



FEASIBILITY CUM DETAILED PROJECT REPORT

VOLUME 1: PHASE - 3 PROJECT

Preparation of Feasibility Cum Detailed Project Report for construction as Double Decker (Flyover cum Metro) for two corridors of Phase-3 for a length of 37.121 Km

Consultant

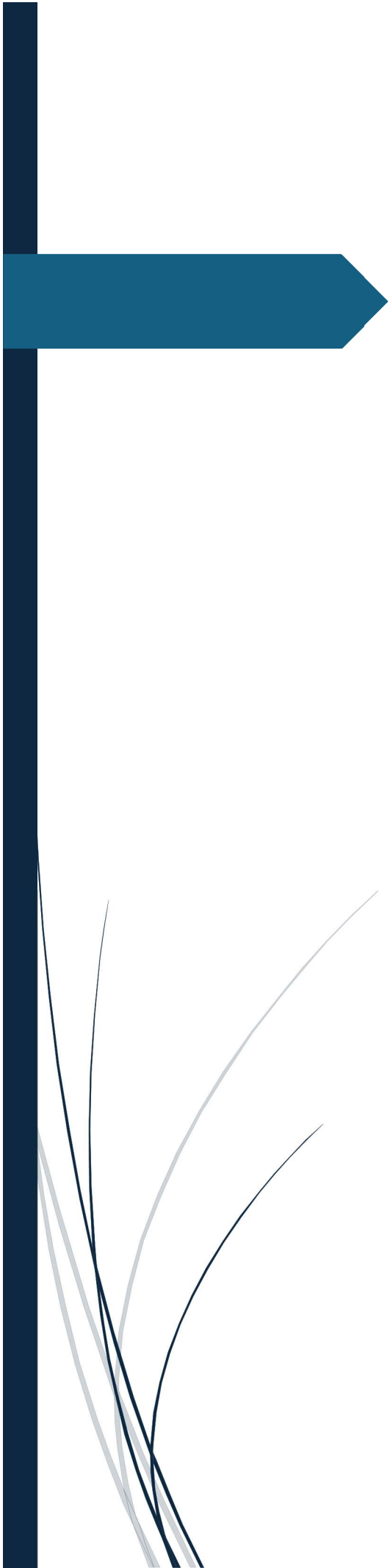


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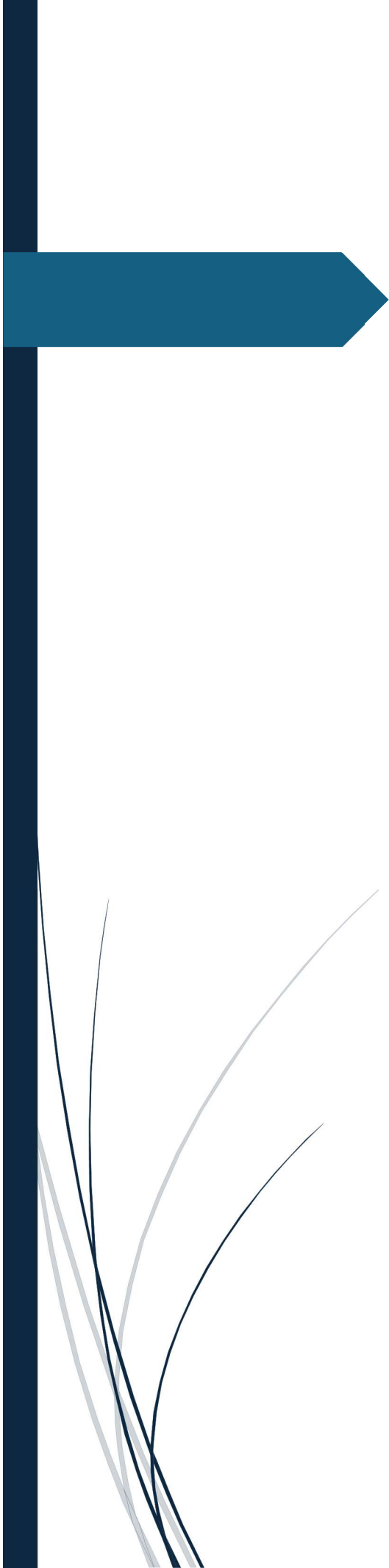
SALIENT FEATURES

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PHASE-3 Flyover in Double Decker Structure

Bengaluru Metro Rail Corporation Ltd. (BMRCL) intends to prepare Feasibility cum Detailed Project Report for construction as Double Decker (Flyover cum Metro) for Phase-3 corridors and of Bangalore Metro Rail Project.

S. No.	Parameter	Corridor 1 (JP Nagar 4th Phase to Hebbal)	Corridor 2 (Hosahalli to Kadabagere)	Total / Remarks
1	Corridor Length	28.486 km	8.635 km	37.121 km
2	Number of Loops	15	8	23
3	Land Area	31.54 acres	16.02 acres	47.56 acres
4	Completion Cost			
	(a) Construction Cost (Cr.)	₹ 5,019.54	₹ 1,649.40	₹ 6,668.94
	(b) Land Cost (Cr.)	₹ 2,183.73	₹ 839.66	₹ 3,023.39
	Total Project Cost (4+5) (Cr.)	₹ 7,203.27	₹ 2,489.06	₹ 9,692.33
5	Alignment Flyover Design	As per IRC Guidelines (IRC 86:2019, IRC 92:2017)		
6	Design Speed	80 kmph	80 kmph	
7	Min Speed	40 kmph	40 kmph	
8	Lane Configuration	4 Lane Divided	4 Lane Divided	
9	Foundation Type	Pile foundation, Open foundation, Raft foundation		
10	Substructure	RCC Pier, Precast Pier Cap, Portals		
11	Superstructure	Level 1: Precast Rib & Spine Girder / I - Girder		
		Level 2: Precast Box Girder / U - Girder		
12	FIRR			
	(a) Metro viaduct with Metro revenue	6.54%		
	(b) Double Decker with Metro Revenue	3.15%		
	(c) Double Decker + Metro & Toll Revenue	7.00%		
	(d) Road Flyover + Toll Revenue	7.58%		
13	EIRR			
	(a) Metro	17.04%		
	(b) Double Decker (Metro Viaduct + Flyover)	16.50%		
	(c) Road Flyover	15.24%		
14	Project Timeline	The completion period of Elevated flyover in Double Decker structure is 5 years (i.e.2025 to 2030).		



EXECUTIVE SUMMARY

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0.1 Introduction

Bengaluru, India's technology capital, has witnessed rapid urbanization, population growth, and robust growth in automobile ownership over past four years by crossing 1.2 crore registrations as on Feb 2025¹. Existing road infrastructure, particularly in core areas, is increasingly strained, resulting in severe traffic delays recent reports indicate that Bengaluru commuters experience some of the highest traffic delays. Bengaluru's infamous traffic meant the city was ranked 3rd slowest in travel time, after Barranquilla in Colombia and Kolkata, in the global traffic index for 2024 by Tom Tom traffic index². Traditional road widening is no longer a viable solution due to skyrocketing real estate prices and limited availability of land for expansion.

Recognizing these challenges, Bangalore Metro Rail Corporation Limited (BMRCL) has taken a commendable step by envisioning a Double Decker Corridor, an innovative infrastructure model where the first level will be a four-lane road flyover, and the second level will accommodate the Metro Rail system.

This initiative builds on the existing Metro network plans, with Detailed Project Reports (DPRs) already prepared for the proposed metro corridors. By integrating road and rail in a vertically stacked structure, BMRCL aims to optimize scarce urban space, improve mobility, and future-proof Bengaluru's transport infrastructure.

Now, Bengaluru Metro Rail Corporation Ltd. (BMRCL) intends to prepare Feasibility cum Detailed Project Report for construction as Double Decker (Flyover cum Metro) for (i) Corridor-1 from JP Nagar 4th Phase to Hebbal of 28.486 Km length (CH:0+631 to CH:29+117) (approx.) of Phase-3, (ii) Corridor-2 from Hosahalli to Kadabagere of 8.635 Km length (CH: 1+040 to CH:10+955 (approx.) of Phase-3.

For this purpose, BMRCL has engaged M/s Aarvee Associates for the preparation of Feasibility cum Detailed Project Report construction as Double Decker (Flyover cum Metro).

0.2 Existing Transportation System

An extensive overview of the study area characteristics for the proposed Double Decker (Flyover cum Metro) for (i) Corridor-1 from JP Nagar 4th Phase to Hebbal of 29.20 Km length (CH:0.600 Km to CH:29.600 Km) (approx.) of Phase-3, (ii) Corridor-2 from Hosahalli to Kadabagere of

¹ <https://timesofindia.indiatimes.com/city/bengaluru/bengaluru-vehicular-population-crosses-1-2-crore-karnatakas-3-crore/articleshow/119915885.cms#:~:text=The%20total%20number%20of%20registered,power%20despite%20global%20economic%20fluctuations.>

² <https://www.tomtom.com/traffic-index/ranking/?country=IN>

11.45 Km length (CH: 0.600 Km to CH:12.050 Km (approx.) of Phase-3 of Bangalore Metro Rail Project has been provided in the chapter. The region spans pass through 3 Zones, viz. Bruhat Bengaluru Mahanagara Palike (BBMP), adjoining areas of the Bangalore Development Authority (BDA), and the study area extends to parts of the Bengaluru Metropolitan Region (BMR), covering a combined area of 2390.46 sq. km., including the Bengaluru International Airport Area Planning Authority (BIAAPA) and an influence area of 578.00 sq. km., demarcated as a 5 km buffer on either side of the corridor.

Bengaluru is well-connected regionally through robust roads, rail, and air network. The city's road system includes radial and ring roads like the Outer Ring Road and major highways such as NH 48, NH 44, and NH 75, linking it to neighboring cities. Rail connectivity is provided by the Southwestern Railway Zone, with key stations like Krantiveera Sangolli Rayanna and Bengaluru Cantonment, supported by five radial corridors. Kempegowda International Airport (KIA) handles over 37.5 million passengers annually, while HAL Airport caters to defense and non-scheduled aviation. Public transport is anchored by KSRTC and BMTC, ensuring seamless interstate, regional, and intra-city connectivity.

Bengaluru's escalating traffic congestion, driven by rapid urbanization and inadequate public transport, has led to severe road network strain, increased air pollution, and mobility challenges, necessitating strategic infrastructure upgrades, enhanced public transit, and sustainable traffic management solutions.

Previous studies, such as the Comprehensive Mobility Plan (CMP) and Revised Master Plan for Bengaluru 2015 and 2031, underline strategies for sustainable urban growth, enhanced regional connectivity, and effective public transport integration. Transit-Oriented Development (TOD) and parking policies aim to increase public transport usage and reduce congestion.

The chapter concludes with Corridor-wise Site Appreciation section provides an in-depth analysis of the land use characteristics and ramp locations along various proposed elevated corridor alignments. The consultants conducted a reconnaissance survey to capture the existing features of the study areas, highlighting commercial, industrial, mixed-use, educational, recreational, and public and semi-public land use activities. Key nodes such as malls, hospitals, schools, parks, and government offices are detailed for corridors like JP Nagar 4th Phase to Hebbal and Hosahalli to Kadabagere among others. The study identifies ramps along the JP Nagar to Hebbal, and Hosahalli to Kadabagere corridor, strategically placed to ensure seamless connectivity and reduce traffic congestion at critical junctions, such as Vega City Mall, Kittur Rani Chennamma Circle, NICE Road, and NH4. Justifications for each ramp are provided, emphasizing accessibility to major transport hubs, residential areas, and commercial centers, with accompanying field photographs to illustrate key points. This comprehensive assessment underpins the design

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rationale and connectivity improvements for the proposed elevated corridors. Photographs highlight key features, such as service road extensions, and existing foot over bridges.

The following Figure 0-1 & Figure 0-2 illustrates the Study and Influence area designated for conducting various traffic and travel surveys related to the proposed double decker fly over & Metro.

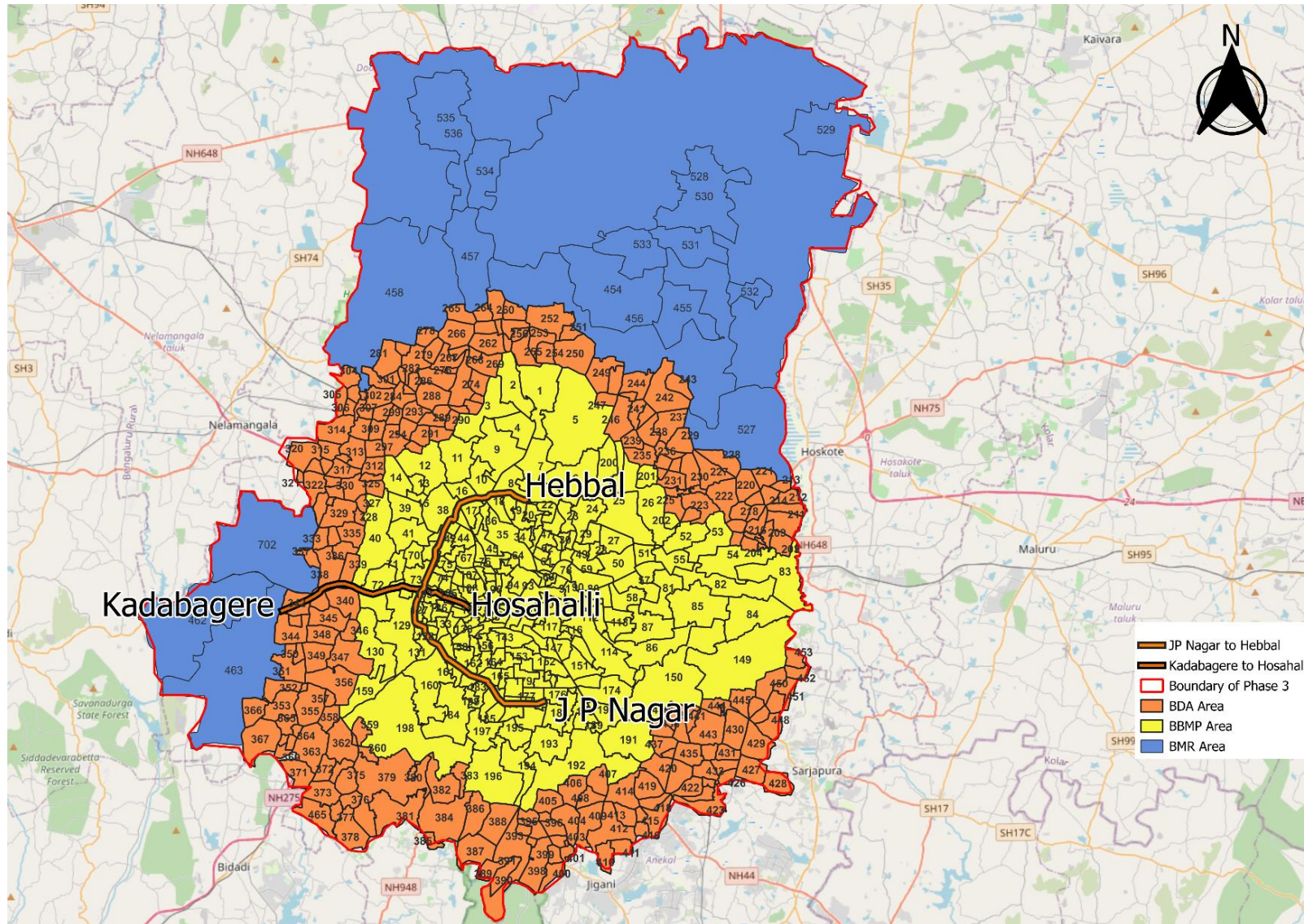


Figure 0-1: Study Area

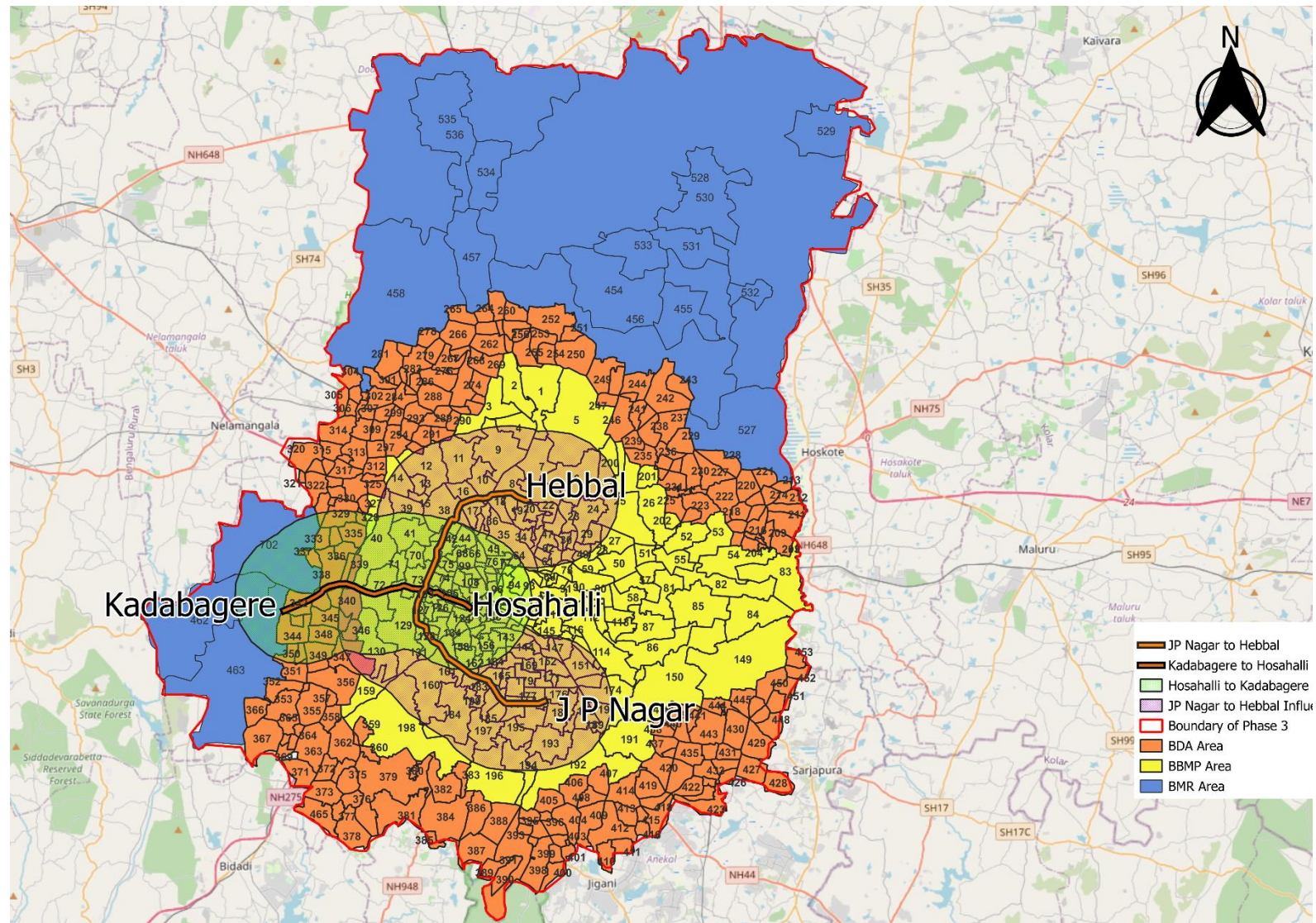


Figure 0-2: Influence Area

0.3 Traffic Surveys and Data Analysis

A comprehensive analysis of traffic surveys conducted as part of the Feasibility cum Detailed Project Report construction as Double Decker (Flyover cum Metro) for (i) Corridor-1 from JP Nagar 4th Phase to Hebbal of 29.20 Km length (CH:0.600 Km to CH:29.600 Km) (approx.) of Phase-3, (ii) Corridor-2 from Hosahalli to Kadabagere of 11.45 Km length (CH: 0.600 Km to CH:12.050 Km (approx.) of Phase-3 corridor of Bangalore Metro Rail Project has been carried out. The study aimed to evaluate traffic demand, existing road conditions and potential flyover ridership to determine the project's viability. Multiple surveys were carried out, including classified traffic volume counts (CTVC) at mid-block and screen-line locations, turning movement counts at key junctions, pedestrian volume counts, parking surveys, and origin-destination studies. Additional efforts included stated preference surveys to assess user willingness to pay for the service and non-motorized transport (NMT) surveys to evaluate opinions on infrastructure needs.

Classified Traffic Volume Counts (CTVC) surveys analyze the volume of different vehicle types passing through a specific road section. These surveys use video recording for data collection over a 24-hour period, ensuring accurate classification of vehicles into motorized and non-motorized categories. The results indicate that maximum traffic was recorded on Outer Ring Road near Laggere (154,276 PCUs).

Turning Movement Volume Counts (TMC) survey identifies traffic flow at intersections and measures the number of vehicles making left, right, and U-turns. Conducted at major junctions, the survey highlights congestion-prone areas. The results show the highest traffic at the Hebbal Flyover junction (411,388 PCUs) and the lowest at the Agrahara Dasarahalli intersection (48,189 PCUs). These findings assist in designing better traffic signal timings and road expansions.

Pedestrian surveys analyze foot traffic at key intersections and crossings to improve pedestrian facilities. This survey was conducted at 16 locations along Corridor 1 and 4 locations along Corridor 2. The highest pedestrian movement was recorded at the Hebbal Flyover junction, with 5,642 pedestrians crossing during peak hours. Similarly, at the Magadi Main Road and Outer Ring Road junction, 4,738 pedestrians were counted. The findings highlight the need for better pedestrian infrastructure at busy junctions. These surveys help in planning safer crossings and footbridges.

Parking surveys assess vehicle parking demand at different locations, including near metro stations and commercial areas. Data from these surveys revealed high parking demand at proposed metro stations, emphasizing the need for additional parking facilities. Eleven locations were surveyed, each covering a 250-meter radius around station areas.

Occupancy surveys determine the average number of passengers per vehicle. Conducted manually by enumerators at mid-block and screen-line locations, these surveys found that the highest occupancy was observed in institutional buses (33.41 passengers per bus), followed by city buses (30.24 passengers per bus). Private cars had an average occupancy of 2.28 persons per vehicle, highlighting a need for carpooling incentives.

Origin-Destination surveys track trip patterns of commuters to analyze traffic movement. Conducted at major corridors, they revealed that most daily trips are work-related (78.9%), followed by education (6.9%) and business (5.5%). This data aids in planning efficient public transportation systems.

User opinion surveys provide qualitative insights into commuters' travel experiences, concerns, and preferences. A survey of 1,000 respondents found that 91% of commuters were unwilling to pay tolls for improved road infrastructure. Additionally, 78% reported peak-hour congestion between 6 AM - 9 AM, and 48% between 6 PM - 9 PM. This data is crucial for addressing public dissatisfaction with transportation facilities.

Journey Time and Speed-Delay surveys assess travel time variations and delays caused by congestion. The results showed that the majority of delays along key corridors were due to traffic signals, pedestrian crossings, and police checking. Delays ranged from 100 to 300 seconds in high-traffic areas, reinforcing the need for better traffic management solutions.

Conducted among cyclists and pedestrians, Non-Motorized Transport (NMT) Opinion survey found that only 2.67% of commuters owned bicycles, and around 60% walked daily. Safety concerns were raised, with about 64% feeling "somewhat safe" while walking, while 17% felt unsafe. Additionally, 63.37% of the respondents were aware of a bicycle-sharing system, with over half willing to pay up to ₹50 for such services.

Boarding and alighting surveys measured public transport usage. This survey was conducted at 25 bus stops along the proposed Mass Rapid Transit System (MRTS) corridors to measure passenger boarding and alighting patterns. The busiest stop in Corridor 1 was BEL Road - BEL Circle, with 11,889 passengers per day. In Corridor 2, the highest count was at Kamakshipalya Bus Stop on Magadi Main Road, serving 10,801 passengers

The road network inventory survey assessed key road parameters such as right-of-way, carriageway width, pavement condition, and pedestrian facilities. The survey revealed that approximately 50% of roads have a two-lane configuration, while 45% have three lanes and only 5% have four lanes. Pavement conditions were generally good, with 74% rated as "good" and 26% as "fair". Footpaths were available on only 41% of surveyed roads, with 21% having widths of less than 1 meter, emphasizing the need for better pedestrian infrastructure.

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The household survey analyzed demographic and travel behavior data from 5,000 households. Around 52% of respondents were between the ages of 25-50, and 38% of surveyed households had four members. The average household size was 3.41, and 52% of households had at least one student. Education levels varied, with 24.94% having a graduate degree, while 10.03% were illiterate. The survey also examined trip behavior, revealing that 62% of trips were work-related, followed by 21% for education. The per capita trip rate was 0.57, with an average trip length of 14.87 km.

In conclusion, the study provides a comprehensive evaluation of the feasibility for constructing the Double Decker (Flyover cum Metro) for the identified corridors in Bangalore. It highlights the need for such a solution due to significant traffic congestion, poor road performance, and increasing demand for efficient public transport. The traffic survey results, including traffic volumes, parking requirements, road conditions, and user preferences, offer critical insights for planning and decision-making.

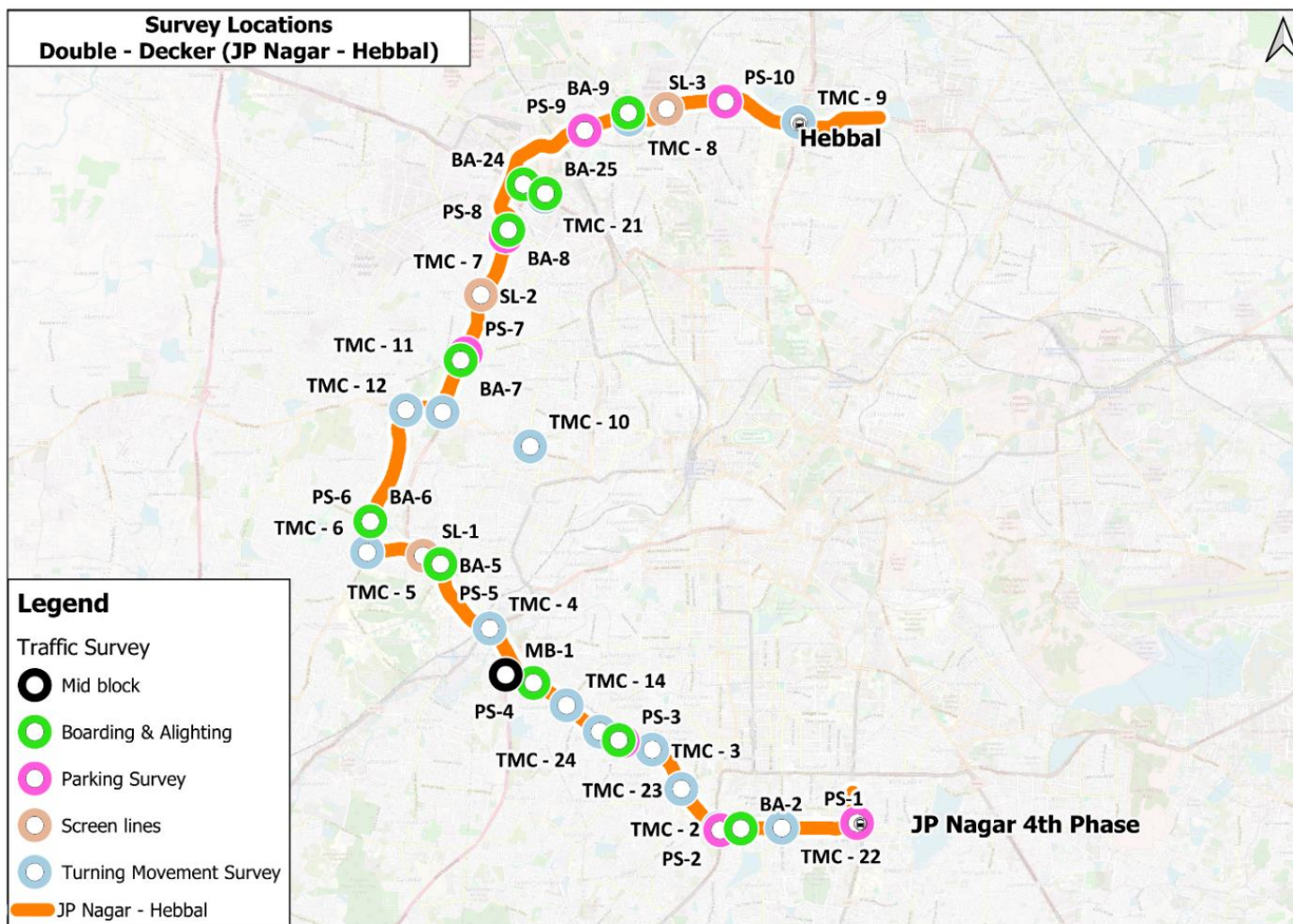


Figure 0-3: Proposed Traffic Survey Locations – JP Nagar to Hebbal (Mid Block, Boarding Alighting, Parking, Screen Line and Turning Movement Count)

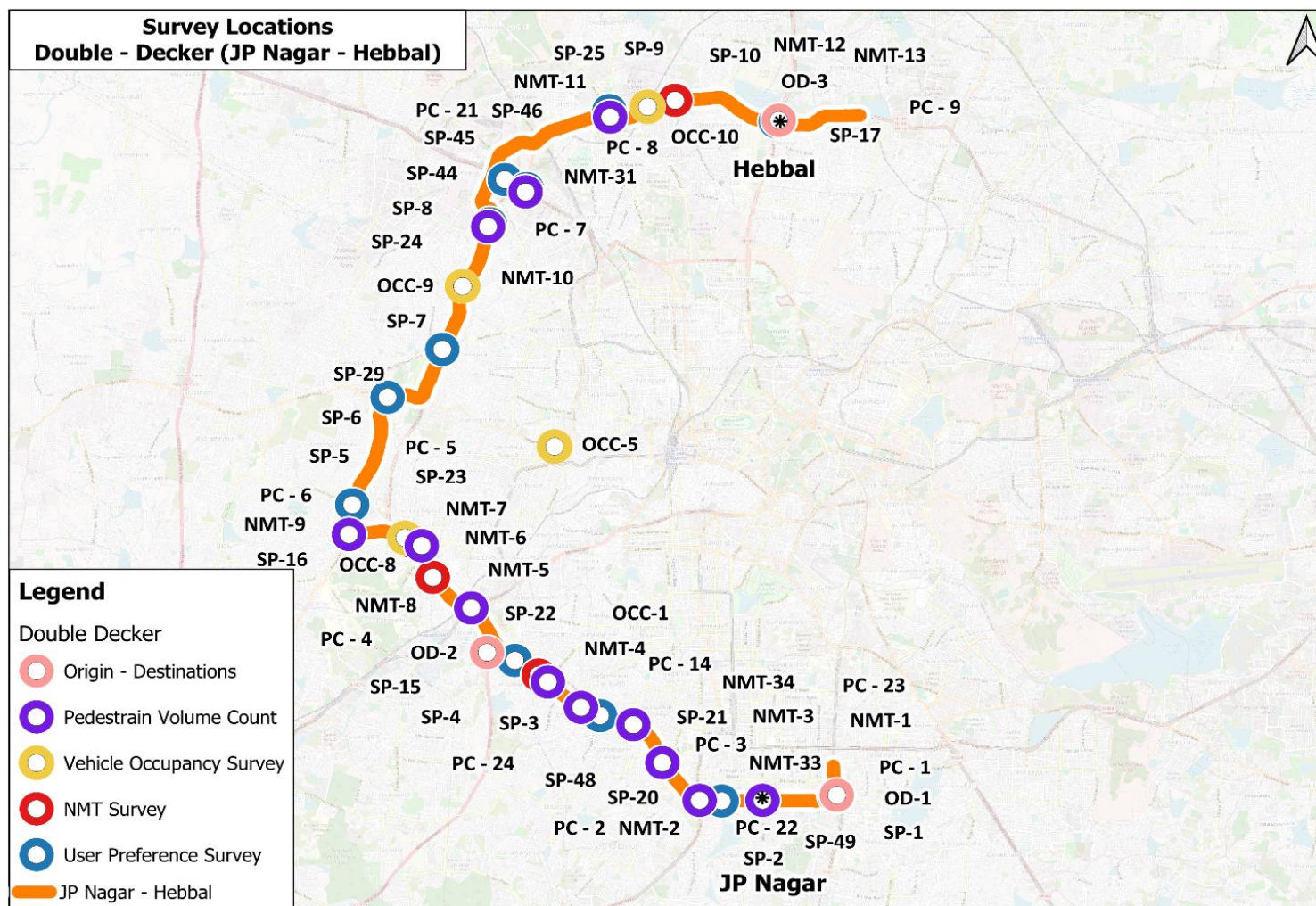


Figure 0-4: Proposed Traffic Survey Locations – JP Nagar to Hebbal (Origin-Destination, Pedestrian Volume Count, Vehicle Occupancy, NMT Opinion, User Preference)

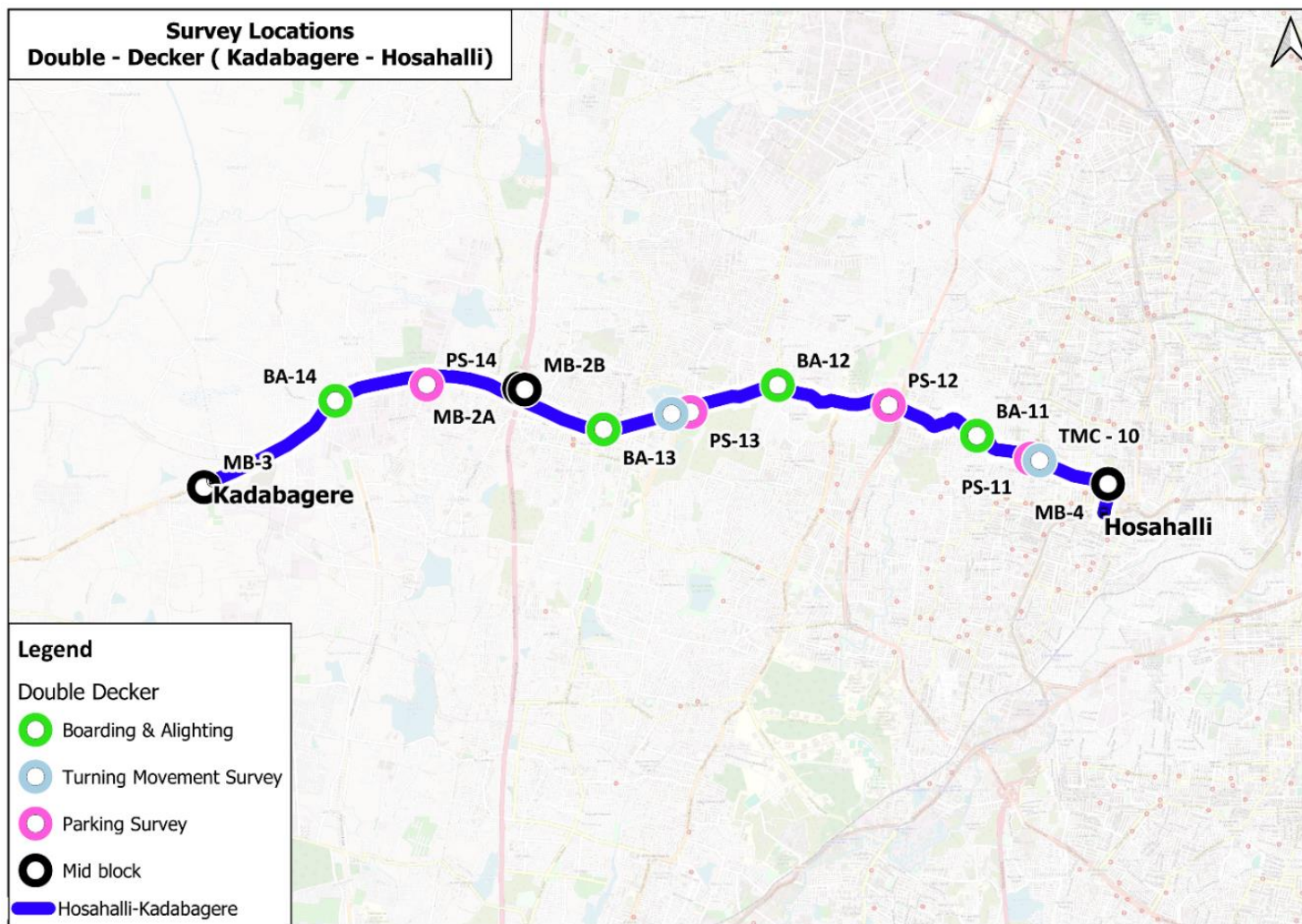


Figure 0-5: Proposed Traffic Survey Locations – Hosahalli to Kadabegere (Mid Block, Boarding Alighting, Parking and Turning Movement Count)

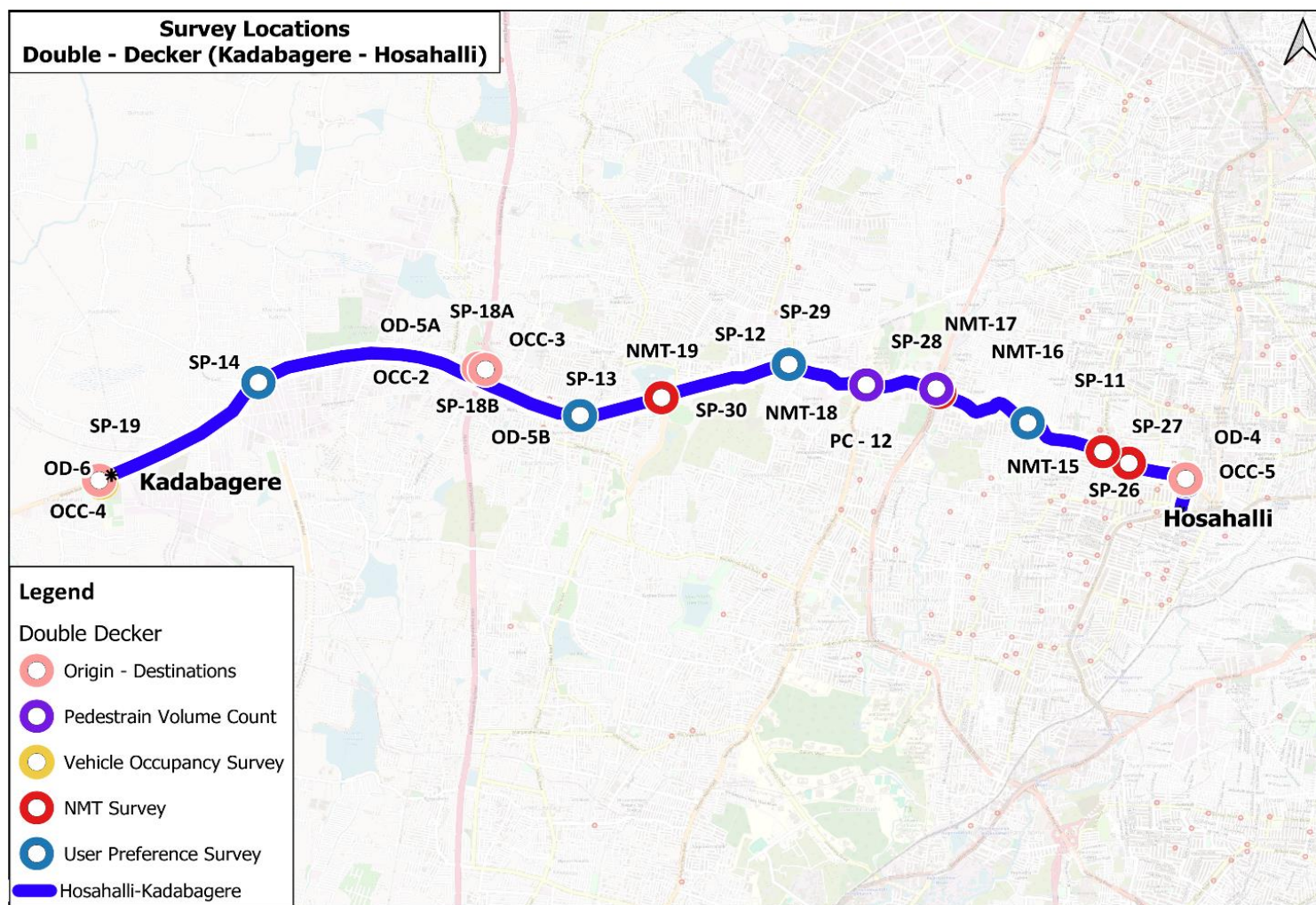


Figure 0-6: Proposed Traffic Survey Locations – Hosahalli to Kadabegere (Origin-Destination, Pedestrian Volume Count, Vehicle Occupancy, NMT Opinion, User Preference)

0.4 Travel Demand Model

The study area passes through 3 Zones, viz. Bruhat Bengaluru Mahanagara Palike (BBMP) (741 sq. km), adjoining areas of the Bangalore Development Authority (BDA) (478.5 sq. km), and the study area extends to parts of the Bengaluru Metropolitan Region (BMR) (1170.96 sq. km), covering a combined area of 2390.46 sq. km., including the Bengaluru International Airport Area Planning Authority (BIAAPA). This inclusion ensures that the impact of these trips is adequately considered in the analysis. This study area has been considered the same as that of the final CMP for Bengaluru 2020, Phase 3 Metro DPR Study. The area within 5.0 kilometers on either side of the study corridor have been considered as influence area of 578.00 sq. km.

Traffic Forecast

This section provides an overview of the key aspects of the Feasibility cum Detailed Project Report for the construction of Double Decker (flyover cum Metro), including the planning period, population and employment projections, and ridership forecasts for the proposed corridors. The study aims to evaluate the future demand for the double-decker system and its impact on the region's growth

Planning Period

As per the scope of the study, the feasibility for the construction as Double Decker (Flyover cum Metro) shall be assessed up to 2061. The Traffic estimates are assessed for the base year 2024 and horizon years 2031, 2041, 2051 and 2061.

Population Projections

After referring to CMP 2020 for Bangalore, the consultants have assumed an overall average growth rate of 3%, considering ongoing development activities in the corridor and the anticipated boost to growth in rural areas due to Metro connectivity. A summary of the population forecast is provided in Table 0-1.

Employment Projections

After referring to CMP 2020 the consultants have assumed an overall average growth rate of 5%, increase over the previous decade taking into account high growth in IT sector and migration. A summary of the population forecast is provided in Table 0-2

Ridership for Proposed Double decker flyover Corridor

The base year calibration and validation were performed for Base year 2024 and ridership forecast is carried out for horizon years 2031, 2041, 2051, and 2061.

Table 0-1: Population Projection in the Study Area

Sl. No.	Jurisdiction	2011	2024	2031	2036	2041	2046	2051	2056	2061
1.	BBMP	84,49,004	1,50,15,984	1,91,38,991	2,19,03,616	2,46,68,241	2,77,20,080	3,07,71,920	3,35,00,723	3,62,29,527
2.	BDA	6,12,376	11,75,692	16,24,816	19,04,216	21,83,617	24,89,416	27,95,215	31,01,283	34,07,351
3.	BMR	6,68,137	12,60,106	16,59,084	19,44,378	22,29,671	26,12,300	29,94,929	33,22,866	36,50,802
4.	Total	97,29,517	1,74,51,782	2,24,22,891	2,57,52,210	2,90,81,529	3,28,21,797	3,65,62,064	3,99,24,872	4,32,87,680

Table 0-2: Employment Projection in the Study Area

Sl.No.	Jurisdiction	2011	2024	2031	2036	2041	2046	2051	2056	2061
1.	BBMP	37,09,113	63,06,713	95,69,495	1,10,75,149	1,25,80,803	1,42,91,101	1,60,01,399	1,74,20,376	1,88,39,354
2.	BDA	2,68,833	5,79,700	8,12,408	9,63,026	11,13,645	12,83,578	14,53,512	16,12,667	17,71,823
3.	BMR	2,93,319	6,17,492	7,63,908	8,62,312	9,60,716	11,10,859	12,61,002	13,99,079	15,37,156
4.	Total	42,71,264	75,03,905	1,11,45,811	1,29,00,488	1,46,55,164	1,66,85,539	1,87,15,913	2,04,32,123	2,21,48,333

Table 0-3: Homogeneous sections Traffic flow between the junctions along JP Nagar to Hebbal corridor (DN)

Do Nothing-Traffic On Existing Road(Ground)					Do Nothing-Traffic On Existing Road(Ground)				
JP NAGAR to HEBBAL					HEBBAL to JP NAGAR				
Junctions	2031	2041	2051	2061	Junctions	2031	2041	2051	2061
JP nagar to Saraki junction	2895	3465	3863	4348	Hebbal Junction to Peenya Junction	4350	5238	5970	6582
Saraki junction to Mysore Road Junction	4599	5243	5851	6287	Peenya Junction to Sumanahalli Junction	3721	4302	4743	5201
Mysore Road Junction to Sumanahalli Junction	3013	3462	3921	4117	Sumanahalli Junction to Mysore Road Junction	3330	3908	4333	4711
Sumanahalli Junction to Peenya Junction	3799	4309	4776	5114	Mysore Road Junction to Saraki junction	3855	4440	5098	5393
Peenya Junction to Hebbal Junction	4587	5422	6308	6969	Saraki junction to JP nagar	2978	3639	4238	4693

Table 0-2: Homogeneous sections Traffic flow between the junctions along JP Nagar to Hebbal corridor on existing road with Elevated corridor

Do something-Traffic On Existing Road(Ground)					Do something-Traffic On Existing Road(Ground)				
JP NAGAR to HEBBAL					HEBBAL to JP NAGAR				
Junctions	2031	2041	2051	2061	Junctions	2031	2041	2051	2061
JP nagar to Saraki junction	2701	3222	3613	3986	Hebbal Junction to Peenya Junction	3773	4647	5620	6333
Saraki junction to Mysore Road Junction	4292	5094	5490	5870	Peenya Junction to Sumanahalli Junction	3410	3990	4665	5027
Mysore Road Junction to Sumanahalli Junction	3030	3503	3828	4141	Sumanahalli Junction to Mysore Road Junction	3257	3843	4328	4686
Sumanahalli Junction to Peenya Junction	3476	4017	4522	5003	Mysore Road Junction to Saraki junction	3623	4229	4704	5340
Peenya Junction to Hebbal Junction	3971	4891	5725	6506	Saraki junction to JP nagar	2744	3483	4068	4311

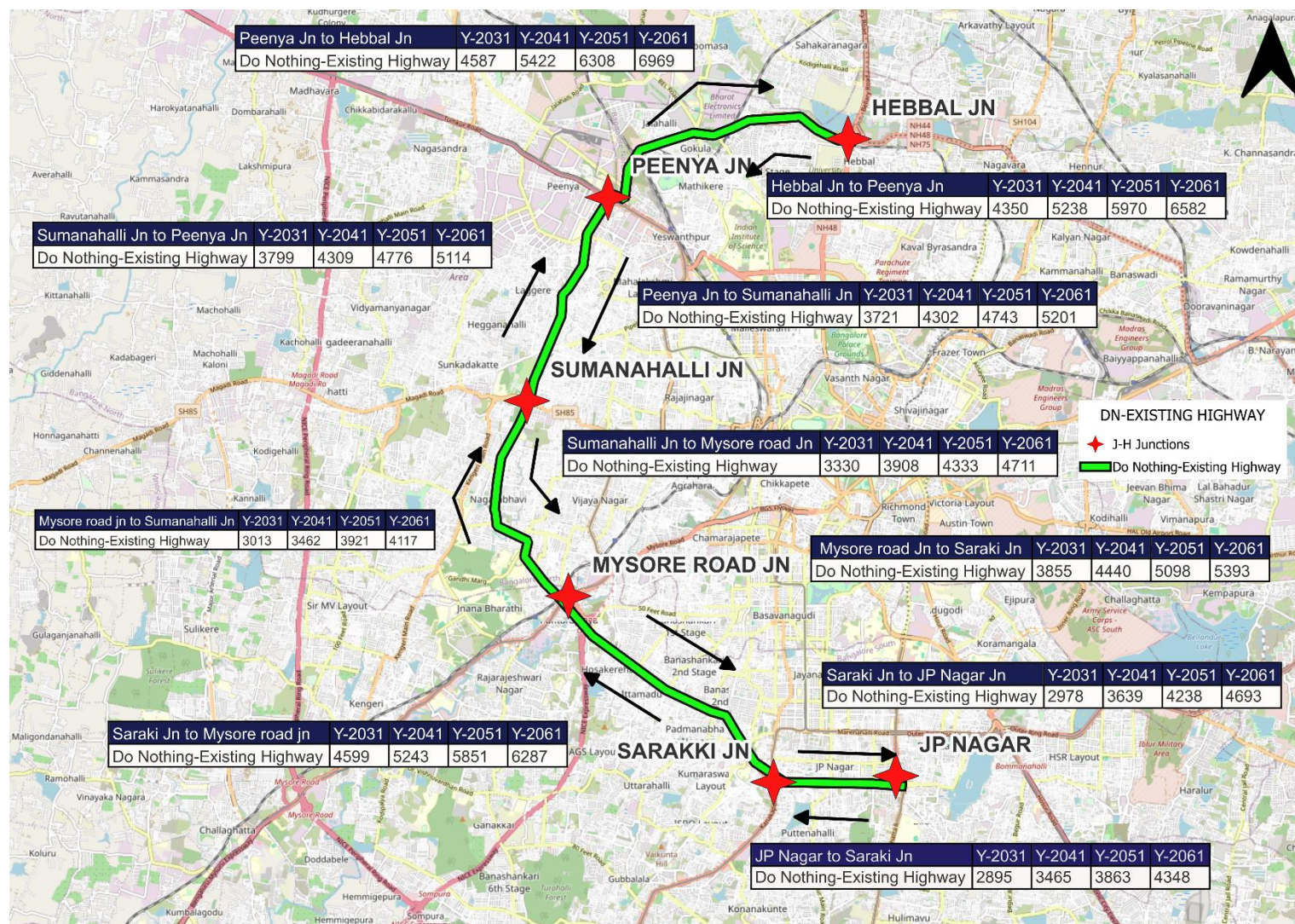


Figure 0-7 Homogeneous sections Traffic flow between the junctions along JP Nagar to Hebbal corridor-Do Nothing.

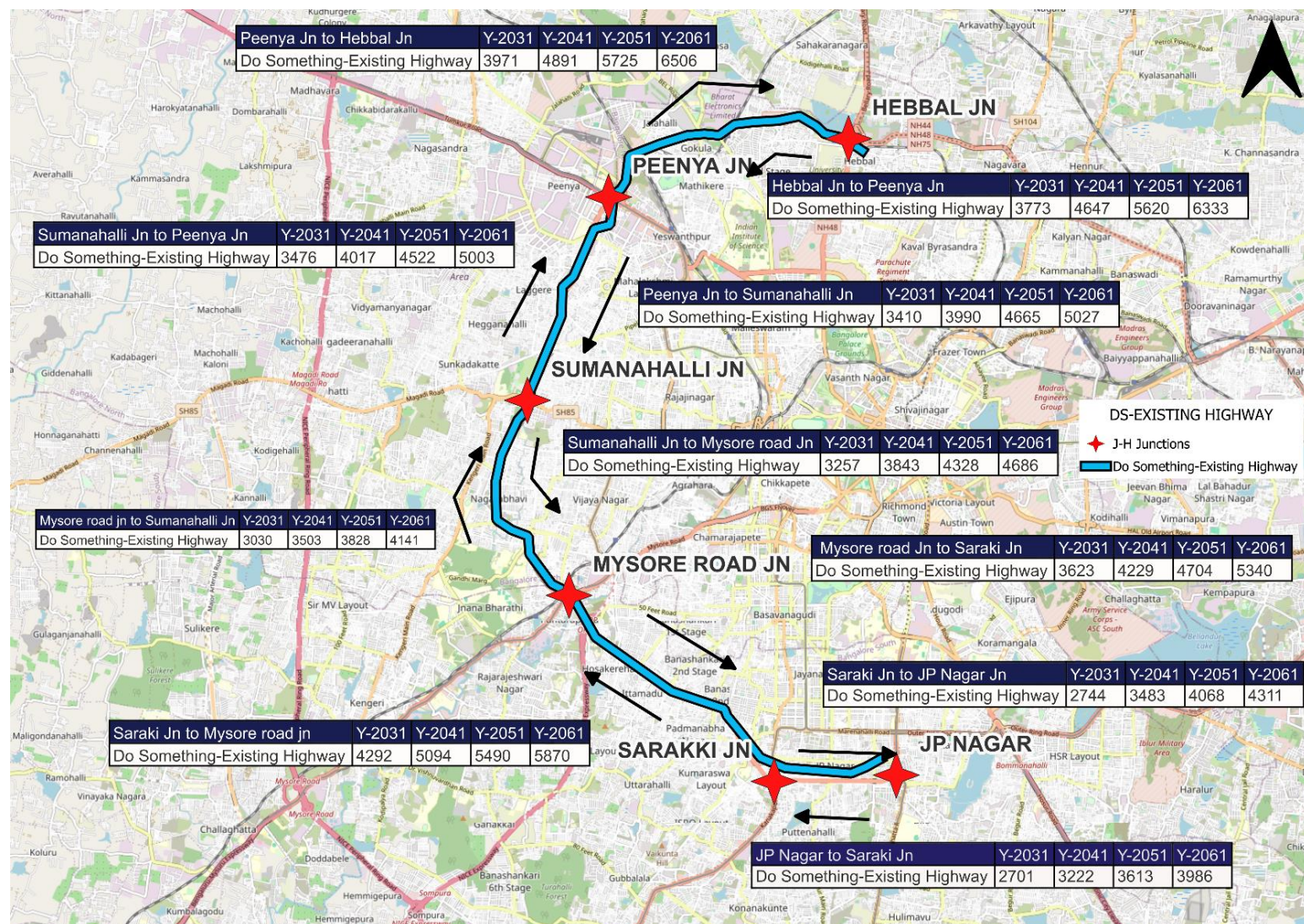


Figure 0-8 Homogeneous sections Traffic flow between the junctions along JP Nagar to Hebbal Corridor with elevated corridor - Do Something.

Table 0-3 Homogeneous sections Traffic flow between the junctions along Kadabagere to Hosahalli corridor

Do Nothing-Traffic On Existing Road(Ground)					Do Nothing-Traffic On Existing Road(Ground)				
KADABAGERE to HOSAHALLI					HOSAHALLI to KADABAGERE				
Junctions	2031	2041	2051	2061	Junctions	2031	2041	2051	2061
Kadabagere to Magadi Road Junction	1837	2095	2631	2690	Toll Gate Junction(Hosahalli) to Sumanahalli junction	2325	2506	2521	2684
Magadi Road Junction to Sumanahalli Junction	2294	2576	3000	3125	Sumanahalli Junction to Magadi Road Junction	1641	2003	2186	2394
Sumanahalli junction to Toll Gate Junction(Hosahalli)	2532	2539	2701	2733	Magadi Road Junction to Kadabagere	1335	1455	1554	1696

Table 0-4 Homogeneous sections Traffic flow between the junctions along Kadabagere to Hosahalli Corridor on existing road with elevated corridor

Do something-Traffic On Existing Road(Ground)					Do something-Traffic On Existing Road(Ground)				
KADABAGERE to HOSAHALLI					HOSAHALLI to KADABAGERE				
Junctions	2031	2041	2051	2061	Junctions	2031	2041	2051	2061
Kadabagere to Magadi Road Junction	1369	1640	1834	2159	Toll Gate Junction(Hosahalli) to Sumanahalli junction	1517	1777	1999	2119
Magadi Road Junction to Sumanahalli Junction	2102	2439	2604	2821	Sumanahalli Junction to Magadi Road Junction	1343	1723	2015	2225
Sumanahalli junction to Toll Gate Junction(Hosahalli)	1677	1926	2193	2545	Magadi Road Junction to Kadabagere	945	1067	1140	1272

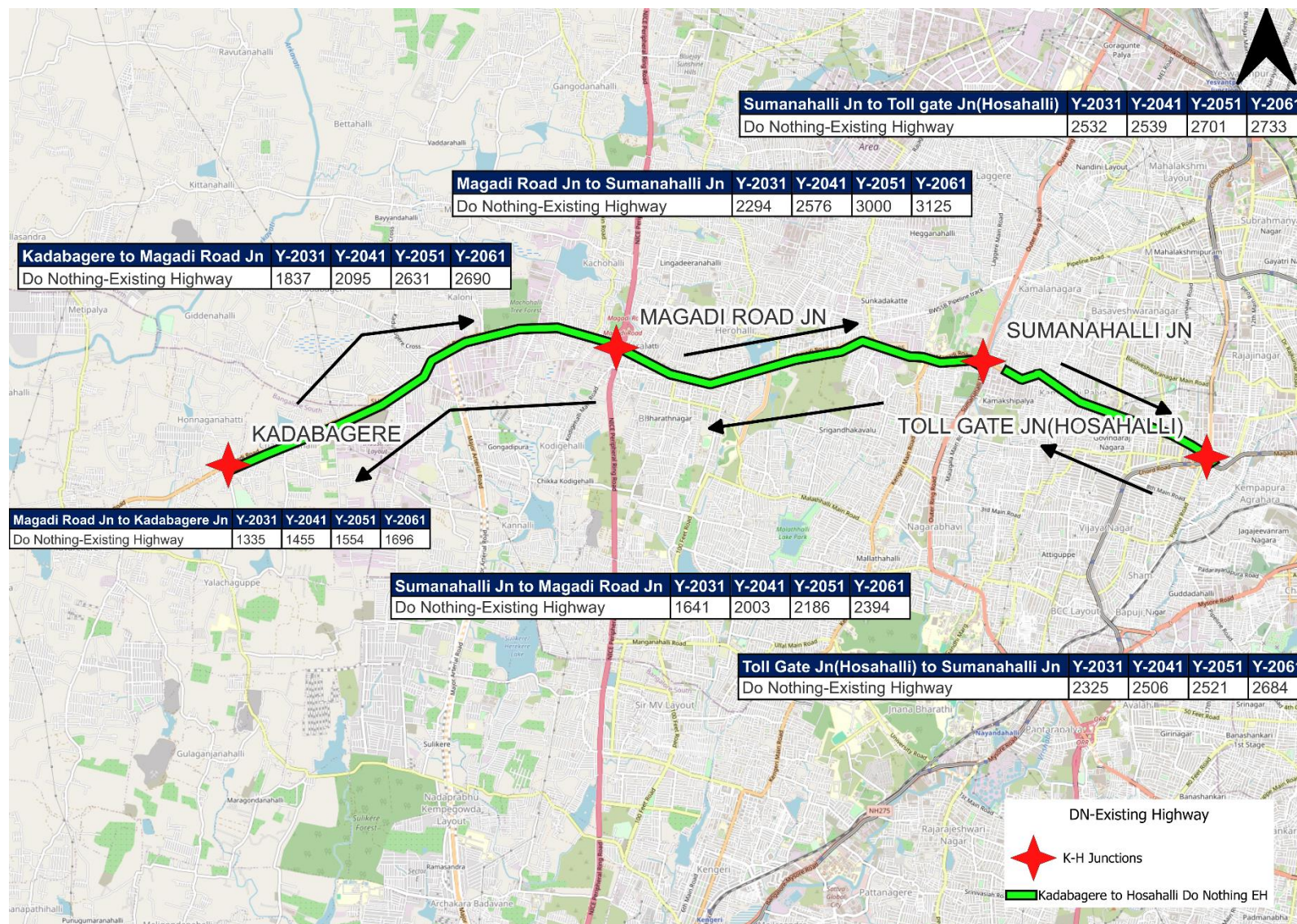


Figure 0-9 Homogeneous sections Traffic flow between the junctions along Kadabagere to Hosahalli corridor

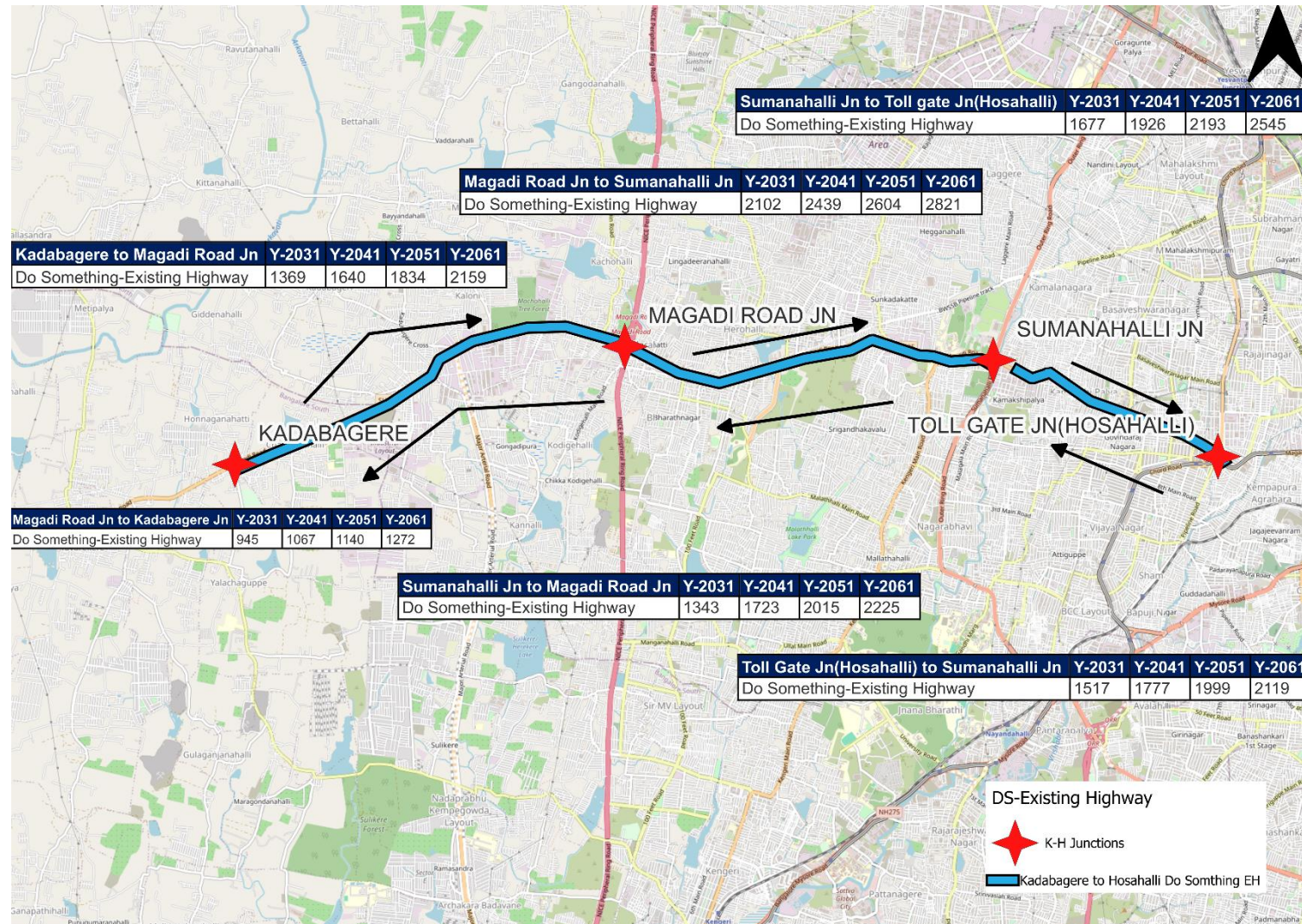


Figure 0-10 Homogeneous sections Traffic flow between the junctions along Kadabagere to Hosahalli Corridor - Do Something Existing Highway Scenario

0.5 Alignment Details

Engineering Survey

The topographic survey for the proposed Double Decker (Flyover cum Metro) for (i) Corridor-1 from JP Nagar 4th Phase to Hebbal of 28.486 Km length (CH:0+631 to CH:29+117) (approx.) of Phase-3, (ii) Corridor-2 from Hosahalli to Kadabagere of 8.635 Km length (CH: 1+04 to CH:10+955 (approx.) of Phase-3 corridor of Bangalore Metro Rail Project has been provided in the chapter. The survey was conducted using advanced Aerial LiDAR Technology via Drone/UAV systems, enabling high-precision elevation measurements and the creation of three-dimensional geospatial data. This approach ensures detailed topographical coverage across a 100m from centre of the alignment while minimizing manual labour and ensuring accuracy.

Geometric design parameters

Geometric design of the Elevated highway shall be in accordance with Geometric Design Standards for Urban Roads and Streets IRC:86-2018 and Guidelines for the Design of Interchanges in Urban Areas IRC:92-2017 considering the urban conditions.

Table 0-5: Design Speed (IRC: 86:2018)

Class of Urban Road	Type of Terrain		
	Plain	Rolling	Mountainous and Steep
Urban Expressway	80	70	60
Arterial Road	60	50	40
Sub Arterial Road	60	50	40
Collector Street	40	40	30
Local Street	30	30	20

Table 0-6 Horizontal Curve Parameter (IRC: 86:2018)

Design Speed	Minimum Radius (m) when Super Elevation is Limited to	
	7 Percent	4 Percent
50	90	105
60	130	150
70	175	200
80	230	265

Table 0-7: Safe Sight Distance

Design Speed (km/hr)	Safe Stopping sight distance (m)
50	60
60	80
70	105
80	120

Gradients

Most urban roads carry mixed traffic including slow moving vehicles like bicycles and animal/hand carts. Besides this, urban roads generally have intersections at frequent intervals. In view of this, as a rule, a gradient of 4 per cent should be considered the maximum for urban roads.

On roads carrying predominantly slow-moving traffic, however, the gradient should desirably not exceed 2 per cent. At intersections, the road should be as near level as possible.

Ramp profiles usually consist of a section of tangent grade between two vertical curves, valley curves at the lower end and the summit curve at the upper end. The ramp may be for one way or two-way operation. The tangent grades on ramps should be as flat as feasible, and desirably, it should be limited to a maximum of 4 per cent and in no case, should it exceed 6 per cent.

Alignment Description

Metro Alignment

The proposed alignment JP Nagar 4th phase station to Hebbal covers a distance of 32.15 km via Vega City Mall, JP Nagar, Dayanand Sagar College of Engineering, Kamakya Junction, Directorate of Secondary Education and Research Training, PES University, Mysore Road, Nagarbhavi, Dr. Ambedkar Institute of Technology (AIT), Sumanahalli Cross, Goraguntepalya, Muthyalanagar, BEL circle and Nagashettyhalli terminates at Hebbal. The corridor is proposed completely elevated and 22 stations have been proposed on the corridor.

The proposed alignment Hosahalli to Kadabagere covers a distance of 12.50 Km via KHB colony, Kamakshipalya, Sumanahalli cross, Sunkadakatte, Herohalli, Byadarahalli, Kamath layout and terminates at Kadabagere. The corridor is proposed completely elevated. Total of 9 stations have been proposed along the corridor.

Elevated Road Flyover

Phase-3 Corridor-1: JP Nagar 4th phase to Hebbal

The proposed alignment corridor JP Nagar 4th phase to Hebbal covers a distance of 28.486 Km starting from CH: 0.631 Km and running up to CH: 29.117 Km.

Sl. No.	Description	Chainage (Km)	Length in Km
1	Double Decker (J.P. Nagar 4 th Phase to Hebbal)	0.631 to 29.117	28.486

Sl. No.	Description	Chainage	Length of Loop in Km
1	RAMP	0+631	-
2	LOOP LHS	3+820	0.370
3	LOOP RHS	3+820	0.370
4	LOOP LHS	8+840	0.610
5	LOOP RHS	9+560	0.390
6	LOOP LHS	11+240	0.280
7	LOOP RHS	11+177	0.280
8	LOOP RHS	12+608	0.290
9	LOOP LHS	16+575	0.160
10	LOOP LHS	17+980	0.320
11	LOOP RHS	17+980	0.320
12	LOOP LHS	22+034	0.300
13	LOOP RHS	22+034	0.300
14	LOOP LHS	22+825	0.300
15	LOOP RHS	22+825	0.300
16	LOOP LHS	29+600	0.975
17	RAMP	29+117	-
Total			5.565

Phase-3 Corridor-2: Hosahalli to Kadabagere

The proposed alignment corridor from Hosahalli to Kadabagere covers a distance of 8.635 km starting from CH: 1.041 Km and running up to CH: 5.120 Km and CH: 6.400 Km and CH: 10.955 Km.

Sl. No.	Description	Chainage	Length in Km
1	Double Decker (Hosahalli to Kadabagere)	1.040 to 5.120	4.08
		6.400 to 10.955	4.555
	Total		8.635

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Sl. No.	Description	Chainage	Length of Loop in Km
1	RAMP	1+041	-
2	LOOP LHS	3+540	0.230
3	LOOP RHS	3+520	0.440
4	LOOP RHS	3+700	0.940
5	LOOP LHS	4+520	0.420
6	RAMP	5+120	-
7	RAMP	6+400	-
8	LOOP LHS	8+875	0.290
9	LOOP RHS	8+875	0.290
10	LOOP LHS	9+369	0.290
11	LOOP RHS	9+258	0.290
12	RAMP	10+955	-
Total			3.190

Construction Methodology

This construction methodology for double decker is designed to optimize space utilization, minimize traffic disruptions, and ensure structural safety, while also maintaining cost-effectiveness and environmental sustainability throughout the project lifecycle.

The proposed structure consists of:

- Level 1 (Flyover): *Precast Rib & Spine Girder system*, suitable for efficient span coverage.
- Level 2 (Metro viaduct): *Precast Box Girder/U-girder/I-girder*, ensuring quicker installation and better load distribution.

For sections requiring a composite structure, the use of I-Girders is recommended, offering enhanced structural integrity and simplified construction for longer spans or areas with complex alignment.

0.6 Station Planning

This chapter has been extracted from the Detailed Project Report (DPR) of Metro Phase-3, with modifications based on the latest Feasibility cum Detailed Project Report for the proposed Double-Decker structure (flyover-cum-metro) corridors. The proposed Bangalore Metro Phase-3 corridors has been planned to serve major passenger catchment areas/ destinations and to enable convenient integration with other modes of transport. Stations vary in complexity along the route and have been located by an interactive process influenced by alignment, ridership forecasts,

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Inter- station Distance (ISD)/station spacing, land availability, interchange requirements with other modes of transport, utilities, road and pedestrian requirements, etc.

Station Planning Parameters

The station planning will be determined by the following factors. The essential quality in a good station layout is the provision of sufficient space for efficient movement of passengers between ground level entrances on to the trains and vice versa in the most direct, simple and logical way.

Table 0-8 Typology of stations in Phase 3 – Corridor 01 & 02: JP Nagar to Hebbal and Hosahalli to Kadabagere

Sl. No	Proposed Station Type	Station Typology	Platforms	Remarks	Station Description
1	Type A	Elevated	Side platforms	135 x 24 M at Road Median	Street Level – Entry Exits, DG room, Pump Room and Parking, Service road Level 01 – Concourse Level -ASS /TSS, other services and passenger amenities, Level 02 – Platform Level - track and platforms, emergency staircase to concourse
2	Type B	Double Decker Elevated	Side platforms	135 x 24 M at Road Median	Street Level – Entry Exits, DG room, Pump Room and Parking, Service road Level 01 – Elevated Carriage way Level 02 – (Concourse) -ASS / TSS, other services and passenger amenities, connecting unpaid FOB from opposite side Level 03 – (Platform) - track and platforms
3	Type C	Double Decker Elevated (JP Nagar)	Side platforms	135 x 28.6 M at Road Median (crossing existing Metro line)	Street Level – Entry Exits, DG room, Pump Room and Parking, Service road Level 01 – Elevated Carriage way Level 02 – Existing Metro Line Level 03 (Concourse) – ASS / TSS, other services and passenger amenities, connecting unpaid FOB from opposite side Level 04(Platform) – Track and platforms
4	Type D	Double Decker Elevated (Mysore Road)	Side platforms	135 x 24 M at Service Road (Crossing Existing Flyover, IR	Street Level – Under Pass Entry Exits ,DG room, Pump Room and Parking , Service road Level 01 – Cross over Road , unpaid FOB from opposite side Level 02 – Commercial Level Level 03 – Elevated Carriage way

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Sl. No	Proposed Station Type	Station Typology	Platforms	Remarks	Station Description
				and Metro lines)	Level 04 (Concourse) – ASS / TSS, other services and passenger amenities, connecting paid FOB from existing metro station Level 05 (Platform) - track and platforms
5	Type E	Interchange Double Decker (Sumanahalli Cross)	Side platforms	135 x 38.6 M at Road Median	Street Level – Under Pass Entry Exits ,DG room, Pump Room and Parking , Service road Level 01 – Elevated Carriage way Level 02 – (Concourse) -ASS / TSS, other services and passenger amenities, connecting paid FOB from existing metro station Level 03 (Lower Platform) – track and platforms Level 04 (Upper Platform) – Track and platform
6	Type F	Double Decker Elevated (Goragunte palya)	Side platforms	135 x 28.6 M at Road Median (crossing existing Metro line)	Street Level – Entry Exits ,DG room, Pump Room and Parking , Service road Level 01 - Existing Metro Line Level 02 - Elevated Carriage way Level 03 (Concourse) -ASS / TSS, other services and passenger amenities, connecting unpaid FOB from opposite side Level 04 (Platform) - track and platforms
7	Type G	Double Decker Elevated	Side platforms	135 x 24 M at Road Median (At Cross Over)	Level 01 – Underpass Level 02 – Entry Exits ,DG room, Pump Room , Parking , Service road and Crossover road Level 02 - Elevated Carriage way Level 03 (Concourse) -ASS / TSS, other services and passenger amenities, connecting unpaid FOB from opposite side Level 04 (Platform) - track and platforms

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Sl. No	Proposed Station Type	Station Typology	Platforms	Remarks	Station Description
8	Type H	Double Decker Elevated (Sunkadakatte)	Side platforms	135 x 34 M at Road Median (At Depot Location)	Street level – Entry Exits ,DG room, Pump Room and Parking , Service road Level 01 (Concourse) -ASS / TSS, other services and passenger amenities, connecting unpaid FOB from opposite side Level 02 (Platform) – track (Along with depo lines) and platforms Level 03 – Elevated Carriage way

0.7 Intermodal Integration

Intermodal Integration with Existing Modes

This chapter has been extracted from the Detailed Project Report (DPR) of Metro Phase-3, with modifications based on the latest Feasibility cum Detailed Project Report for the proposed double-decker flyover-cum-metro corridors. The concept of inter-modal integration with the modes is to provide first and last mile connectivity to the commuters residing in the stations influence zone. The MoHUA has also laid down policy guidelines to include this important aspect of last mile connectivity in the DPRs for the Metro systems. This connectivity is expected to be achieved through proper access to the stations by city buses, intermediate public transport (auto rickshaws and cycle rickshaws) and pedestrian facilities etc.

Inter-modal integration explores the coordinated use of two or more modes of transport for efficient, speedy, safe, pleasant and comfortable movement of passengers in urban areas. It provides convenient and economical connections of various modes to make complete journey from origin to destination.

Feeder Bus System

The planning of seamless transport integration facilities at the influence zones of various proposed stations is of utmost importance. Feeder services to the proposed metro network are essential for convenient and quick transfer of passengers. As all commuters will not be in the influence zone or within walking distance of the proposed network, proper planning for feeder services is necessary.

Various modes of transportation like feeder buses, auto rickshaw/taxi and bicycles can provide first mile as well as last mile connectivity to the proposed station. For the catchment area of about

0.5 -1 km from the proposed network, commuters can easily access it by walk. People residing in the next 1 km can reach the station by cycles, 2-wheelers and auto-rickshaws. Areas beyond the 2-km catchment will require feeder buses to reach the metro station.

0.8 Land Requirement, Topography & Utilities

The topographic survey for the proposed Double Decker (Flyover cum Metro) for (i) Corridor-1 from JP Nagar 4th Phase to Hebbal of 28.486 Km length (CH:0+631 to CH:29+117) (approx.) of Phase-3, (ii) Corridor-2 from Hosahalli to Kadabagere of 8.635 Km length (CH: 1+04 to CH:10+955 (approx.) of Phase-3 corridor of Bangalore Metro Rail Project has been provided in the chapter. The survey was conducted using advanced Aerial LiDAR Technology via Drone/UAV systems, enabling high-precision elevation measurements and the creation of three-dimensional geospatial data. This approach ensures detailed topographical coverage across a 100m from center of the alignment while minimizing manual labor and ensuring accuracy.

Survey Methodology

The survey employed a combination of advanced technologies and systematic procedures to ensure precise data collection and analysis. Ground control surveys were conducted using DGPS and DT levelling to establish accurate control points and elevation benchmarks essential for the alignment corridor. Aerial LiDAR technology was utilized via Drone/UAV systems, specifically the DJI Matrice 300 RTK equipped with Zenmuse L1 sensors, enabling high-density data capture for detailed 3D mapping and imagery. The survey corridor, covering a width of 100 meters from centre of the alignment, was comprehensively mapped using these advanced systems. Data processing was carried out using cutting-edge software, including DJI Terra, MicroStation & Terra Solid, and Agissoftware, to process LiDAR data, generate orthoimages, and create Digital Elevation Models (DEM) and Digital Surface Models (DSM).

Land Requirements

Table 0-9 Summary of Land Requirement for Phase 3

Sl. No.	Description	Land area in Sq.m			Cost Details in Rs. in Cr.		
		Private Land	Govt. Land	Total Land	Private Land	Govt. Land	Total Land
	Phase-3						
1	Corridor-1 (J.P.Nagar 4 th Phase to Hebbal)	88,988	38,645	1,27,633	2011.13	172.6	2183.73
2	Corridor-2 (Hosahalli to Kadabagere)	31,251	33,614	64,865	770.61	69.05	839.67
	Total	1,20,239	72,259	1,92,498	2,781.74	241.65	3,023.40
	Total area in acres	29.71	17.86	47.57			

0.9 Project Cost Estimates

Cost estimates for elevated flyover of Double Decker structure of Phase-3 corridor-1 from JP Nagar 4th phase to Hebbal have been prepared covering civil, electrical works etc. at March 2025 price level and with a completion by 2030.

In order to arrive at realistic cost of various items, costs have been assessed on the basis of the Double Decker cost of Phase-2 from RV Road to Central Silk Board, 2017 prices and the suitable escalation factor has been applied to bring these costs to March' 2023 price level. The completion cost has been calculated from 2023 to 2028. Further escalation at 5% per annum is added to arrive at the completion cost at 2030.

Table 0-10: Abstract Cost Estimate – Phase-3

Sl.No.	Description	Unit	Qty	Amount incl. GST and escalation (Rs. In Cr.)	Rate per Km
1	Structure Cost incl. Loops				
	Corridor-1 (J.P.Nagar 4th Phase to Hebbal)	Km	28.486	5019.54	
	Corridor-2 (Hosahalli to Kadabagere)	Km	8.635	1649.40	
	Sub Total (A)		37.121	6668.94	179.65
2	Land Cost				
	Corridor-1 (J.P.Nagar 4th Phase to Hebbal)	Acre	31.54	2183.73	
	Corridor-2 (Hosahalli to Kadabagere)	Acre	16.02	839.66	
	Sub Total (B)		47.56	3023.39	81.45
3	Total Completion Cost.			9692.33	261.10

0.10 FIRR

Financial viability is carried out for period of 30 years excluding the construction period of 5 years for the project corridor of 37.121 Km length. The basic methodology followed for estimating the financial viability of the project is to calculate the FIRR (Financial Internal Rate of Return) on the investment for the project.

The objective of the viability analysis is to ascertain the existence of sustainable project returns, which has been calculated below.

Table 0-11: FIRR under Different Scenarios-Phase-3

Scenario	FIRR
Metro viaduct with Metro revenue	6.54%
Double Decker with Metro Revenue	3.15%
Double Decker + Metro & Toll Revenue	7.00%
Road Flyover + Toll Revenue	7.58%

0.11 EIRR

For deriving the values of economic indicators (EIRR, ENPV), cost and benefit streams have been constructed in terms of money value. The Toolkit on Finance and Financial Analysis 2013 by MoHUA suggests that ENPV be calculated on the social cost of capital, which is 14% (acceptable EIRR rate for MRTS projects) or Government security rate, which is 7.03% in June 2023. The EIRR of Road Flyover and Double Decker structure has been calculated as per the IRC SP 30, 2019 guidelines.

The following scenarios are worked out for achieving EIRR

Table 0-12 Different scenarios worked out for achieving EIRR-Phase-3.

Sl. No.	Component	EIRR
1	Metro as per Phase 3 DPR	17.04%
2	Road Flyover	15.24%
3	Double Decker structure (Flyover cum Metro)	16.50%

The project has an EIRR of more than 14%, indicating that the benefits to society are greater than the cost of capital for the Project. It also meets the acceptable norm of MoHUA. Thus, the project is economically viable and should be implemented. The EIRR of Road Flyover and Double Decker structure has been calculated as per the IRC SP 30, 2019 guidelines.

0.12 Conclusions & Recommendations

1. Bengaluru, being the fifth largest Metropolitan city and the third most populous city in the country, is witnessing tremendous growth in the last three decades. To increase the public transport share and to reduce the traffic on the roads, BMRCL, as the SPV, has implemented 77 Km of Metro in operation with a daily ridership of over 9.00 Lakh commuters. In addition to this, the sanctioned lines of Phase-2, Phase-2A & 2B and Phase-3 will be about 143 Km. Further, the Phase-3A project of length 36.59 Km has been approved by Government of Karnataka.
2. GoK has advised that wherever new Metro elevated lines are being done, they should be done in Double Decker mode, one deck for Metro rail movement and the other deck for two-way road traffic.
3. Bengaluru, one of the fastest growing mega cities in India, has seen tremendous growth in the past decades, resulting in increase in the number of vehicles and severe strain on the road infrastructure. The population of the city has been growing at a fast pace and the projected population in Bangalore Metropolitan Area (BMA) in the years 2021, 2031, 2041 and 2051 is 143.5 lakhs, 208.50 lakhs, 266 lakhs and 332.3 lakhs respectively.

4. There has been a huge rise in the number of private vehicles and the vehicles registration in Bengaluru has increased from 61.1 lakh to 100.1 lakhs from year 2015 to 2021 and is expected to increase rapidly. The average journey speed during peak period in the city is 17 kmph which is less when compared to other Metro cities.
5. The Brand Bengaluru program has been conceptualised by Government of Karnataka (GoK) and Brand Bengaluru – Sugama Sanchara Bengaluru was derived particularly to decongest the city of Bengaluru. The BBMP has suggested that the construction of Integrated Road flyover all along the Metro alignments and construction of elevated corridor with end-to-end connectivity and integrated with Metro.
6. Keeping in mind the growth of economic activities and rapid increase in the city's population, it is necessary to take up the long term mega infrastructure projects such as construction of integrated road flyovers all along the New metro alignments for decongestion of the traffic.
7. In order to alleviate the traffic congestion in the city, GoK has decided that Elevated road may be provided by building a Double Decker structure along with Metro viaduct as far as possible. This is considered beneficial since both the Elevated road and Metro can be provided within the same Right-of-Way (RoW) with some additional land acquisition for loops, ramps, stations etc., on account of the elevated road. Construction of Elevated road flyover after completion of the Metro to ensure flow of future traffic needs will be prohibitively expensive to acquire land and dismantling of structures.
8. The proposed elevated road on Outer Ring Road (ORR)-West in corridor-1 will provide direct and fast connectivity to Airport and other parts of the city from Southern and Western part of the city. It will also help in mitigating heavy traffic congestion on the ORR.
9. The Double Decker structure is proposed for 4 lanes of road with 2 lanes in each direction at elevated level, in addition to retaining the existing roads at surface level and the existing underpasses and many of the existing flyovers.
10. The proposed Double Decker structure is primarily planned to run by the side of the existing flyovers to cater to the long distance travellers, whereas the existing grade separators will cater to the local area traffic. Since, planned Double Decker is of a long length, entry and exit ramps are proposed to be provided at major radial road crossings.
11. The elevated double-decker corridor offers a strategic solution by segregating different traffic modes—vehicular and metro—within a compact right-of-way, thus ensuring optimal land use. Considering the high cost and scarcity of urban land in Bangalore, such vertical integration of infrastructure is both economically prudent and spatially efficient. The benefits to road users include reduced travel time, fuel savings, improved road safety, and increased reliability of public transport, all contributing to better quality of urban life.
12. The current traffic volumes at major junctions are already exceeding **10,000 Passenger Car Units (PCUs)**, and several homogeneous road sections are witnessing traffic flows that

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surpass their designed service volume. Signal cycle lengths often exceed 120 seconds, highlighting severe inefficiencies and delays. The existing road network is operating beyond its planned capacity, and with the city's population and vehicle ownership projected to grow significantly, the pressure on infrastructure will only worsen and the details of the same are in the below table.

Location Code	Location Name	2024	2031	2041	2051	2061
		Total PCUs	Total PCUs	Total PCUs	Total PCUs	Total PCUs
Corridor 1 - JP Nagar 4th Phase to Hebbal of Phase-3						
TMC -1	Junction between Outer Ring Road and Bannerghatta Road - JP Nagar 3rd Phase	12,304	14,962	18,511	21,625	24,120
TMC -22	Junction between Outer Ring Road and 14th Main Road - JP Nagar	8,627	10,583	13,395	15,806	17,604
TMC -2	Junction between Outer Ring Road and Kanakapura Road - JP Nagar Metro Station (Sarakki)	12,596	15,155	18,629	21,760	23,997
TMC -23	Junction between Outer Ring Road and Subramanya Pura Road - Kadirenahalli Cross	9,604	11,674	14,498	16,854	18,512
TMC -3	Junction between Outer Ring Road and 80 Feet Road - Banashankari Stage-II (Devegowda Petrol pump)	9,305	11,398	14,483	17,068	19,008
TMC -24	Junction between Outer Ring Road and Kathriguppe Main Road - Banashankari Stage-3	9,609	11,733	14,722	17,205	19,171
TMC -14	Junction at Banashankari 3rd Stage Outer Ring Road - 80 Feet Road (Hosakerehalli cross)	6,364	7,796	9,954	11,728	13,146
TMC -4	Junction between Outer Ring Road and Mysore Road - Nayandahalli Circle	11,845	14,439	17,817	20,999	23,305
TMC -5	Junction between Outer Ring Road and Nagarbhavi Main Road - Nagarbhavi Circle	8,993	10,883	13,559	15,675	17,191
TMC -6	Junction between 80 Feet Main Road and Old Outer Ring Road - Kengunte Circle	8,406	10,270	13,096	15,349	17,095
TMC -12	Junction between Magadi Main Road and Old Outer Ring Road – Kottigepalya	13,407	16,251	20,414	24,178	26,545
TMC -11	Junction between Magadi Main Road and Outer Ring Road - Sumanahalli	14,317	17,370	21,518	25,194	27,493
TMC -7	Junction between Kanteerava Studio Main Road and Outer Ring Road – Yashwantpur	9,665	11,906	15,159	18,045	20,370
TMC -21	Junction between Tumkur Road and Outer Ring Road - Goraguntepalya	14,082	17,055	20,733	23,883	25,789
TMC -8	Junction between MS Ramaiah Road and Outer Ring Road (NH-75) - BEL Circle	12,691	15,456	19,819	23,155	25,742
TMC -9	Junction between Mangalore-Villupuram Road (NH-75) and Bellary Road (NH-44) - Hebbal Flyover	30,446	39,132	49,323	57,563	63,759
Corridor 2 - Hosahalli to Kadabagere of Phase-3						
TMC -10	Junction between Magadi Main Road and 80 Feet Ring Road - Agrahara Dasarahalli (KHB colony under pass)	4,858	5,905	7,450	8,632	9,556
TMC -11	Junction between Magadi Main Road and Outer Ring Road - Sumanahalli	14,317	17,370	21,518	25,194	27,493
TMC -12	Junction between Magadi Main Road and Old Outer Ring Road - Kottigepalya	13,407	16,251	20,414	24,178	26,545
TMC -13	Junction at Magadi Main Road near Herohalli Lake - Aniana Nagar	9,779	12,450	16,205	19,471	21,891

13. Justification of grade separator facilities across junction:

As per IRC 92 2017, IRC 86-1983, IRC SP 41-1994 and IRC 62-1976 the necessity of providing grade separator and interchange facilities for any intersection will arise at the following situations.

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- When the total traffic on all the arms of the existing intersection is in excess of 10,000 PCUs per hour, resulting in serious congestion and frequent choking of the intersection.
- When the signal stopping time at the existing intersection exceeds 120 seconds.
- When the estimated traffic volumes within next 5 years is in excess of the capacity of the existing intersection.
- The Design Service volume of urban roads between intersections for four lane divided traffic flow is 3600 PCUs per hour.

Phase-3: The Corridor-1 flyover chainage is from 0.631 Km to 29.117 Km of 28.486 Km from JP Nagar 4th Phase (Delmia circle ramp) to Hebbal. The Corridor-2 flyover chainage is from 1.040 Km to 5.120 Km and 6.400 Km to 10.955 Km of length 8.635 Km from Magadi Road to Sunkadakatte and Sunkadakatte to Kadabagere.

It is observed that, the present peak hour traffic in all the junctions is more than 10,000 PCUs per hour and between the junctions is also more than 3600 PCUs per hour. It is general trend that the traffic will continue to grow in future with increase in population with the time.

In view of the above reasons, it is proposed to provide a continuous flyover to facilitate free flow of traffic without any interruption in Corridor-1 from JP Nagar 4th phase (Delmia circle ramp) to Hebbal of length 28.486 Km and in corridor-2 from Magadi road to Sunkadakatte and Sunkadakatte to Kadabagere of length 8.635 Km. The ramps of flyover are provided on either side of the Depot location at Sunkadakatte to reduce the height of viaduct so that the Depot entry line ramp can be accommodated within the available Depot land.

14. The FIRR and EIRR details for Phase-3 project is as below:

Sl.No.	Description	FIRR	EIRR
1	Metro viaduct with Metro revenue	6.54%	17.04%
2	Double Decker with Metro Revenue	3.15%	-
3	Double Decker + Metro & Toll Revenue	7.00%	16.50%
4	Road Flyover + Toll Revenue	7.58%	15.24%

The total completion cost of the elevated viaduct in the Double Decker structure is Rs.9692.33 Cr. and the FIRR with only Metro revenue is 3.15% (without any toll road revenue). In case toll road is introduced, the FIRR of Road flyover with toll revenue is 7.58% and for the Double Decker structure (Metro + road flyover) with Metro revenue and toll revenue will be 7.00% and EIRR is 16.50% and hence the project is viable.

Considering the present traffic congestion, increase in number of private vehicles, reduction in average journey speed, higher travel time required and considering the benefits of constructing the elevated road and Metro within the same Right of Way (RoW) (saving in land cost), it is therefore recommended for construction of elevated road along with Metro viaduct as a Double Decker structure in Phase-3 corridor-1 from JP Nagar 4th Phase (Delmia circle ramp) to Hebbal for a length of 28.486 Km and in corridor-2 from Magadi road to Sunkadakatte and Sunkadakatte to Kadabagere for a length of 8.635 Km with entire funding of Rs.9,692.33 Cr. to be borne by the State Government.