factories Rules, 1969. The Labour Commissioner's office collects and maintains data for shops and commercial establishments under the provisions of The Karnataka Shops and Commercial Establishments Act, 1961 and Rules 1963.

15. In India, the size of enterprises is defined based on turnover and not on the number of employees. The threshold of large enterprises with over 100 employees was derived from the literature on other Asian countries and similar contexts (OECD 2024; Wikipedia n.d.).

16. The Bengaluru TOD Policy 2022 adopts the 6-6-6 principle to define the subzones around transit stations. The area or access shed within a 6 minute walking distance from the station (broadly translating to 500 m) represents the Core TOD Zone, that within a 6 minute cycling distance from the station (1,000 m) represents the Standard TOD Zone, and that within a 6 minute feeder bus service from the station (2,000 m) represents the larger catchment beyond the TOD Zone.

17. See Endnote 14.

18. Although the factory data was more comparable with the ASI 2019–20 data, large discrepancies were found when the data were compared with data from the Sixth Economic Census, and it was difficult to interpret the data rationally or meaningfully. This could be due to the 10-year gap between the two datasets, but more so because the household-level economic census captures all formal and informal (unorganized sector) enterprises and workers, whereas the data from the respective Labour Departments capture only enterprises and employees that are required to register in accordance with the relevant Factories Act and Karnataka Shops and Commercial Establishments Act.

19. The two largest manufacturing job clusters, Peenya and Jigani-Bommasandra Industrial Areas, are located on the fringes, along Tumkur Road in the north-west and Hosur Road in the south-east, respectively. The major services job clusters are in central and inner-city areas (near MG Road, Indiranagar, Koramangala) and along the eastern arc of the ORR, with Whitefield and Electronics City being the prominent hi-tech hubs on the outskirts (Figure 5 and Appendix D).

20. This is assuming that large land parcels exist, or large plots would be planned, and some land aggregation occurs to take advantage of the greater development rights along wider roads.

21. The Bengaluru TOD Policy 2022 considers the area within a 6-minute walk or 500 m as the average or comfortable walking distance to transit. The commonly cited global standard is a quarter mile, or 400 m (Walker 2011).

22. For instance, Wipro SEZ on Sarjapur Road, Bhartiya City SEZ and Mall on Thanisandra Main Road, and KIADB Hardware Park near the international airport, where buildings with floor plates of 50 m x 80 m or larger are being developed.

23. These include hostels, paying guest accommodations, serviced apartments, bed-and-breakfast hotels and homestays, eateries, daily need markets, consumer goods stores, etc.

24. According to the 2011 Census figures, nearly 30 percent of households within municipal limits (and many more beyond) did not have access to piped water supply and sewerage, given the slow progress in extending these networks beyond the erstwhile municipal area (Chanchani et al. 2023). In 2018, this number was about 25 percent, based on the utility's assessment (BWSSB n.d.)

25. Specifically, the three goals were to increase the motorized mode share of public transport to 70 percent and the combined mode share of walking, cycling, and public transport to 80 percent by 2031; house about 60 percent of the city's population within the Intense/Core TOD Zones, which may require a transit network of about 600 km; and achieve gross population densities of 250 to 400 persons per hectare (pph) along transit corridors, depending on various factors.

26. These may include, for example, the mill lands behind the city railway station; industrial land parcels in Rajajinagar, Yeshwanthpur, Peenya, or Jigani-Bommasandra; from HMT, Bharat Electronics Limited (BEL), Hindustan Aeronautics Limited (HAL), or Industrial Training Institute (ITI) industrial townships; defense areas and government-owned properties; or low-density housing in inner-city areas and along arterial transport corridors.

27. A well-thought-out phasing strategy for transit lines and TOD is crucial given the differential nature of development, contexts, and temporalities involved in the long-term process of economic development and city building.

28. This would include transit and pedestrian plazas; bus bays; bicycle, auto and taxi stands; and pick-up and drop-off, parking, and vending zones along with seating, landscaping, and wayfinding signage.

29. Examples are Biocon Campus–Hebbagodi metro station, Infosys Campus–Konappana Agrahara metro station, and Embassy Tech Village–Kadubeesanahalli metro station (Siddiqui 2024a).

30. Short, direct routes connecting the transit station and several activity generators in the station area.

31. On- and off-street public parking zones would benefit platform/gig economy workers such as delivery agents and auto and cab drivers.

32. For instance, the feeder bus services operated by the Delhi Metro Rail Corporation is a use case, which has not been scaled up, but is a useful model.

33. A cess is a form of tax charged over an existing or basic tax. It can be levied by the government for specific purposes and must be utilized for these purposes. For example, a public transport cess imposed on property tax in a city is meant to be used for public transport purposes only.

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# ABOUT WRI INDIA

WRI India, an independent charity legally registered as the India Resources Trust, provides objective information and practical proposals to foster environmentally sound and socially equitable development. Our work focuses on building sustainable and liveable cities and working towards a low carbon economy. Through research, analysis, and recommendations, WRI India puts ideas into action to build transformative solutions to protect the earth, promote livelihoods, and enhance human well-being. We are inspired by and associated with World Resources Institute (WRI), a global research organization. Know more: www.wri-india.org.

**Our challenge**

Natural resources are at the foundation of economic opportunity and human well-being. But today, we are depleting Earth's resources at rates that are not sustainable, endangering economies and people's lives. People depend on clean water, fertile land, healthy forests, and a stable climate. Livable cities and clean energy are essential for a sustainable planet. We must address these urgent, global challenges this decade.

**Our vision**

We envision an equitable and prosperous planet driven by the wise management of natural resources. We aspire to create a world where the actions of government, business, and communities combine to eliminate poverty and sustain the natural environment for all people.

**Our approach**

COUNT IT

We start with data. We conduct independent research and draw on the latest technology to develop new insights and recommendations. Our rigorous analysis identifies risks, unveils opportunities, and informs smart strategies. We focus our efforts on influential and emerging economies where the future of sustainability will be determined.

CHANGE IT

We use our research to inform government policies, business strategies, and civil society action. We test projects with communities, companies, and government agencies to build a strong evidence base. Then, we work with partners to deliver change on the ground that alleviates poverty and strengthens society. We hold ourselves accountable to ensure our outcomes will be bold and enduring.

SCALE IT

We don't think small. Once tested, we work with partners to adopt and expand our efforts regionally and globally. We engage with decision-makers to carry out our ideas and elevate our impact. We measure success through government and business actions that improve people's lives and sustain a healthy environment.