

# Understanding Mobility Patterns And Mode Choice In Shared Micro-Mobility Access To Bengaluru Metro Stations Within T.O.D Influence Zones

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**Abstract:** – This study explores shared micro-mobility (SMM) use for metro access in Bengaluru's transit-oriented development (T.O.D.) zones, identifying a gap in linking user behaviours to last-mile connectivity, with past studies being focused on infrastructure (Archana, 2019; The Indian Express, 2023). This study adds user-centric insights to enhance inclusive TOD planning. The research aims to understand the impact of socio-demographic profiles and trip characteristics on the use of SMM services such as e-bikes and bicycles in TOD zones. The study hypothesises that user demographics and TOD proximity significantly influence ridership (Eom, Lee, & Lee, 2023; Zhao et al., 2018). Addressing a research gap of linking user-focused factors to SMM, the research selects four metro stations with different predominant land-use types. Survey-based Travel Length Frequency Distribution (TLFD) data were used with the Isochrone method in ArcGIS (Department of Planning, 2022) to delineate the TOD influence zones. Primary surveys collected data on ridership, trip purpose, trip frequency, and socio-economic characteristics from the users within the TOD influence zones. The research identified statistically significant differences in mode choice across age, gender, and varied aspects (Olabi et al., 2023; Bobičić & Esztergár-Kiss, 2024). At Baiyappanahalli, most of the users accessed the metro for work trips, while Indiranagar recorded the highest proportion of older users using SMM (Kidiyoor, 2022).

**Keywords**– Shared Micro-Mobility (SMM), Mode Choice, Transit-Oriented Development (TOD), Metro Access, Trip Length Frequency Distribution (TLFD)

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## INTRODUCTION

The movement of people across urban spaces significantly influences city development (Wang, Fang, Zeng, & Cheng, 2024). Bengaluru's urbanisation rate in 2011 was 90.94%, far higher than Karnataka (38.67%) and the national average (31.16%) (Directorate of Census Operations, Karnataka, 2011). Rapid urbanisation has strained transport infrastructure. Registered vehicles surged from 55.26 lakh to over 1.04 crore between 2012–2022 (Kidiyoor, 2022). Bengaluru ranks as the third slowest city globally for traffic congestion, after Barranquilla (Colombia) and Kolkata (India) (The Indian Express, 2023). A perception-based survey by Ola Mobility Institute in 2018 found 70% of citizens felt last-mile connectivity needed improvement (Archana, 2019). Consequently, many commuters rely on walking or private vehicles due to the lack of affordable and convenient alternatives. Around 60% of commuters use personal vehicles (NITI Aayog, 2025).

Micromobility originated in Europe, with Denmark and the Netherlands as early adopters due to cycling infrastructure. In India, shared micro-mobility (SMM) gained traction in the late 2010s, with companies launching e-bikes and scooter-sharing services (Shaheen, Cohen, & Broader, 2021; Ghosh, 2020). Micromobility vehicles in India are lightweight, often electric, with speeds of 6–25 km/h, suitable for trips under 10 km (Olabi et al., 2023). In Bengaluru, services like Yulu provide vital last-mile metro connectivity, though around 66% of users are infrequent, making fewer than two trips per week (Yulu, 2025). TOD policy aims for 70% of trips by public transport, within a 1000 m catchment radius (Directorate of Urban Land Transport, 2023).

SMM adoption is growing, but few Indian studies link user-specific factors such as age, gender, trip purpose, and land-use context to mode choice in TOD zones. This study addresses that gap by analysing behavioural and accessibility differences across four metro stations.

## LITERATURE STUDY

Zhao et al. (2018), Eom et al. (2023), Olabi et al. (2023), Bobičić and Esztergár-Kiss (2024), Kegalle et al. (2023), and Osama and Sayed (2017) provide insights into parameters affecting SMM adoption, including ridership (mode share, trip purpose, frequency), demographics (age, gender, occupation, literacy), and density as shown in table 1. These studies collectively conclude that ridership patterns, trip purpose, and socio-demographics significantly influence mobility behaviours (Olabi et al., 2023; Shaheen et al., 2021). Demographics such as age and gender are particularly influential. For example, cycling studies in Beijing highlight how age and socio-economic background affect adoption (Zhao et al., 2018). Similarly, research on micromobility mode preferences near subway stations shows strong links to trip purpose and frequency (Eom et al., 2023). Barriers such as inadequate infrastructure, safety issues, and cost burdens are also recurring themes (Bobičić & Esztergár-Kiss, 2024; Kegalle et al., 2023). Thus, the literature underscores the need for context-specific, user-focused approaches to SMM integration into TOD planning.

**Table 1: Parameters studied Across Selected Research Studies (Source: Author's compilation)**

Sr. No.	Parameters	Indicators	Research papers					
			[10]	[11]	[12]	[13]	[14]	[15]
1	Ridership	Mode Share (%)	✓	✓				
		Trip Length (mts)		✓		✓		
		Trip purpose (%)	✓	✓	✓		✓	✓
		Trip frequency (%)	✓					
		Details of mode used (%)		✓	✓	✓	✓	✓
2	Demographic details	Age		✓				
		Gender		✓				
		Population Density (Ppl/Km <sup>2</sup> )		✓				
		Employment		✓			✓	
		Literacy				✓		
		2W Driving License			✓			

### Policy Overview

Bengaluru's Draft TOD Policy promotes compact, mixed-use, transit-enabled development. Goals include 70% modal share in public transport, 60% of the city's population housed in TOD zones, and higher densities around metro stations with Floor Area Ratios (FAR) between 300–500% (Directorate of Urban Land Transport, 2023). Additionally, Bengaluru's Non-Motorised Transport (NMT) Policy addresses gaps in pedestrian and cycling infrastructure, proposing safety toolkits, cycling master plans, and public awareness initiatives (Directorate of Urban Land Transport, 2025). However, inter-agency coordination issues limit effective implementation (C., & Dhindaw, 2024).

### Overview of the Study Area and Urban Mobility Context

Bengaluru, Karnataka's capital, is India's fifth-largest urban agglomeration, with around 14 million residents by 2024 (World Population Review, 2025). The Bruhat Bengaluru Mahanagara Palike (BBMP) spans 741 sq. km, while the larger metropolitan region covers 8,005 sq. km (Wikipedia, 2025). Population density was 4,378/km<sup>2</sup> in 2011 (Deccan Herald, 2025).

Namma Metro Phase 1 (42.3 km, 40 stations) became fully operational in 2017. By 2024, it was India's

second-largest metro in coverage and ridership after Delhi (The Economic Times, 2023). Daily ridership averages around 720,000 (Moneycontrol, 2023). Despite a proposed 600 km cycling network by 2035, Bengaluru’s pedestrian and cycling infrastructure remains limited (Directorate of Urban Land Transport, 2020). SMM services like Yulu provide 15,000+ vehicles and ~100,000 daily rides, but providers like Bounce and Vogo have exited the market (Magol, 2025; Quartz, 2025). Government agencies such as the DULT (Directorate of Urban Land Transport), BBMP (Bruhat Bengaluru Mahanagara Palike) and BMLTA (Bengaluru Metropolitan Land Transport Authority) are instrumental in making SMM a reality. Interagency coordination plays a vital role in implementing SMM, as demonstrated in Figure 2.

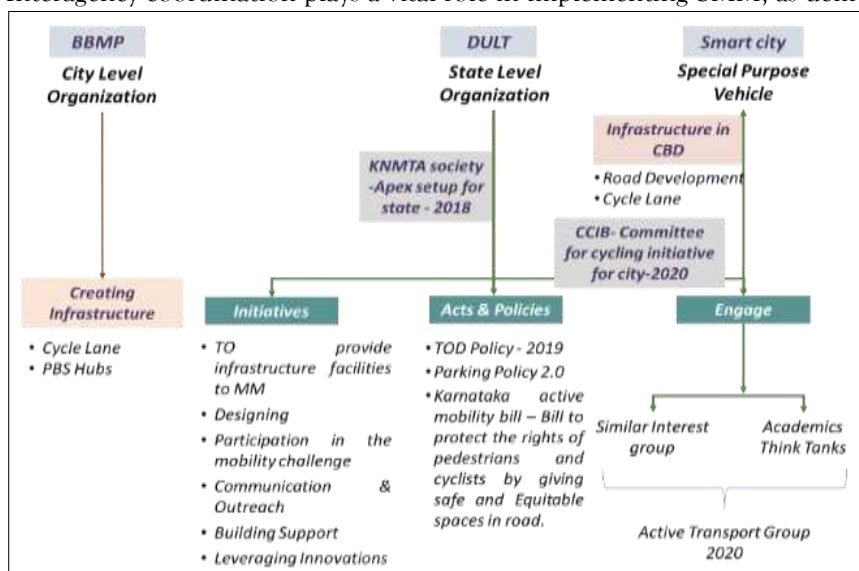


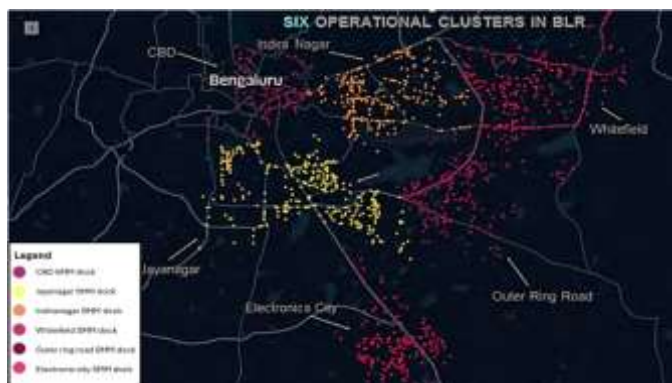
Figure 1: Framework for Government Assistance for the Implementation of Shared Micromobility (Source: DULT Website)

## RESEARCH METHODOLOGY

This study combines GIS analysis and primary surveys. TLFD data were mapped using Isochrone analysis in ArcGIS to delineate TOD zones (Department of Planning, 2022). User surveys captured socio-demographics, trip purposes, ridership frequency, and access costs. Sample sizes were determined using Cochran’s formula, based on daily ridership data from October 2023 (Directorate of Urban Land Transport, 2020). Four stations—Sir M.V., MG Road, Indiranagar, and Baiyappanahalli—were purposively selected due to varied land uses (EMBARQ India, 2014). Data collection included questionnaires, field observations, and interviews. Secondary data were sourced from BDA, BBMP, BMRCL, and Census reports (Directorate of Census Operations, Karnataka, 2011; Bangalore Development Authority, 2015).

### A. Selection of Metro stations

A multi-criteria assessment was conducted using five parameters, which are essential and interrelated: availability of shared micro-mobility services (via the Yulu app), predominant land use road sectional components, Metro ridership data and population density. SMMs are already operational in parts of the city and are now being launched citywide by the Directorate of Urban Land Transport and Yulu to promote last-mile connectivity via SMM options as illustrated in Figure 4. This is primarily in and around metro stations, local residential neighbourhoods, and activity nodes where the service will provide GPS-enabled SMM, located via a mobile app. The first step in launching SMM involves the development of SMM infrastructure, including SMM Parking Hubs, Tracks, etc. Even though the city had a limited dedicated cycling network, it is managed by utilising the space of footpaths. Since the introduction of the SMM option, the availability of SMM vehicles has increased rapidly citywide. Currently, over 4,700 bicycles are in operation, offering around 10,000 rides per day with an average trip length of 2 kilometres per vehicle. Approximately 60% of these trips were for workplace connectivity, 15% were first/last mile connectivity to metro and suburban rail, and the rest were leisure trips within residential areas.



**Figure 2: Micro-mobility Operation Clusters in Bengaluru (Source: Infrastructure Development & Corporation (Karnataka) Limited, 2020)**

As indicated in the Revised Bengaluru Master Plan 2015, the categorisation shown in Table 2 demonstrates the dominance of urban features around each metro station. Sir M.V. station has wider surrounding characteristics of civic and temporal institutions, and the museums category of public/semi-public transport. MG Road is a hub of commercial activity, which is mainly characterised by retail, offices and entertainment. Indiranagar is primarily a residential area; it has housing layouts and community spaces with elements of mixed-use development. Baiyappanahalli is located on the periphery of the City Centre. It is also located near maintenance depots and warehousing, thus it has been classified in the category of industrial land use.

**Table 2: Station Typologies (Source: EMBARQ India, 2014)**

Sl. No.	Transit stop	Level of network integration	Primary functional Land Use	Environmental and natural context elements	Heritage and Socio-Cultural Influences
01	Baiyappanahalli	Regional	Industrial	–	–
02	Swami Vivekananda Road	Sub Centre	Public or Semi Public	–	Traditional Fabric
03	Indiranagar	City	Residential	Natural assets + Green system	Heritage fabric+ Religious Structure
04	Halasuru	Sub Centre	Mixed Use	Natural assets	Historic Landmark
05	Trinity	Sub Centre	Commercial	Natural assets	–
06	M.G. Road	Sub Centre	Commercial	Natural assets	Historic Landmark
07	Cubbon Park	Local Centre	Public or Semi Public + Green Space	Natural assets	Heritage fabric+ Historic Landmark
08	Vidhana Soudha	Local Centre	Public or Semi Public	Natural assets	
09	Sir M. V.	Local Centre	Industrial	Natural assets	Heritage fabric+ Historic Landmark
10	Kempegouda Interchange	Regional	Transportation	–	Heritage Fabric
11	City Railway	Regional	Mixed Use	Green system	–

	Station				
12	Magadi Road	Sub Centre	Mixed Use		
13	Hosahalli	City	Residential	—	—
14	Vijayanagara	City	Residential	—	—
15	Attiguppe	Sub Centre	Residential	—	—
16	Deepanjali Nagar	Sub Centre	Mixed use	Natural assets	—
17	Mysore Road	City	Industrial	Natural assets	—
18	Nagasandra	Sub Centre	Industrial	Natural assets	—
19	Dasarahalli	Sub Centre	Mixed Use	—	—

Metro ridership data of the Bengaluru Metro as illustrated in Figure 5, it can be inferred that significant patterns of travel demand for commuters for October 2023 show greater footfall at stations such as Sir MV, Indiranagar, Byappanahalli, and MG Road, with the highest attendance. With a recent expansion in early 2024, Namma Metro has been established as the second largest metro in India in operational coverage and passenger volume of ridership in the country, behind the Delhi Metro [30]. Daily ridership has expanded to around 720,000 daily commuters.

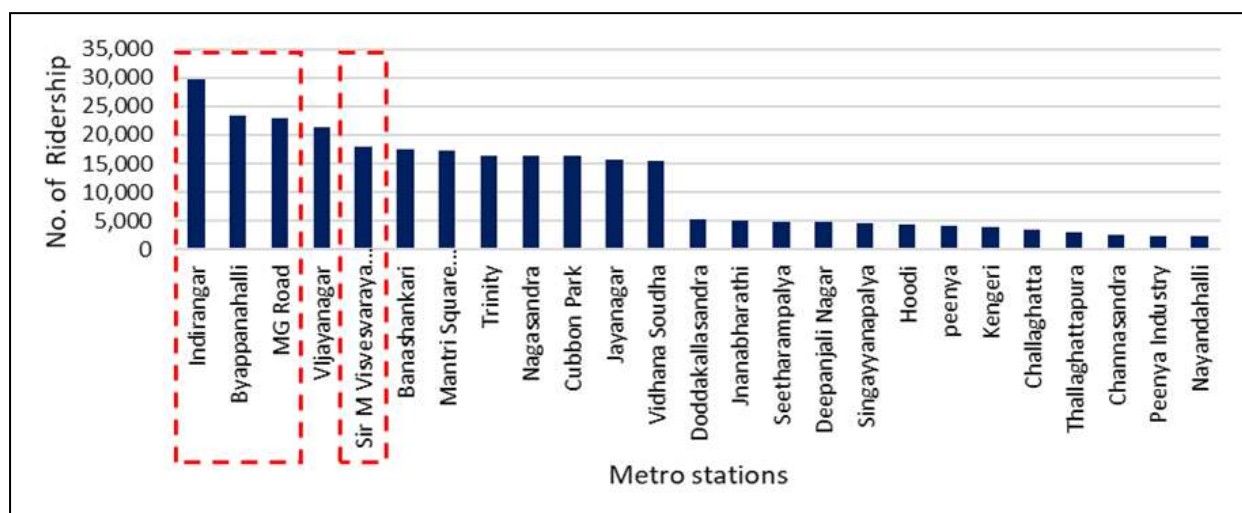


Figure 3. Bengaluru Metro's Station Footfall Recorded on 8th October 2023. (Source: Christian methew philip, 2023)

The presence of pedestrian facilities is compromised for the use of SMM. Sir MV, Indiranagar, Baiyyappanahalli, and MG Road fall under multiple wards within the Bruhat Bengaluru Mahanagara Palike (BBMP) limits. Specifically, these areas are covered by wards 58, 80, 88, 89, and 112, among others (BBMP, n.d.). Based on the data of the 2011 census, Ward 58 (Hosathippasandra) has a population of 34,577. Ward 80 (Shankar Matt) has a population of 46,569. Ward 112, along with wards 88 and 89, has a population within the range of the other wards, considering the average ward population is around 42,650 [31]. Figure 6 provides a spatial representation of Bengaluru's metro network with land-use zones, ward-level population density, and ticketing data based on metro usage for each station. Based on 5 metrics, four metro stations were purposively sampled for in-depth analysis along the eastern corridor. Selected stations are Sir M.V, MG Road, Indiranagar, and Baiyappanahalli. Each of these stations represents diverse land-use patterns: institutional, commercial, residential, and industrial, respectively.

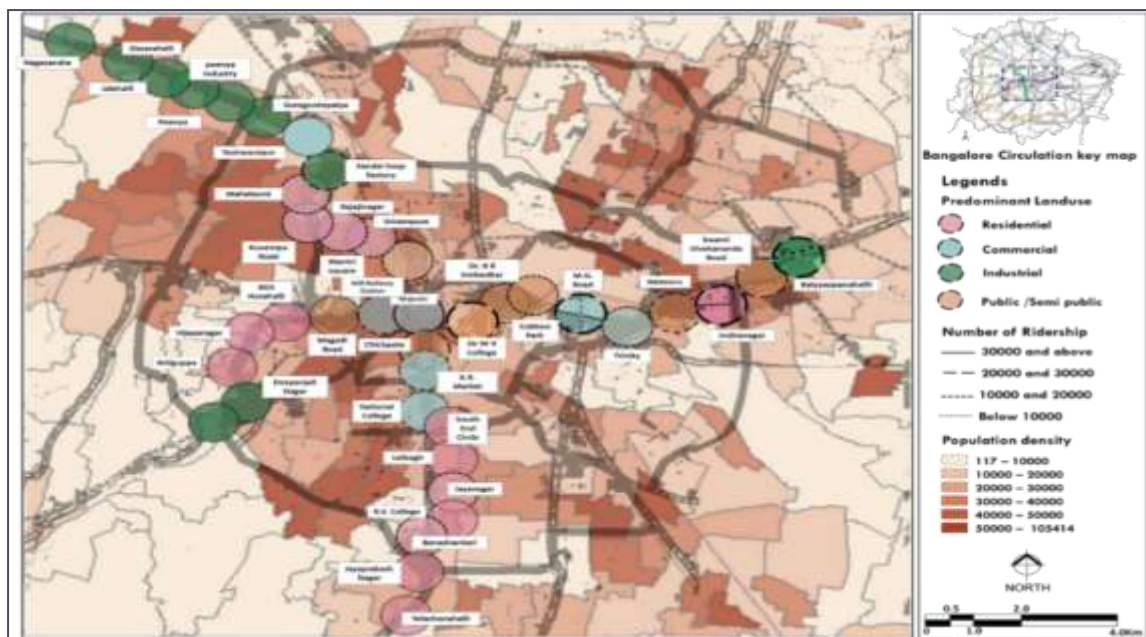


Figure 4: Selection of Study Area Map based on Multi-Criteria Assessment (Source: Author's Illustration).

The Figure 7 presents metro stations that are surrounded by distinct land use contexts in Bengaluru. Sir M.V. Metro Station is located in a public/semi-public zone, dominated by landmarks such as Sir M.V. Hospital, NIMHANS and UVCE college. MG Road Metro Station serves a commercial area, anchored by important sites, such as Brigade Road, Garuda Mall, and Mayo Hall. Indiranagar Metro Station is built in a residential area near 100 Feet Road, CMH Hospital, and several local parks. Baiyappanahalli Metro Station mainly serves an industrial land use context, like the Railway Yard, Old Madras Road, and various industrial sheds. The radius of 1000 meters, in Bengaluru's case, as per Bengaluru's TOD Policy published by DULT, which defines this as the "Standard TOD zone" defined as the area within 6 minute cycling distance from metro stations to promote public transit use, increase compact development, and ensure consistent evaluation of land use and user behaviors [17].

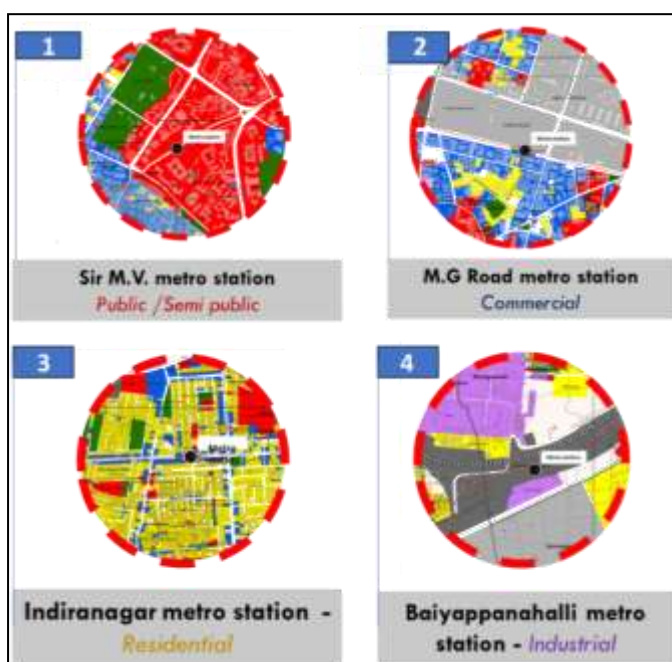


Figure 5: Land use Map of Selected Metro Stations TOD (Source: Revised Master Plan Proposed Landuse Map – 2015, Bbmp, N.D.-B)

### B. Methodological Approach to Data Gathering in Transit-Oriented Zones

The different types and sources of data required to support this study were identified. The data were collected through questionnaires, direct observations, interviews with key informants, and photographic documentation, as illustrated in Table 3. Direct observations, interviewing key informants, and photographs were used to gather data from categorised respondents into pedestrians and public transport users.

**Table 3: Data Types, Sources, and Methods of Collection Analysis (Source: Author's Illustration, 2024)**

Data type	Required data	Sources	Method of collection
Primary	Socio-economic characteristics	Field	Questionnaire
	Mode used	Field	Questionnaire
	Trip purpose	Field	Questionnaire
	Trip origin and destination	Field	Questionnaire
	Duration of the journey	Field	Questionnaire
	Preferred mode of Transport	Field	Questionnaire
	Footpaths condition	Field	Questionnaire
	Cycle tracks condition	Field	Questionnaire
	Perceived potential for SMM	Field	Questionnaire
	Observed SMM Fleet Size	Field	Questionnaire
Secondary	Land use map	BDA (Bengaluru Development Authority)	Website, Official meeting
	Population density	Census, district handbook	Website
	Availability of shared micro-mobility	DULT, yulu	Website
	Percentage of ridership	BMRCL (Bengaluru Metro Rail Corporation Limited)	Website
	Road sectional elements	DULT, BBMP (Bruhat Bengaluru Mahanagara Palike), BDA	Website
	Built-up density	GIS, satellite imagery	

### C. Sampling Framework for User Data at Metro Stations

The Cochran Method is used to calculate the total number of samples from the whole metro passenger count [32]. The first step in the data collection process was to establish the population using the data on ridership of the metro stations within the study area. Data obtained on the ridership were used for sample size calculation as follows:

$$n = \frac{t^2 \times P(1 - P)}{ME^2}$$

$$ME^2$$

where n is the sample size, t is the Z-score for 95% confidence (z value 1.96), P is the proportion of riders at a specific station relative to total ridership, and ME is the margin of error, taken as 5%. Results are illustrated in Table 4.

**Table 4: Sample size for each metro station (Source: Generated by author by source BMRCL ridership data – Oct 10, 2023)**

Metro station name	Ridership per day on 10 <sup>th</sup> Oct 2023 (N)	Peak Hour (10 am) Ridership on 10 <sup>th</sup> Oct 2023 (p)	proportion (P = p/N)	Sample Size by using the Cochran formula (n)
Sir MV	18009	456	0.0253	38
MG Road	22914	759	0.0331	49
Indiranagar	29729	1295	0.0436	64
Baiyappanahalli	23327	819	0.0351	52
Total sample size				203

Note: Bengaluru Metro's total daily ridership (6,80,194 on 10<sup>th</sup> Oct 2023) is used uniformly for all station-level proportions.

## DISCUSSION AND INTERPRETATION OF FINDINGS

GIS-based mapping revealed variation in TOD zone sizes. MG Road had the largest extent (6.68 sq. km), reflecting lower-density development, while Indiranagar's compact zone (4.32 sq. km) indicated higher density (Directorate of Urban Land Transport, 2023). Demographic analysis showed younger cohorts (15–29) dominating at MG Road and Sir M.V., while Indiranagar had a higher share of older users (58%). Gender disparities were stark, with men comprising over 70% of SMM users, peaking at 81% in Baiyappanahalli (Osama & Sayed, 2017). Work trips dominated except at Sir M.V., where education trips (38%) were higher due to nearby institutions.

Access patterns varied: at Indiranagar and MG Road, over 60% of users lived within 1 km of stations, whereas Baiyappanahalli commuters often travelled >1.5 km with higher costs (₹25–50). Women and older adults faced longer distances, higher access costs, and safety challenges, reflecting inequities in infrastructure and affordability (Kegalle et al., 2023; Bobičić & Esztergár-Kiss, 2024). Trip purposes also differed: Baiyappanahalli was work-dominated (72%), Indiranagar a residential commuter hub, MG Road a commercial centre, and Sir M.V. education-focused (EMBARQ India, 2014).

### A. GIS-Based Catchment Mapping for Metro Station Accessibility

The isochrone analysis in ArcGIS was employed to delineate the TOD influence zone and identify areas in the city that are accessible within defined travel times and considering arterial and sub-arterial roads for accurate delineation [1]. This method is based on cumulative TLF data derived from interval ranges, frequency, and cumulative user data from the survey. Figure 8 illustrates the spatial extent of TOD regions. Sir MV - TOD influence zone occupies 3.32 sq. km and an average radius of 1133.7 m. MG Road metro station covers 6.68 sq. km with an average radius of 1245 m, making it be largest TOD area and indicating lower density development where users take a longer distance in comparison to other TODs. Indiranagar - TOD influence zone occupies 4.32 sq. km with a radius of 1044.1 m, being a small TOD zone among others, due to high-density development. Baiyappanahalli - TOD influence zone, slightly larger, covers 4.52 sq km with a radius of 1150.7 m. The analysis reveals significant variation, indicating that TOD influence zones cannot be applied with a uniform distance.



Figure 6: Delineation the TOD influence zone around 4 metro stations (Source: Author's illustration)

### B. User Demographics and Travel Behaviour in Shared Micro-Mobility Access near Metro Stations

The demographic profile demonstrated in Figure 9 across all four metro stations exhibits a strong representation from younger (15–29) and middle-aged (30–59) cohorts. Indiranagar has the greatest

proportion of older riders (58%), while Sir MV and MG Road have a larger proportion of younger riders, which is likely due to their proximity to educational institutions and commercial employment hubs.

A notable male preponderance is seen across stations, with over 70% male respondents; Baiyappanahalli records the highest at 81%. Work remains the dominant travel purpose, except at Sir MV, where 38% of trips are education-related, as shown in Figure 9, due to proximity to institutions. When considering how commuters usually travel, the majority commute 5–6 days per week, with Indiranagar having the largest share of daily commuters, reinforcing its role as a primary trip destination for work. The share of leisure trips remains low at all stations regularly. Travel durations and the patterns of mode choices are station-specific.

While walking and personal vehicles are preferred, with metro is chosen by 67% at Indiranagar and 55% at Baiyappanahalli, indicating better connectivity or preference. Baiyappanahalli shows strong potential with 50% preference, possibly due to existing or planned infrastructure. Both Indiranagar and Baiyappanahalli exhibit better walkability, supported by footpaths and cycle tracks, as shown in survey responses. MG Road shows limited micromobility adoption, likely due to dense commercial development and constrained pedestrian infrastructure. To summarise, Sir MV primarily serves students, and MG Road has mixed land-use activity that supports short-distance users; Indiranagar is a commuter hub; and Baiyappanahalli reflects a strong male presence and active mode preference because of industries.

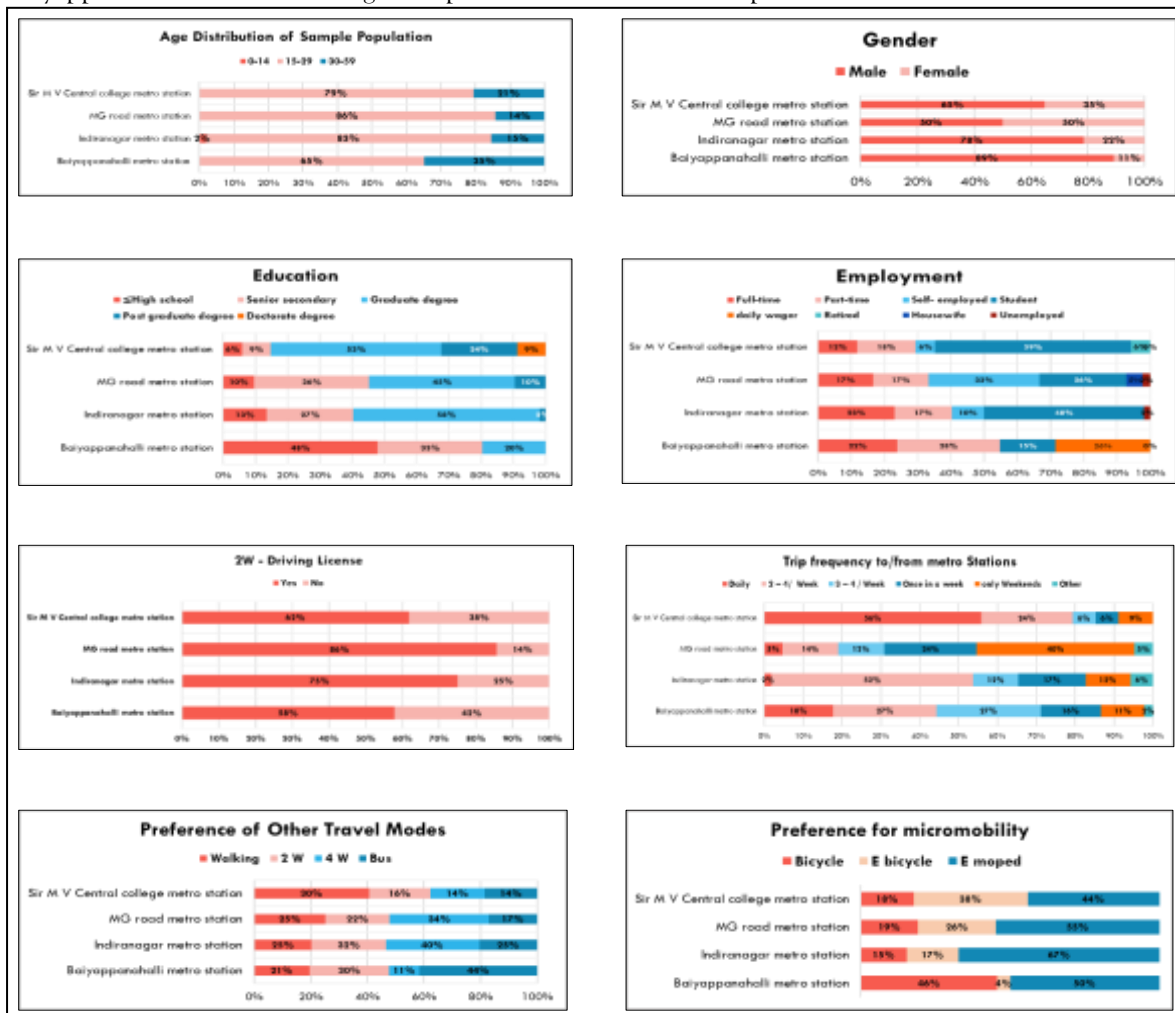


Figure 7: Survey-Based Graphs on Socio-Cultural and Travel Characteristics (Source: Author's Field Survey and Illustration)

### C. Comparative Assessment of Access Modes by Age and Gender Groups for Metro TOD Influence Zones

Figure 10 (Left) presents access distance, time and cost to four TOD metro stations (Sir MV, MG Road, Indiranagar, and Baiyappanahalli), broken down by age. Younger users aged 15–29 years had shorter

distances (0–1000 m) from metro stations compared to older users. At MG Road, over 50% and for Indiranagar 45% fell into this range. In contrast, Baiyappanahalli found that approximately 35% of older users (30–59 years) indicated distances above 1500 m, likely due to the lack of housing nearby. Access time indicated that at both MG Road and Indiranagar, over 60% of young users were under 10 minutes from the metro station, while at Baiyappanahalli indicated 30% of older users reported travel times of 15–20 minutes. Access costs indicated that older users paid ₹5-25 on access, over 55% of young users, and Baiyappanahalli rose to greater than ₹51, for approximately 35% of older users. Overall, MG Road and Indiranagar indicated first access burden was the strongest; Baiyappanahalli represented greater distance, time, and cost access burdens for users, especially older users.

Figure 10 (right) compares gender differences in metro access based on distance, time, and cost. Across all three measures, males reported easier access. Over half of the male respondents at MG Road and Indiranagar accessed transit within 0–1000 m, while more than 30% of female respondents in Baiyappanahalli travelled over 1500 m, compared to only 10% of males. Travel time showed a similar pattern: 60% of males reached the metro within 10 minutes, whereas most females in Baiyappanahalli and Indiranagar required over 15 minutes, possibly due to safety concerns or route choices. Access costs were also higher for females; while 55% of males paid ₹0–25, around 35–40% of females—particularly in Baiyappanahalli—paid ₹5–50, likely relying on autos or cabs. MG Road emerged as the most gender-equitable station, while Baiyappanahalli and Indiranagar displayed significant disparities. Addressing these gaps requires affordable, gender-inclusive shared mobility options, targeted subsidies for women, enhanced safety through better lighting and surveillance, and land-use planning with affordable housing near metro stations. These measures would improve equitable transit access for women, older adults, and underserved groups.

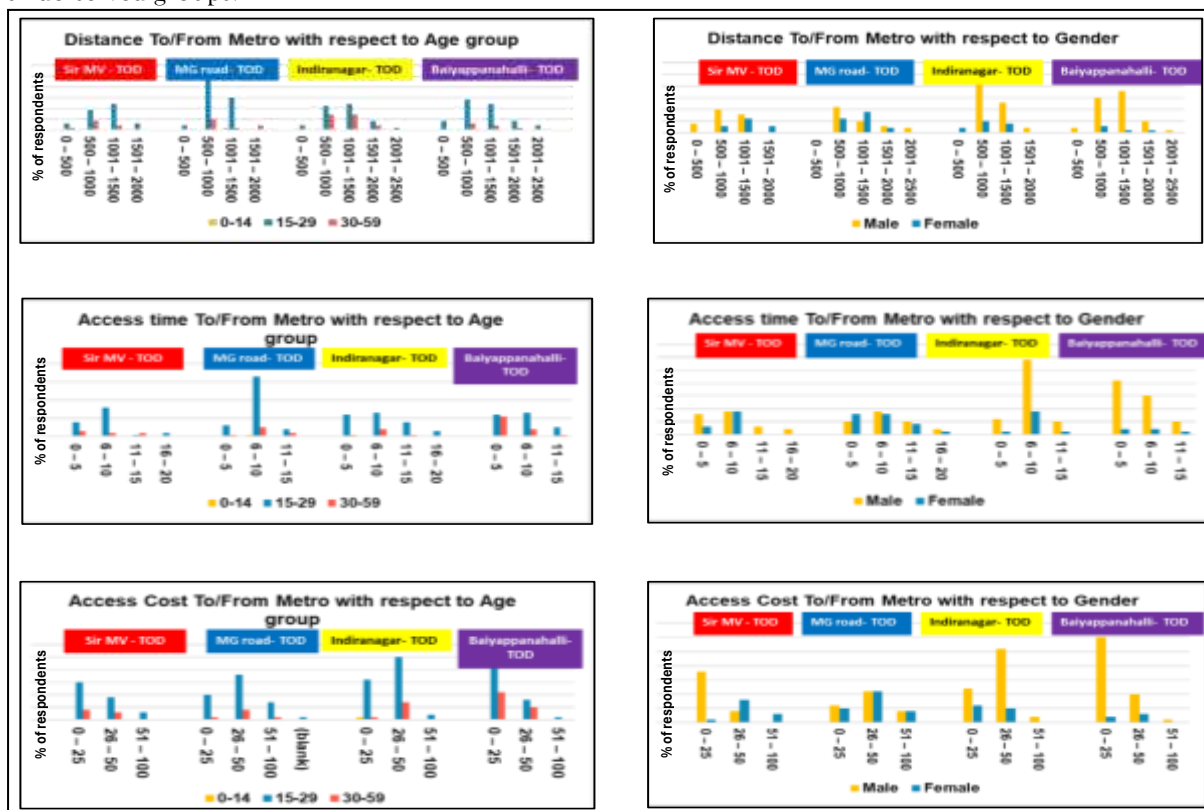


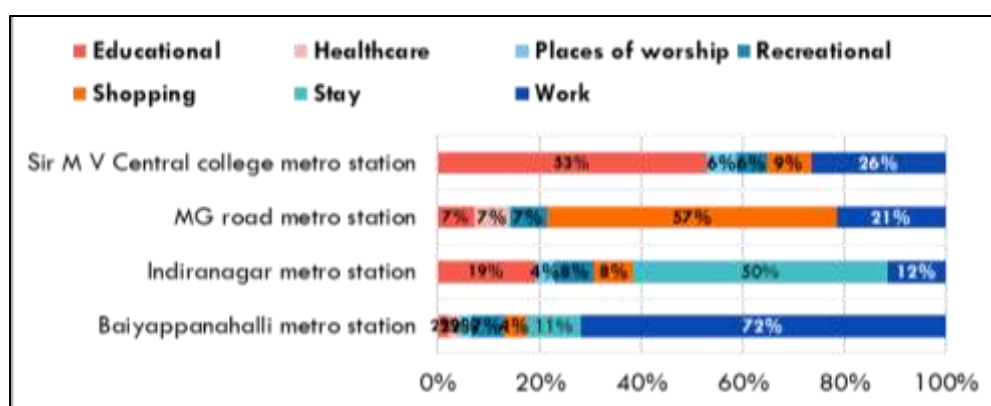
Figure 8: Graphs Showing Variation in Mode Choice by Age and Gender Cohorts (Source: Author's illustration)

The starting price to rent a Yulu bike for short-term use is Rs. 5, which is the base fee. After that, you pay Rs. 2.5 per minute while riding and Rs. 0.5 per minute while pausing [33]. Table 5 indicates that Indiranagar and MG Road offer the quickest and most affordable access to metro stations via SMM. Sir M.V. College has moderate access time and cost, while Baiyappanahalli shows the widest time range and highest cost burden.

**Table 5: Access Characteristics to Metro Stations by SMM (Source: Author)**

Station	Catchment (Radius in m)	Time (Minutes)	Cost (₹)
Sir M.V. College	1133.7 m	5 – 10 min	₹5–25
MG Road	1245 m	>60% < 10 min	₹5–15
Indiranagar	1044.1 m	>75% < 10 min	₹5–10
Baiyappanahalli	1150.7 m	5 – 15 min	₹5–35

Figure 11 describes the purposes of trips to the four metro stations. At Sir M V Central College, educational trips constituted the majority at 53%, followed by work-related trips (26%). MG Road indicates its strong commercial appeal, with a small percentage of work trips (21%). The majority of trips (50%) were for stay/accommodation purposes, and Other purposes, such as education, shopping, and miscellaneous trips, were comparatively lower. Baiyappanahalli was predominantly accessed for work trips, accounting for 72%. Healthcare, social, and recreational trip purposes remained consistently low across all stations. In summary, the chart presents functional variability between each station. Sir M V Central College is education-centred, MG Road is retail-focused, Indiranagar appears to serve primarily as a residential or temporary accommodation zone, and Baiyappanahalli is a commuter station.



**Figure 9: Trip purpose to metro Stations (Source: Author's Illustration)**

## CONCLUSION

GIS-based mapping demonstrated a wide variation in extents of TOD, suggesting uniform TOD influence zone cannot be considered for different stations, with MG Road having the largest extent due to low development density, while a compact zone at Indiranagar suggests higher density development. User behaviour drawn from surveys based on the TLFDD demonstrated that the younger, male commuters prefer short access distances, low access times, and low access cost, particularly at MG Road and Indiranagar. In comparison, older and female commuters, particularly at Baiyappanahalli, face long distances, higher access times, and considerable cost, all of which illuminate equity gaps. Equitable use based on gender and age further indicates potential safety and infrastructure shortcomings. The findings support gender and age-inclusive TOD policies that improve linear affordability and access to other SMM options with subsidies or incentives, safe access infrastructure, and mixed-income, affordable housing within proximity of metro stations. Overall, the proposed interventions should relieve access costs and burdens, and create more equitable and accessible transit environments for the different user groups, particularly women, the elderly, and low-income users.

Future work can consider predictive models and behavioural segmentation to guide the development of SMM services. However, limitations include its station-specific focus and the lack of longitudinal data. The findings provide actionable insights for planners and policymakers striving for equitable mobility in rapidly urbanising cities to enhance inclusive and sustainable urban mobility systems.

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