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Accessibility, Availability, and Mobility Under HDBRTS[1]

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ABSTRACT

The Hubballi–Dharwad Bus Rapid Transit System (HDBRTS) represents one of India's most prominent BRT initiatives in a medium-sized urban context. This paper evaluates the performance of HDBRTS through a multidimensional framework focusing on accessibility, availability, mobility outcomes, and safety. Drawing on primary data from a structured survey of 2,064 commuters—supplemented by focus group discussions, stakeholder interviews, and secondary accident records—the study provides a comprehensive, user-centric assessment of the system.

The findings indicate that HDBRTS has significantly enhanced both physical and functional accessibility, with over 90 per cent of commuters reporting convenient station locations, improved safety for women and children, and substantial reductions in travel time. Service availability is reflected in high commuter preference, frequent daily usage, and strong perceptions of punctuality, positioning HDBRTS as the dominant public transport mode along the Hubballi–Dharwad corridor. Mobility outcomes reveal that the system plays a critical role in facilitating work- and education-related travel, particularly for students and salaried employees, while attributes such as speed, safety, cleanliness, and comfort strongly influence modal choice.

Despite these positive outcomes, the analysis identifies persistent challenges. Affordability concerns remain among illiterate and lower-income commuters, uptake of digital ticketing and value-added services is uneven, and last-mile connectivity gaps limit accessibility for certain population groups. Safety analysis shows a general decline in total accidents along the corridor, though fatal accidents have not reduced proportionately, underscoring the need for stronger enforcement and behavioural interventions.

Overall, the study concludes that HDBRTS has delivered substantial mobility gains and demonstrates strong potential as a replicable model for medium-sized cities in Karnataka. However, sustained performance will depend on complementary measures addressing equity, last-mile integration, digital inclusion, and road safety governance.

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Keywords: *Hubballi–Dharwad BRTS; Accessibility; Availability; Urban Mobility; Travel Behaviour; Public Transport; Road Safety*

Introduction

Accessibility, availability, and mobility are core dimensions that determine the effectiveness of any public transport system. For a Bus Rapid Transit System such as the Hubballi–Dharwad BRTS (HDBRTS), these dimensions are especially important because they directly influence commuter satisfaction, modal choice, travel behaviour, and overall system performance. Evaluating whether HDBRTS has enhanced these aspects is central to assessing its success and its potential to serve as a model for other cities in Karnataka.

This Paper analyses commuters' perceptions and experiences related to the availability of BRTS services (such as frequency, punctuality, and ease of access), the physical and spatial accessibility of bus stops and infrastructure, and mobility outcomes such as travel purpose, time savings, and usage patterns across different socio-economic groups. The analysis draws upon primary survey responses from 2,064 commuters and incorporates occupation-wise, education-wise, and gender-wise variations to understand differential access and usage.

By examining these parameters, the Paper identifies both strengths—such as reduced travel time, perceived safety, and high commuter preference—and areas where gaps persist, including affordability concerns among specific groups, variability in frequency, and limited use of value-added services. The findings provide an empirical foundation for judging whether HDBRTS is delivering on its intended mobility objectives and for proposing enhancements to improve system performance and inclusivity.

Brief Review of Earlier Studies:

Urban transport literature highlights the growing mobility challenges faced by medium-sized cities in developing countries, particularly in the context of rapid motorisation, inadequate public transport infrastructure, and fragmented land-use patterns (Cervero, 2013; Pucher & Buehler, 2012). In India, these challenges are compounded by constrained road space, weak enforcement, and limited institutional coordination, resulting in congestion, safety risks, and environmental degradation.

Bus Rapid Transit Systems (BRTS) have been widely promoted as cost-effective alternatives to rail-based mass transit, offering high-capacity, high-frequency services at relatively lower capital costs (Wright & Hook, 2007). International experiences from Latin America and East Asia demonstrate that well-designed BRT systems can significantly improve travel time reliability, accessibility, and modal shift, provided they are supported by strong governance and enforcement mechanisms (Hidalgo & Muñoz, 2014).

However, the Indian experience with BRTS has been mixed. Studies on Ahmedabad and Delhi reveal that while BRT systems can enhance operational efficiency and commuter satisfaction, outcomes are often undermined by design compromises, weak lane discipline, political resistance, and insufficient integration with non-motorised transport (Mahadevia et al., 2016; Tiwari & Jain, 2012). Research further indicates that BRT success is highly context-dependent, shaped by urban form, demand density, right-of-way availability, and institutional capacity (Suzuki et al., 2013).

Recent scholarship emphasises the importance of evaluating public transport systems through multidimensional frameworks encompassing accessibility, availability, affordability, safety, and user perceptions rather than focusing solely on ridership or financial performance (Litman, 2020). Studies also underline the need to incorporate gender, age, and socio-economic equity considerations, as mobility benefits are unevenly distributed across population groups (Gwilliam, 2018).

Despite growing literature on large metropolitan BRT systems, empirical evidence from medium-sized Indian cities remains limited. Moreover, few studies systematically examine workforce conditions, institutional arrangements, and the replicability of BRT models across diverse urban contexts. The present study addresses these gaps by providing a comprehensive, user-centric evaluation of HDBRTS and critically assessing its transferability within Karnataka's urban landscape.

Objectives:

The objective of this paper is to evaluate the performance of the Hubballi–Dharwad Bus Rapid Transit System (HDBRTS) using a multidimensional framework encompassing accessibility, availability, and mobility outcomes. Specifically, the study aims to:

1. To quantify physical and functional accessibility improvements associated with HDBRTS, including station location, safety, and travel time reliability.
2. To assess service availability and operational reliability, focusing on frequency of use, punctuality, and user preference relative to competing transport modes.
3. To examine mobility outcomes in terms of travel behaviour, trip purpose, usage intensity, and modal dependence across socio-economic groups.
4. To evaluate fare affordability perceptions and their variation across education and occupational categories, with implications for equitable access.
5. To analyse safety outcomes along the BRT corridor using longitudinal accident data and commuter perceptions.
6. To identify system-level constraints and enabling conditions influencing BRT performance in medium-sized cities, and to derive transferable policy implications for BRT implementation.

Methodology

This study employs a mixed-method research design to examine accessibility, availability, and mobility outcomes of the Hubballi–Dharwad Bus Rapid Transit System (HDBRTS). Quantitative and qualitative methods are combined to capture both system performance and commuter experiences in a medium-sized urban context.

Primary data were collected through a structured commuter survey administered to 2,064 respondents, representing approximately three per cent of average daily ridership. A cluster sampling approach was adopted by grouping the 34 BRTS stations into six spatial clusters along the corridor, with proportional sampling from each cluster to ensure geographic and socio-economic representation. The survey collected information on commuter characteristics, travel behaviour, service accessibility, availability, affordability, safety perceptions, and mobility outcomes.

Qualitative insights were generated through twenty-one Focus Group Discussions with diverse user groups, including students, women, elderly commuters, informal workers, and persons with disabilities, as well as through interviews with drivers and Point-of-Sale (POS) operators to understand operational and workforce-related issues. Secondary data from official sources, including traffic accident records and operational reports of HDBRTS Company Limited, were used to assess safety trends and system-level performance.

Data analysis involved descriptive statistics and inferential techniques such as chi-square tests, correlation analysis, and simple regression models. Accident trend analysis and GIS-based spatial mapping were used to support interpretation of safety and accessibility outcomes. Methodological triangulation enhances the robustness and validity of the findings.

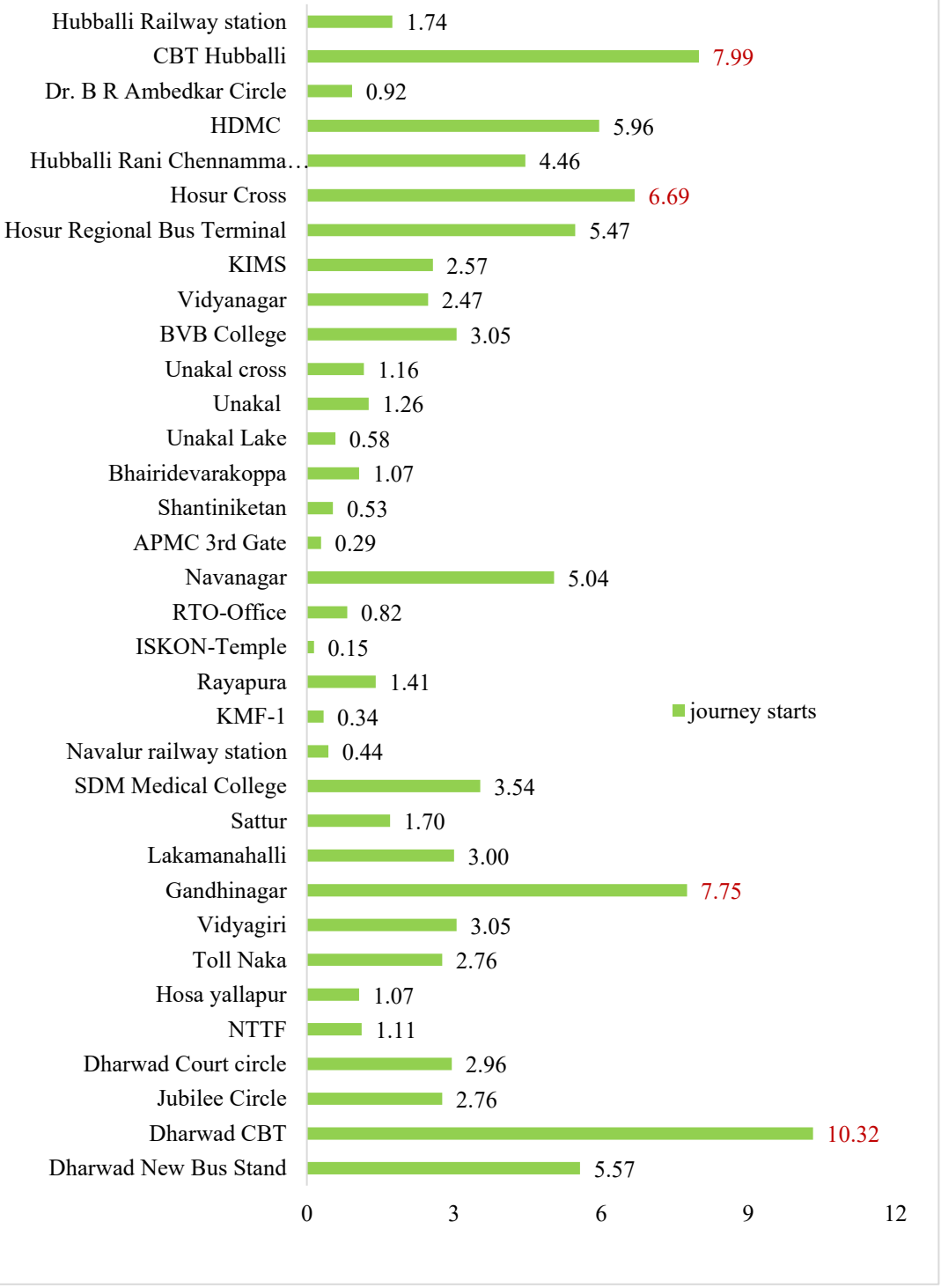
Accessibility

Accessibility is a fundamental component of an efficient public transport system, determining how easily commuters can reach and use services. For the Hubballi–Dharwad BRTS (HDBRTS), accessibility encompasses the spatial distribution of bus stops, ease of boarding and alighting, perceived safety, and the suitability of infrastructure for diverse user groups including women, children, senior citizens, and persons with disabilities. The survey findings presented in this Paper provide a comprehensive assessment of how users perceive and experience accessibility under HDBRTS.

Spatial Accessibility and Stop Usage

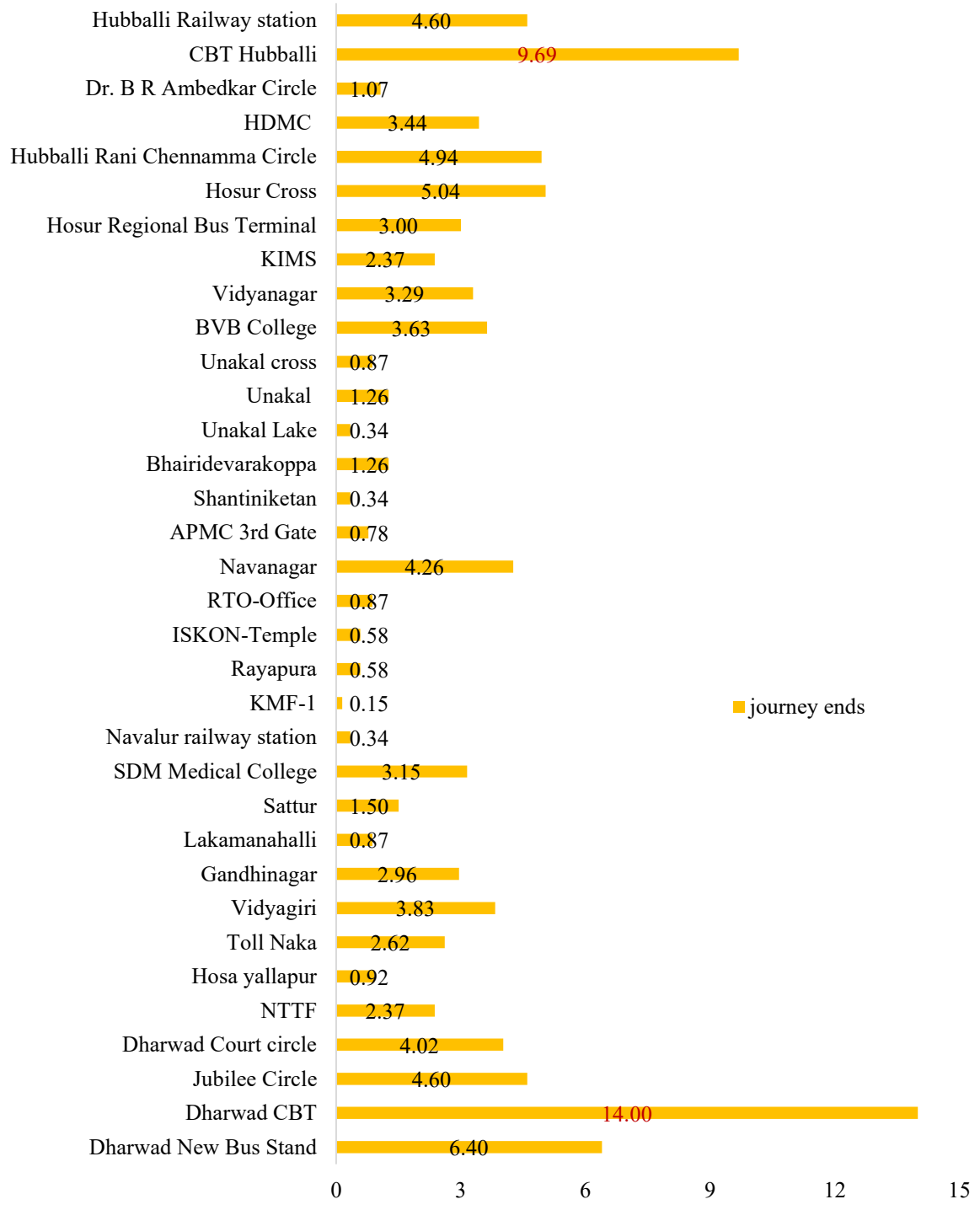
Figure 1a and 1b present boarding and alighting patterns across various BRTS stations. The data reveal that terminal stations in both cities register substantially higher passenger activity compared to mid-corridor stations, with the exception of Navanagar (Hubballi) and Gandhinagar (Dharwad), which function as major intermediate nodes. Dharwad CBT emerges as the most active boarding and alighting point, while ISKCON records the lowest activity. These patterns reflect the spatial concentration of trip origins and destinations and demonstrate the strategic importance of terminal and major interchange stations in the overall accessibility profile of HDBRTS.

Figure 1a: Boarding by Commuters in different stops



Source: Field Survey

Figure 1b: Alighting by Commuters in different stops

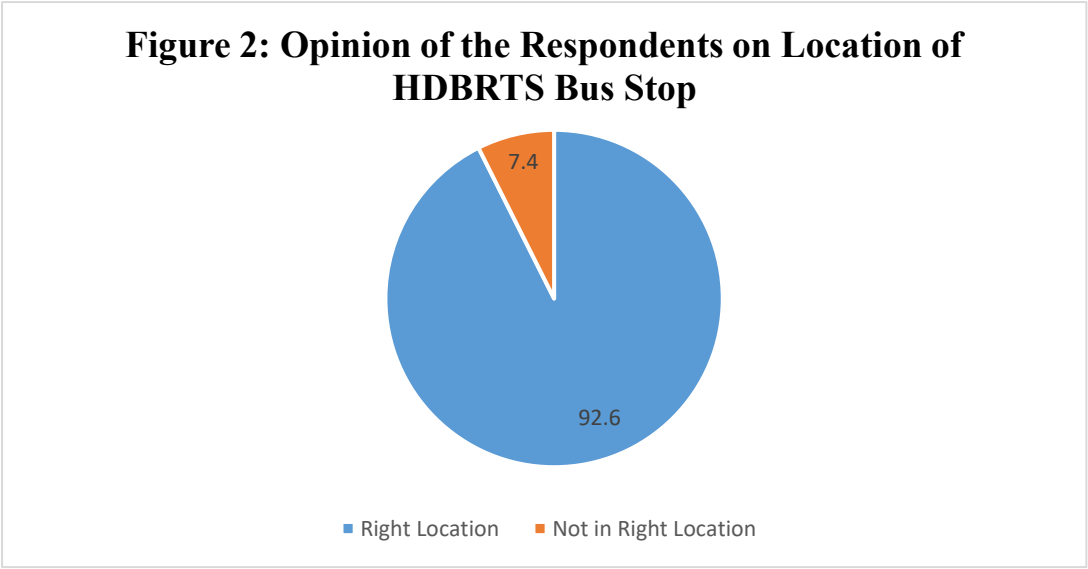


Source: Field Survey

Perceived Accessibility of Bus Stop Locations

As shown in Figure 2, an overwhelming 92.6 per cent of respondents reported that HDBRTS bus stops were located in appropriate and convenient places. This affirms that corridor planning—particularly the spacing and placement of median stations—has enhanced physical access compared to conventional bus services. Despite this, qualitative insights from focus group discussions highlight persistent last-mile accessibility challenges, particularly for elderly commuters, women, and residents of peripheral or low-density neighbourhoods. This indicates that while station placement is broadly effective, complementary feeder and NMT (non-motorised transport) infrastructure remains inadequate.

Figure 2: Opinion of the Respondents on Location of HDBRTS Bus Stop

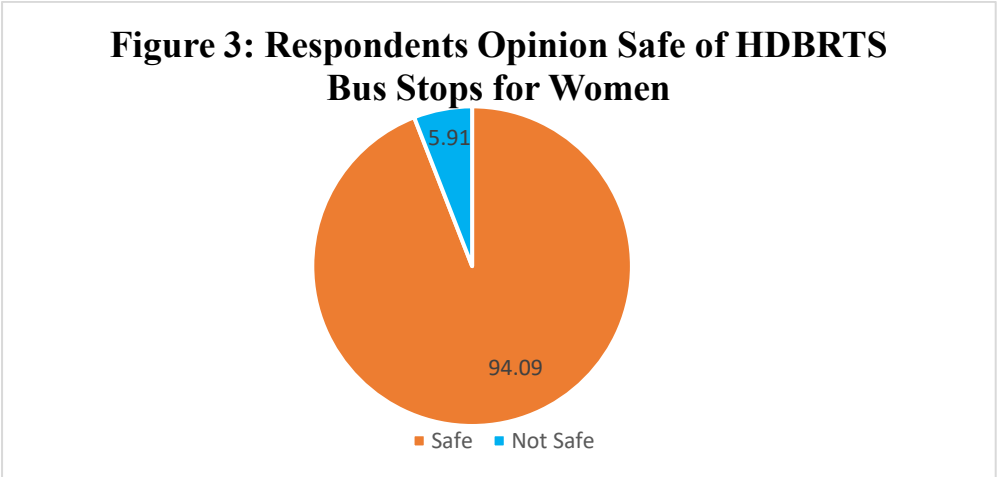


Source: Field Survey

Accessibility Through Safe and Inclusive Station Design

Accessibility is also shaped by the perceived safety and user-friendliness of stations. Figure 3 shows that 94.09 per cent of respondents consider HDBRTS stations safe for women and children. Safety features—including level boarding platforms, automatic doors, adequate lighting, CCTV surveillance, and the presence of staff or security personnel during peak hours—significantly enhance the inclusiveness of the system. These features are in line with global best practices in gender-sensitive and barrier-free transit design.

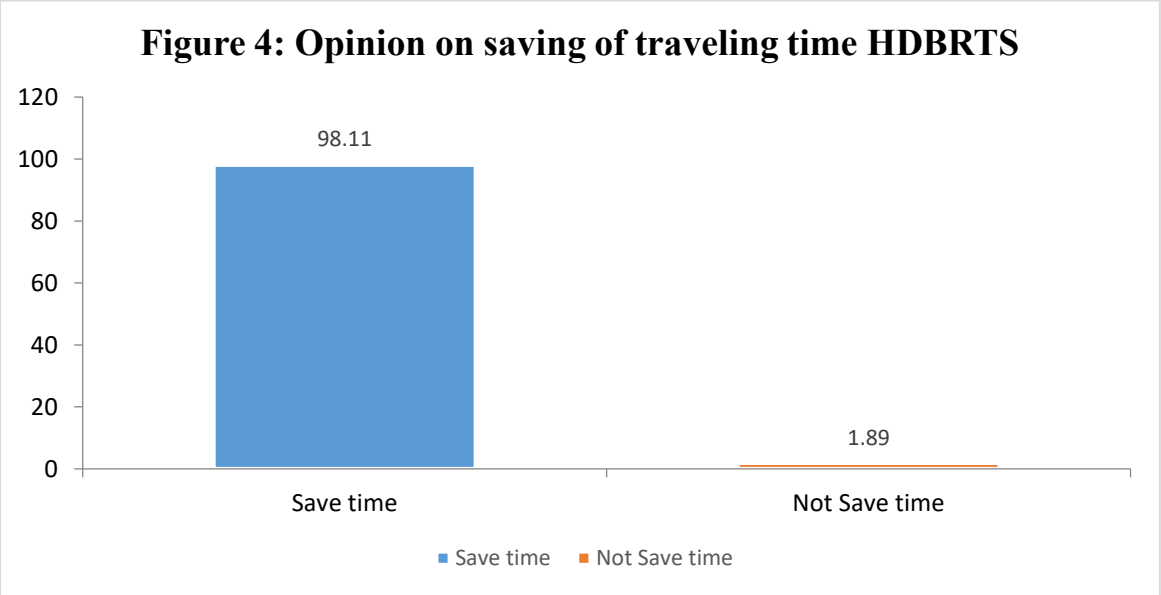
Figure 3: Respondents Opinion Safe of HDBRTS Bus Stops for Women



Source: Field Survey

Functional Accessibility and Travel Time Savings

Functional accessibility refers to the system's ability to reduce travel time and improve the reliability of mobility. As Figure 4 indicates, 98.11 per cent of commuters experience time savings with HDBRTS relative to other transport modes. This is largely attributable to dedicated lanes, zero-traffic corridors, synchronized signalling, and efficient fleet operations. These gains demonstrate that accessibility is not limited to physical reach but also includes the practical ease and efficiency of mobility once on board.

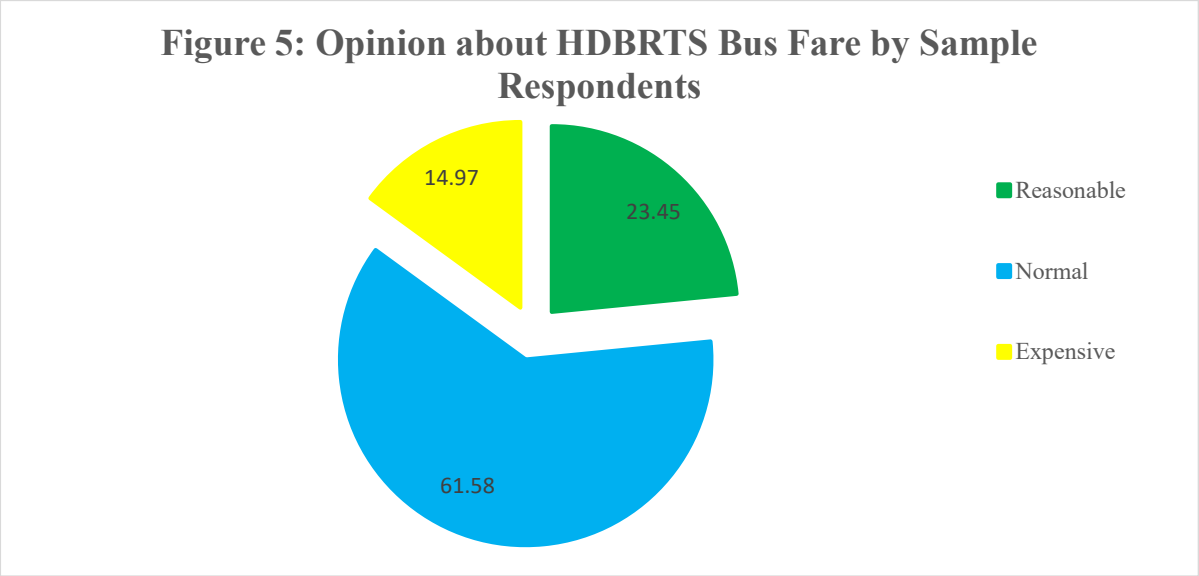


Source: Field Survey

The evidence demonstrates that HDBRTS has substantially strengthened accessibility in the twin cities through well-designed stations, reliably located stops, safe environments, and considerable travel time reductions. However, certain gaps remain—particularly related to last-mile connectivity, uneven coverage in low-density areas, and accessibility challenges faced by vulnerable groups. Addressing these areas through targeted policy interventions, feeder systems, improved pedestrian infrastructure, and inclusive mobility planning will be essential for enhancing accessibility further.

Affordability of HDBRTS

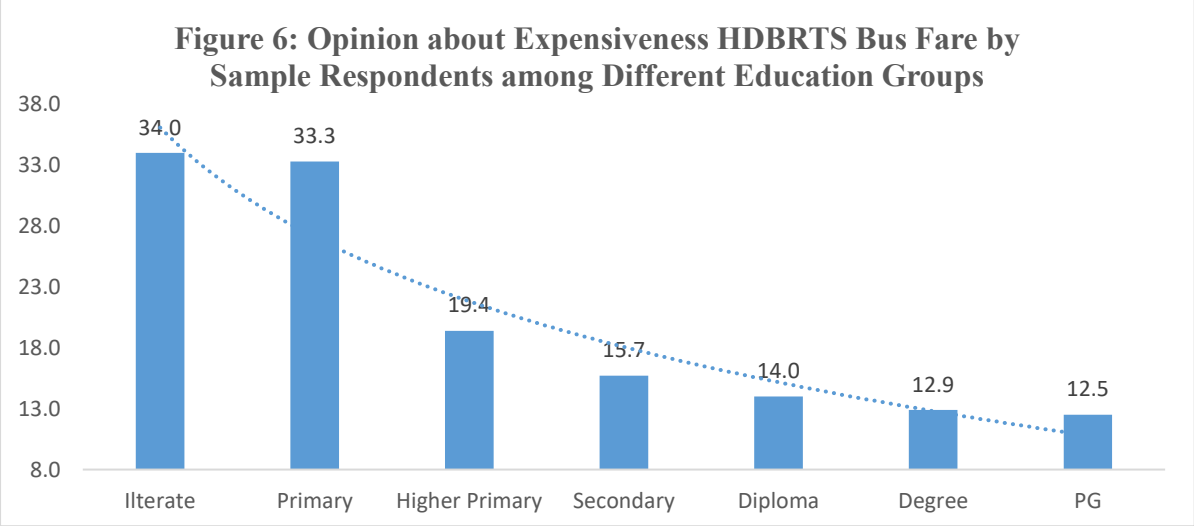
Affordability constitutes an important dimension of accessibility, influencing whether commuters from different socio-economic backgrounds can make regular use of the system. Survey results indicate that a substantial majority of respondents perceive HDBRTS fares as either affordable or reasonable, while only a small proportion consider them expensive. Although the fare structure is identical to that of ordinary NWKRTC buses, HDBRTS offers significantly enhanced service quality—air-conditioned buses, automated doors, digital ticketing, and well-maintained stations—resulting in a generally favourable value assessment. Figure 6.5 provides an overall distribution of fare perceptions, showing that most respondents judge the fare to be affordable, followed by a smaller group who find it reasonable, and a minority who perceive it as expensive. Figure 3.5 shows that a majority of respondents assessed the HDBRTS fare as affordable, while only a relatively small proportion considered it expensive. This general approval, however, varies noticeably across educational groups.



Source: Field Survey

Affordability Across Educational Groups

Respondents with lower education levels—particularly illiterate commuters—reported a markedly higher perception of the fare as expensive. Approximately one-third of illiterate respondents expressed concerns about fare affordability, making them the most cost-sensitive group in the sample. In contrast, only a small share of postgraduate respondents viewed the fare as expensive, indicating a downward trend in perceived financial burden with rising educational attainment. This pattern suggests that education may serve as a proxy for income level, travel purpose, and familiarity with public transport systems. Commuters with higher education may value the improved service quality more strongly, thereby perceiving the fare as justified, whereas economically vulnerable segments may experience even small fare differences as a meaningful financial constraint.



Source: Field Survey

As it is only 15 per cent of the sample respondents that have opined about expensive bus fare of HDBRTS. If we see it among the different education level, it is found that 34 per of the illiterate respondents have reported the HDBRTS fare is expensive, which is the highest among the education groups. On the other hand, only 12.5 per cent of the respondents with the education level of Post-Graduation have reported about the expensiveness of bus fare of

HDBRTS. A trend line has been dragged to see the pattern of opinion among different education levels. The trend line turned to be negative with the higher level of education.

Seating area available at HDBRTS bus stop

Affordability Across Occupational Groups

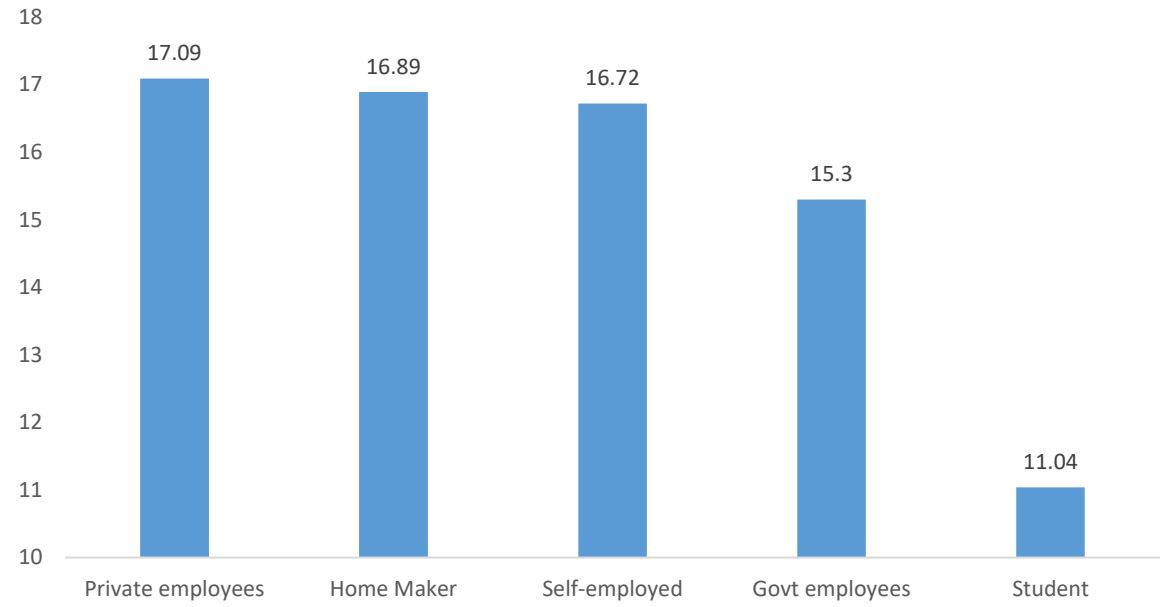
Figure 7 highlights variations in fare perception across occupational categories. Except for students—who show the lowest sensitivity, likely due to concessions such as student passes—all other groups have more than 15 per cent of respondents indicating that fares are expensive. Private-sector employees express the highest level of concern, followed by other working groups.

These variations may reflect differences in income stability, daily travel frequency, and the availability of concessionary schemes. Homemakers and self-employed respondents also demonstrate moderate fare sensitivity, potentially owing to irregular incomes or less frequent but necessity-driven travel.

Source: Field Survey

Taken together, HDBRTS fares are broadly perceived as affordable and reasonable by the majority of commuters.

Figure 7: Opinion about Expensiveness HDBRTS Bus Fare by Sample Respondents among Different Occupation Groups



However, affordability concerns persist among specific socio-economic segments—particularly illiterate commuters and certain occupational categories—highlighting the need for periodic fare assessments and strengthened concession policies. Addressing these disparities will be essential for ensuring equitable access and maintaining the inclusive character of the HDBRTS system.

Availability

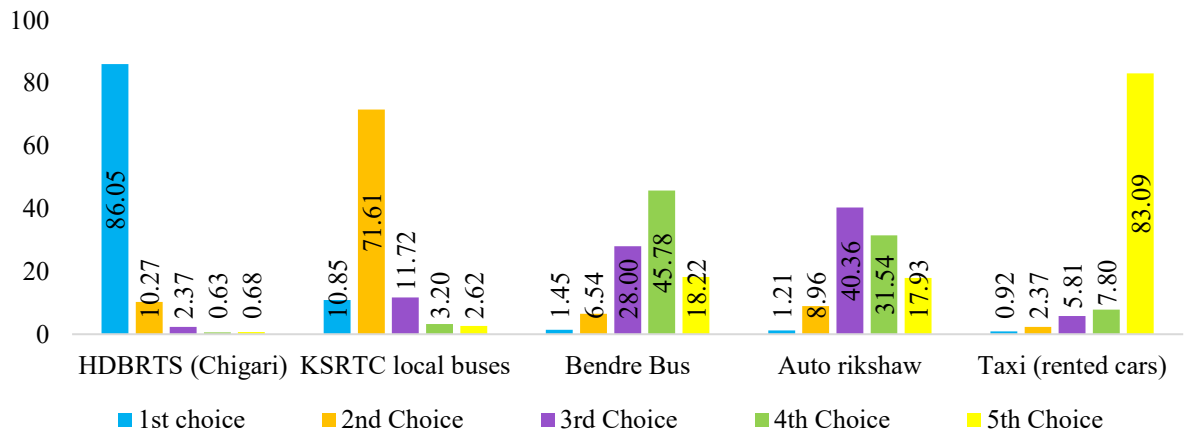
Availability refers to the extent to which public transport services are present, reliable, and sufficiently frequent to meet commuters' daily mobility needs. In the context of the Hubballi–Dharwad BRTS (HDBRTS), availability encompasses route coverage, frequency of service, operational reliability, and comparative accessibility relative to alternative transport modes. The survey findings presented in this section provide insights into commuter preferences, frequency of usage, perceived punctuality, and comparative fare advantage—each of which reflects how users evaluate the availability of the system.

Commuters' First Preference for HDBRTS

Figure 8 illustrates commuters' choice of preferred transportation mode in the twin cities. A striking majority—86.05 per cent—identified HDBRTS as their first choice for travel between Hubballi and Dharwad. Local KSRTC buses were the preferred mode for 10.85 per cent, followed by Bendre buses (1.45 per cent) and auto-rickshaws (1.21 per cent). A small fraction (around 1 per cent) reported rented taxis or cars as their primary mode.

This overwhelming preference for HDBRTS indicates a high degree of service availability along the main transit corridor, coupled with perceived reliability and value for money. It also suggests that commuters recognize HDBRTS as the most dependable option for inter-city travel within the twin cities.

Figure 8: Distribution of Respondents by their Choice of Different Transportations



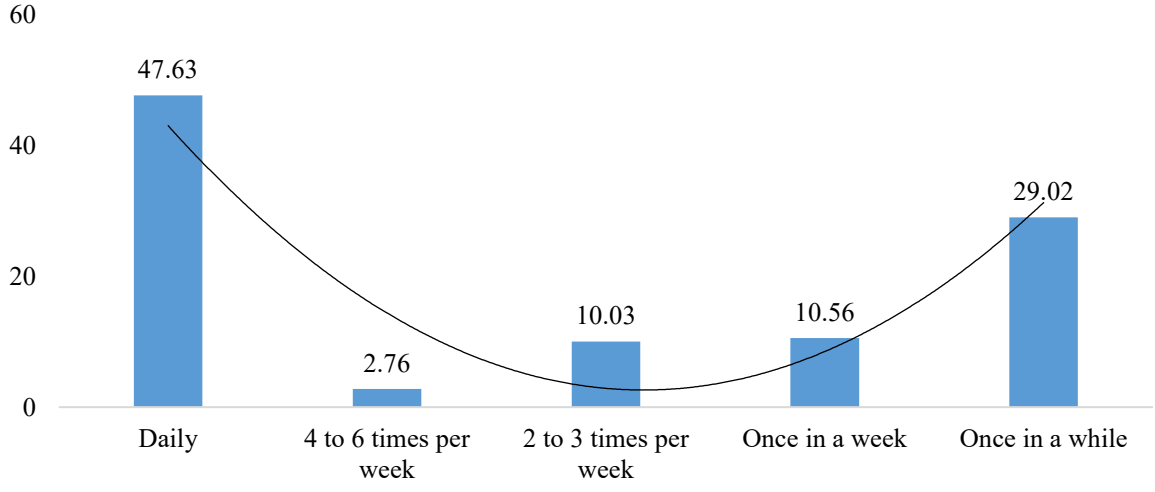
Source: Field Survey

Frequency of Usage

Figure 9 depicts the frequency with which respondents use HDBRTS services. Nearly half (47.63 per cent) reported daily usage, indicating strong dependence on the system for routine travel such as work, education, or essential activities. Another 30 per cent reported using HDBRTS "once in a while," while smaller proportions used it weekly (10.56 per cent), 2–3 times per week (10.03 per cent), or 4–6 times per week (2.76 per cent).

The high proportion of daily users reflects both adequate supply of services and the alignment of BRT operations with commuters' temporal needs. The U-shaped trend line observed in the data suggests polarisation: a large cluster of daily users and a separate cluster of occasional users, indicating that HDBRTS is indispensable for some commuters while serving as a complementary mode for others.

Figure 9: Frequency of Use of HDBRTS by the Sample Respondents



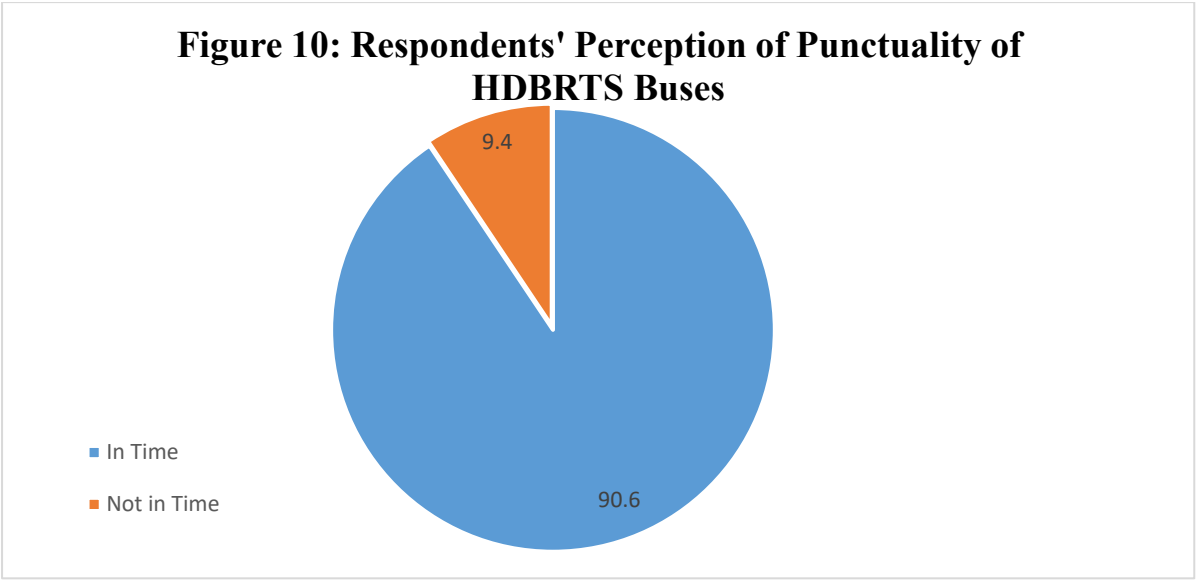
Source: Field Survey

Reliability and Punctuality

Service punctuality is a vital determinant of perceived availability. Figure 10 shows that 90.60 per cent of respondents considered HDBRTS buses to be on time. Only a small portion (9.40 per cent) expressed concerns regarding delays.

This high punctuality rating reflects the operational advantages of the dedicated BRT corridor—segregated lanes, signal prioritisation, and controlled station access—which collectively reduce variability in travel times. For a growing urban region such as Hubballi–Dharwad, reliability strengthens commuter confidence and reinforces the system's availability.

Figure 10: Respondents' Perception of Punctuality of HDBRTS Buses

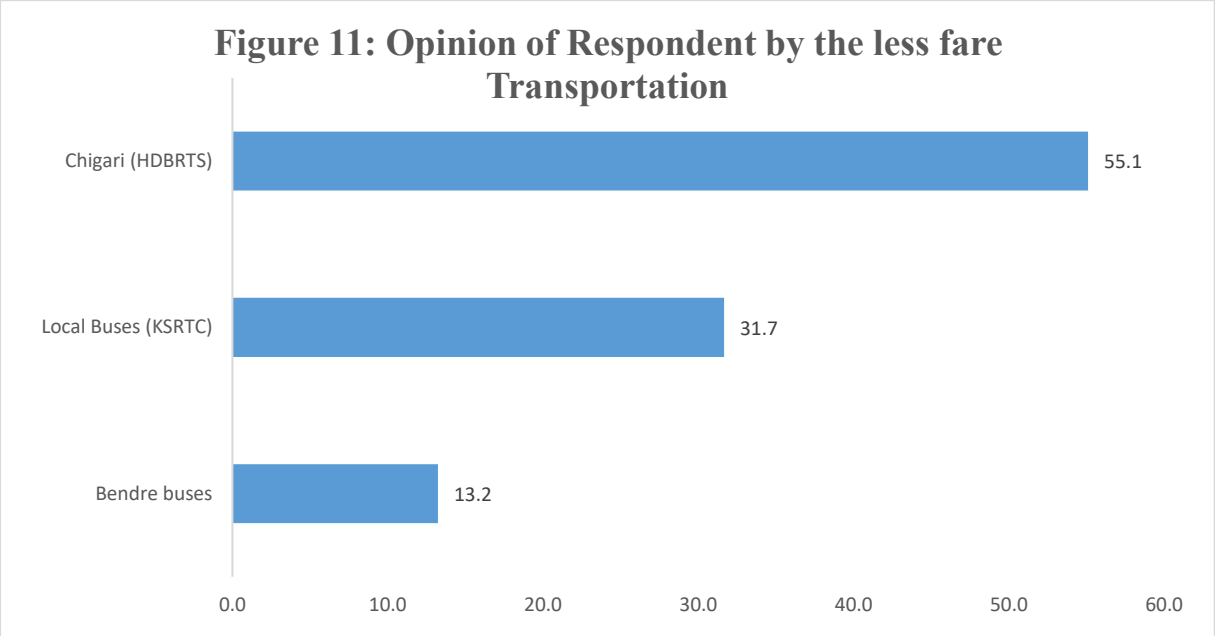


Source: Field Survey

Comparative Perceptions of Fare Advantage

Figure 11 compares commuter perceptions of fare levels across different modes. More than 55 per cent of respondents believed that HDBRTS offered the lowest cost relative to the services provided. Local KSRTC buses were favoured by 31.7 per cent on cost grounds, while 13.2 per cent perceived Bendre (private) buses as cheaper.

Given that HDBRTS fares are identical to ordinary buses but offer markedly higher service standards, this perception further reinforces the system's availability and attractiveness. A transport mode that is not only accessible but also competitively priced strengthens commuter loyalty and encourages modal shift from private to public transport.



Source: Field Survey

Overall, the findings indicate that HDBRTS enjoys high availability in the Hubballi–Dharwad corridor, supported by commuters' clear preferences, frequent usage, strong perceptions of punctuality, and favourable cost assessment. These strengths position HDBRTS as a reliable and accessible mobility option for diverse user groups.

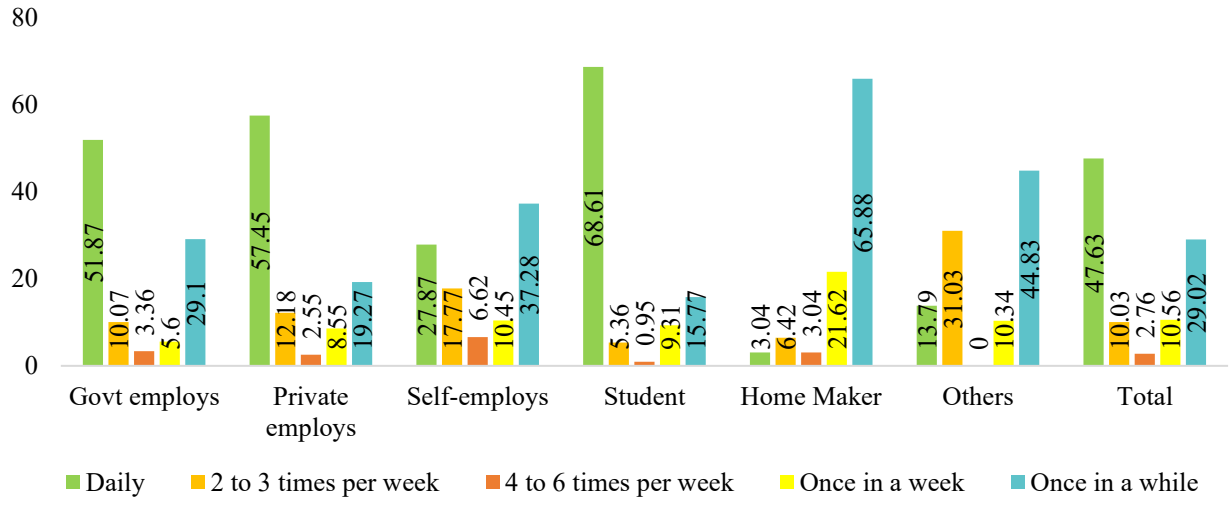
Mobility Outcomes

Mobility outcomes capture the extent to which HDBRTS enhances the efficiency, purposefulness, and quality of commuter travel in the Hubballi–Dharwad corridor. Survey findings provide insights into daily usage patterns, travel purposes, time savings, and user evaluations of service attributes—all of which together reflect the overall effectiveness of the system in meeting mobility needs.

Daily Usage Patterns Across Occupation Groups

Figure 3.12 illustrates the frequency of HDBRTS use across occupational groups. The data show that students constitute the most intensive daily users, with 68.61 per cent relying on the system every day. Among working populations, 57.45 per cent of private-sector employees and 51.87 per cent of government employees reported daily commuting via HDBRTS. In contrast, daily usage among the self-employed remains modest at 27.87 per cent, and only a very small share of homemakers (3.04 per cent) use the system daily.

Figure 12: Frequency of Travel in BRTS Buses by Occupation Category



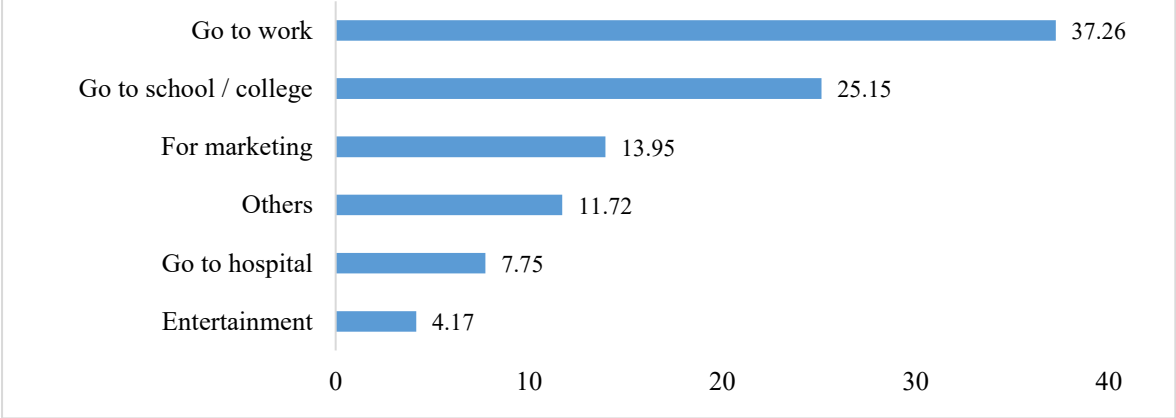
Source: Field Survey

A significant proportion of homemakers (65.88 per cent) and self-employed individuals (37.28 per cent) use the system only occasionally, indicating that their mobility requirements may be irregular or that last-mile constraints shape their modal choices. Overall, the data highlight that HDBRTS primarily serves regular commuters—particularly students and salaried employees—whose travel patterns are predictable and time-sensitive.

Purpose of Travel

Figure 13 presents the distribution of major trip purposes among HDBRTS commuters. Travelling to work emerges as the predominant reason, accounting for 37.26 per cent of trips, followed by travel to schools and colleges at 25.15 per cent. Other key purposes include marketing (13.95 per cent), miscellaneous errands (11.72 per cent), hospital visits (7.75 per cent), and entertainment (4.17 per cent).

Figure 13: Distribution of respondent by the purpose of use HDBRTS

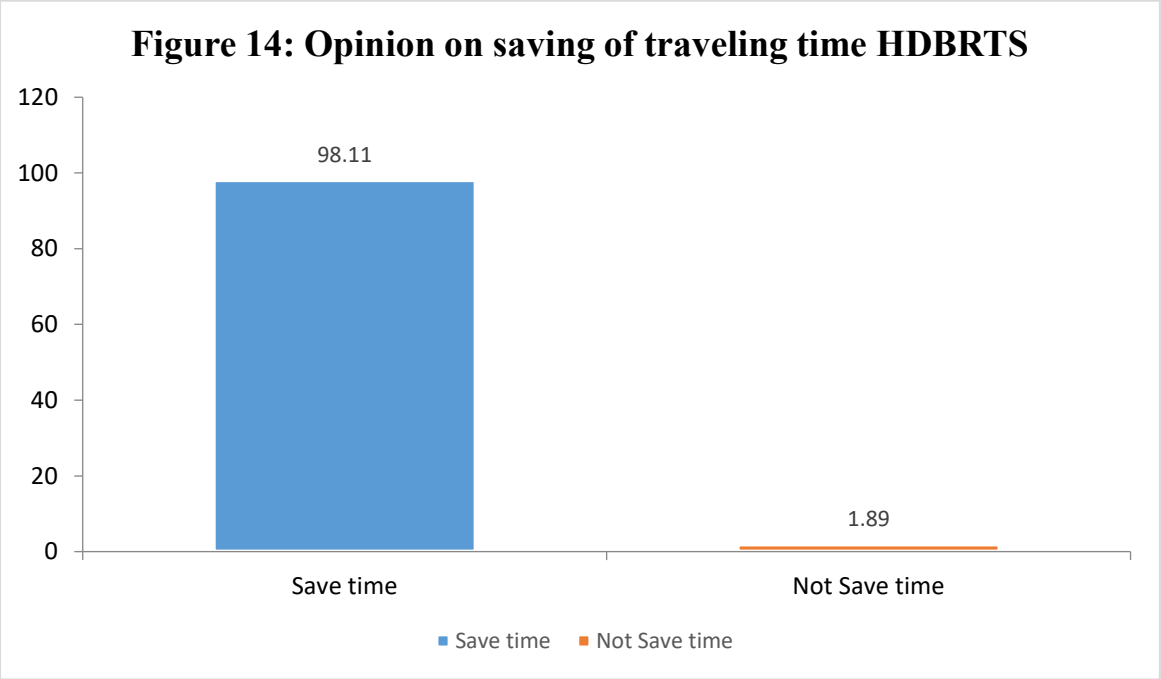


Source: Field Survey

These findings underscore that HDBRTS plays a central role in facilitating economically productive and educational mobility in the twin cities. The high share of work- and education-related trips indicates that HDBRTS is effectively integrated into the routine mobility of the labour force and student population—both critical segments for sustainable urban development.

Perceived Time Savings

One of the most significant indicators of improved mobility outcomes is the extent of travel time savings. Figure 14 shows that an overwhelming 98.11 per cent of respondents reported reduced travel time on HDBRTS in comparison to other transport modes. Commuters attributed these gains to the dedicated, zero-traffic BRT corridor, efficient digital scheduling and signalling systems, and the faster, uninterrupted operations of BRT buses.

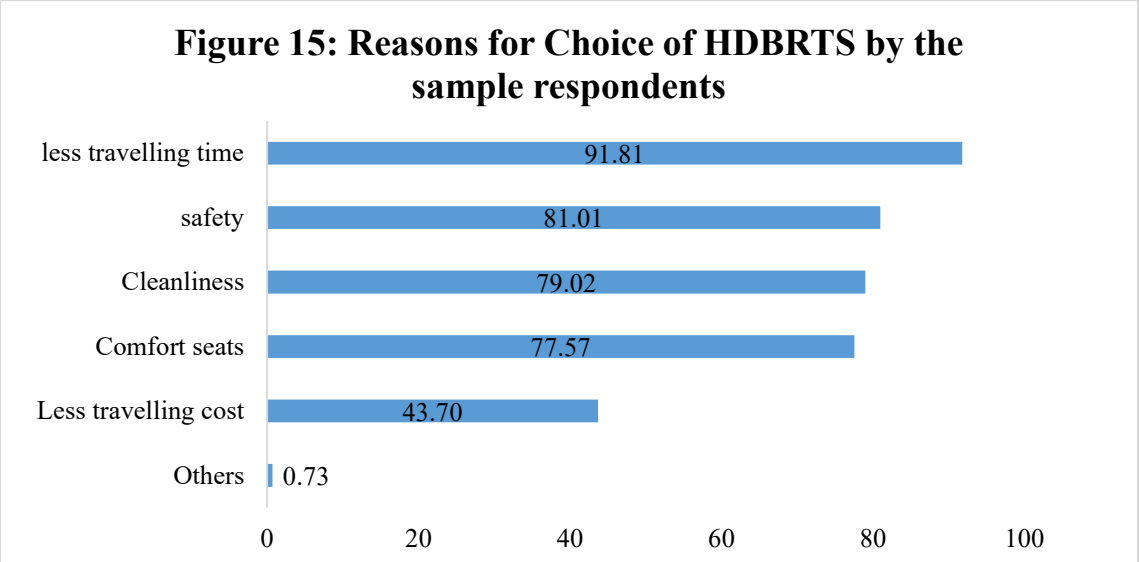


Source: Field Survey

Given the expanding commercial activities and rising travel demand in Hubballi–Dharwad, such time efficiency strongly positions HDBRTS as a competitive mobility solution capable of reducing overall congestion stress and increasing productivity among daily commuters.

Attributes Influencing Travel Choice

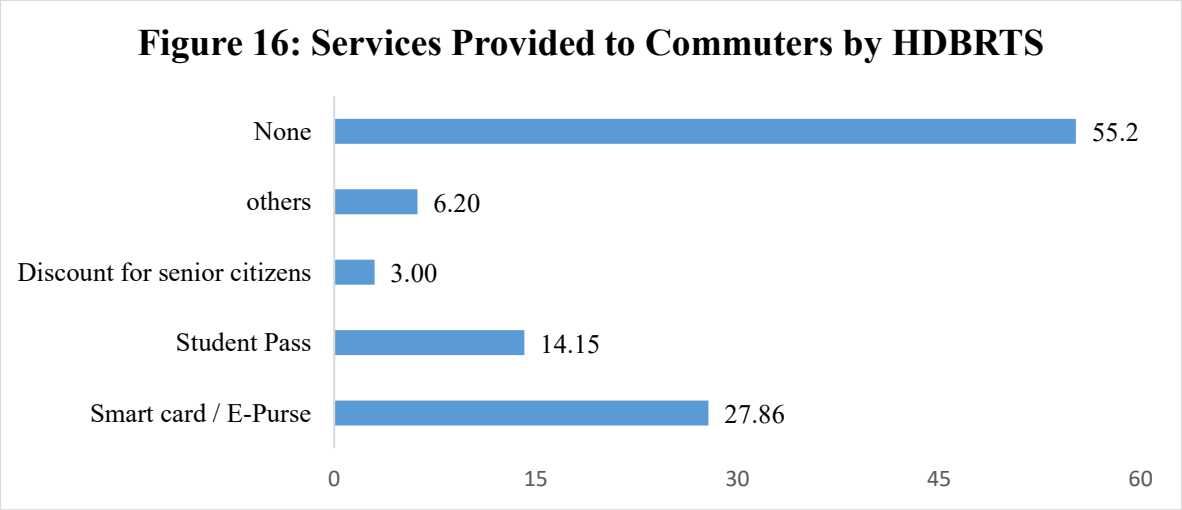
Figure 15 highlights the factors influencing commuter preference for HDBRTS. The most widely cited attribute is reduced travel time (91.81 per cent), followed by perceptions of safety (81.01 per cent), cleanliness (79.02 per cent), and comfortable seating (77.57 per cent). Although less than half of the respondents (43.70 per cent) considered HDBRTS cost-effective, the majority acknowledged that the system's operational and service-related advantages outweighed fare considerations. These findings reinforce the conclusion that commuters prioritise speed, safety, and service quality over marginal cost differences when choosing HDBRTS.



Source: Field Survey

Usage of HDBRTS Services

Figure 16 provides evidence on the utilisation of additional services offered by HDBRTS. A majority of respondents (55.2 per cent) reported not using any supplementary services. Among service users, the Smart Card / E-Purse system was the most widely adopted, utilised by 27.86 per cent of respondents, reflecting a growing preference for digital ticketing. Student passes accounted for 14.15 per cent of users, while senior citizen discounts were used by 3 per cent. An additional 6.20 per cent reported availing other miscellaneous services.



Source: Field Survey

The prominent use of digital ticketing indicates a gradual shift towards cashless, technology-enabled mobility habits among commuters. However, the large share of non-users suggests the need for greater awareness, simplified enrolment procedures, and improved service integration.

Taken together, the findings reveal that HDBRTS has generated substantial positive mobility outcomes in the Hubballi–Dharwad corridor. It is heavily relied upon by students and salaried workers, provides significant travel time savings, supports essential educational and economic travel needs, and is valued for its safety and service quality. At the same time, the relatively low adoption of additional services indicates scope for strengthening commuter engagement and increasing system utilisation.

Safety & Environmental (if included)

Safety and environmental performance constitute critical dimensions of urban mobility systems, particularly in rapidly growing cities where congestion, mixed traffic conditions and weak enforcement often heighten risks for commuters. The Hubballi–Dharwad BRTS (HDBRTS) was designed not only to improve mobility but also to enhance road safety through dedicated corridors, regulated station access, and reduced interaction between buses and mixed traffic. This section examines available accident data to assess whether these benefits have materialised along the key BRTS corridor.

Table 1: Road Accidents (2015-2023): Jubilee Circle to Hosur Cross Route, Dharwad to Hubballi

Sl. No	Year	Total Accidents		
		Fatal	Non-Fatal	Total
1	2015	26	126	152
2	2016	18	88	106
3	2017	15	66	81
4	2018	16	68	84
5	2019	19	99	118
6	2020	34	72	106
7	2021	34	82	116
8	2022	20	103	123
9	2023 up to February	5	23	28

Source: Police Traffic Section, Hubballi-Dharwad

Road Safety Trends Along the BRTS Corridor

Table 1 presents accident data along the Jubilee Circle–Hosur Cross corridor from 2015 to 2023. The figures reveal significant year-to-year fluctuations in both fatal and non-fatal accidents. Total accidents declined sharply from 152 in 2015 to 81 in 2017, followed by an increase to 118 in 2019. The pandemic year (2020) saw a reduction in overall accidents but an increase in fatal accidents, with a similar pattern persisting in 2021. Data for 2023 are partial (up to February), limiting full-year interpretation.

While the overall long-term trend suggests a reduction in the total number of accidents along the corridor after the introduction of HDBRTS, a notable concern emerges: fatal accidents did not decline proportionately and, in certain years (2020–2021), reached their highest recorded levels. This divergence between the decrease in total accidents and the increase in fatal accidents indicates that the safety benefits of improved road infrastructure have been partially offset by behavioural and enforcement-related challenges.

The persistence of fatal accidents suggests that non-compliance with traffic rules—such as encroachment into BRT lanes, over-speeding in mixed traffic, and disregard for signals—continues to pose significant risks. This finding aligns with broader evidence from Indian cities, where upgraded infrastructure has not always translated into safer outcomes without parallel improvements in enforcement, awareness, and user behaviour.

Need for Strengthened Enforcement and Behavioural Interventions

The analysis underscores the need for a multi-pronged approach to strengthen road safety along the BRT corridor. Enhanced enforcement—particularly through automated surveillance, higher penalty rates, and stricter action against repeat offenders—remains essential. In addition, awareness campaigns targeted at two-wheeler riders, pedestrians, and commercial drivers can contribute to behavioural change.

Introducing periodic road safety audits, strengthening lane discipline, and installing traffic-calming measures at critical conflict points may further reduce risk exposure. Measures such as temporary licence suspension or

cancellation for severe violations may be justified in high-risk zones, especially where fatality rates remain stubbornly high despite infrastructural improvements.

Summary & Findings

This Paper examined the performance of the Hubballi–Dharwad Bus Rapid Transit System (HDBRTS) across three core dimensions of mobility—**accessibility, availability, and mobility outcomes**—with an additional assessment of **safety and environmental indicators** along the BRT corridor. The findings, derived from large-scale primary data (n = 2,064) supported by field observations and secondary information, offer a comprehensive understanding of how HDBRTS is functioning within the twin cities.

Accessibility*:* The analysis shows that HDBRTS has significantly improved physical and functional accessibility in the corridor. Over **92 per cent** of commuters reported that BRTS stations were located at appropriate and easily reachable points, while **94 per cent** perceived stations as safe for women and children. Features such as level boarding, CCTV cameras, lighting, and secure station design have contributed to a more inclusive commuting environment. Nearly all respondents (98 per cent) reported notable reductions in travel time, demonstrating that accessibility is strongly influenced not only by physical proximity but also by operational efficiency.

Availability*:* HDBRTS emerges as the preferred mode of transport for the vast majority of respondents: **86 per cent** indicated it as their first choice. Nearly half of all commuters use the system daily, reflecting high service availability and alignment with the routine mobility demands of the population. Punctuality ratings were exceptionally strong, with over **90 per cent** confirming that buses arrived on time. Comparative fare assessments show that more than half the commuters consider HDBRTS cheaper or offering better value compared to other available modes, reinforcing perceptions of availability in both operational and economic terms.

Mobility Outcomes*:* The system demonstrates strong performance in meeting essential mobility needs. Students (69 per cent daily users) and salaried workers from both government and private sectors represent the most frequent users, highlighting HDBRTS as crucial for education and employment-related travel. Work trips (37 per cent) and education trips (25 per cent) dominate the purpose-of-travel distribution. Speed, safety, cleanliness, and comfort are the most influential factors driving BRTS usage, with each being endorsed by more than 75 per cent of respondents. The combination of reduced travel times, consistent service, and enhanced comfort creates meaningful improvements in personal mobility and productivity.

Safety & Environmental Observations: Accident analysis indicates a general decline in total accidents along the BRTS corridor after system introduction, though fatal accidents did not decline proportionately and increased during certain years. This mixed trend highlights the need for enhanced enforcement and behavioural compliance, especially regarding lane discipline and adherence to traffic signals. Environmental findings, while preliminary, suggest potential reductions in congestion and vehicular idling along the segregated corridor, which may contribute to improved local air quality.

In sum, the evidence demonstrates that HDBRTS has made substantial contributions to improving mobility in Hubballi–Dharwad. The system performs strongly on measures of accessibility, availability, travel-time efficiency, user satisfaction, and safety perceptions. However, lingering challenges remain in areas such as last-mile connectivity, affordability for lower-income and illiterate commuters, limited uptake of digital services among certain groups, and the need for stronger enforcement to reduce fatal accidents. Addressing these areas will be critical for sustaining user confidence and strengthening HDBRTS as a viable model for replication in other Karnataka cities.

Suggestions

Based on the analysis of accessibility, availability, mobility outcomes and safety indicators under HDBRTS, several policy and operational measures can be considered to strengthen system performance and enhance commuter

experience. These suggestions aim to improve inclusiveness, efficiency and long-term sustainability while addressing the gaps identified in the field survey.

Strengthening Last-Mile Connectivity: Although the locations of HDBRTS stations are widely perceived as appropriate, last-mile connectivity remains a persistent challenge, particularly in peripheral and low-density neighbourhoods. Improving access to stations through the introduction of electric feeder vehicles, shared bicycle systems, upgraded pedestrian pathways and a more organised integration of auto-rickshaws would considerably broaden the system's effective catchment area and enhance overall accessibility.

Enhancing Affordability for Vulnerable Groups: Affordability concerns were more pronounced among illiterate commuters and those from lower-income households. To ensure equitable access, the system would benefit from targeted measures such as concessional travel passes for low-income groups, simplified procedures for enrolling in digital ticketing systems and periodic fare reviews based on socio-economic assessments. Increasing transparency in fare-setting and sensitising commuters to the value offered by HDBRTS services may also help address cost-related perceptions.

Increasing the Use of Digital Services: Despite the availability of smart cards and e-purse facilities, overall adoption remains low. Strengthening awareness programmes, simplifying the process of obtaining and recharging smart cards and introducing mobile-based ticketing applications would encourage greater adoption. Expanding the number of recharge kiosks to non-BRT locations, such as markets and educational institutions, could further reduce dependence on on-board transactions and improve system efficiency.

Improving Operational Reliability and Real-Time Information: Although punctuality levels are high, commuter experience can be further enhanced by strengthening real-time information systems. Ensuring consistent availability of GPS-enabled arrival displays at all stations, providing reliable live-tracking mobile applications and standardising automated service announcements across the network would improve predictability and enable commuters to plan trips more effectively.

Enhancing Safety Through Better Enforcement: The persistence of fatal accidents along the corridor, despite improvements in infrastructure, highlights the need for stronger road-safety enforcement. Stricter monitoring of lane discipline through automated surveillance systems, higher penalties for corridor violations, regular road-safety audits and targeted awareness programmes for two-wheeler riders and pedestrians are essential. More coordinated traffic management between HDBRTS authorities and the city police is necessary to reduce conflict points and improve overall safety outcomes.

Improving Station and Onboard Amenities: While most respondents view HDBRTS stations as safe and well maintained, infrastructure quality can be enhanced further. Increasing seating capacity, ensuring regular sanitation, adding shaded and weather-protected waiting areas and improving lighting during early morning and late evening hours would significantly benefit vulnerable commuters, including women, children and senior citizens.

Expanding Capacity to Address Future Demand: Given the system's importance for work and educational commuters, service demand is likely to rise in the coming years. Enhancing capacity by increasing the number of buses during peak hours, introducing express services for long-distance commuters, extending the corridor to emerging urban zones and improving integration with regional bus terminals will be essential for maintaining service quality as the city expands.

Institutional Coordination and Data-Driven Planning: Sustained system performance depends on stronger coordination between HDBRTS Company Ltd., NWKRTC, HDMC and the Traffic Police. Establishing a unified mobility cell to coordinate planning, enabling systematic data sharing across institutions and developing performance monitoring dashboards will support evidence-based decision-making and improve system governance.

Conclusion

This Paper assessed the performance of the Hubballi–Dharwad Bus Rapid Transit System (HDBRTS) across critical dimensions of accessibility, availability, mobility outcomes, and safety. The findings indicate that HDBRTS has substantially enhanced the mobility landscape of the twin cities by providing a reliable, time-efficient, and user-friendly public transport service. High levels of daily ridership, strong perceptions of punctuality, and the system's clear preference over alternative modes demonstrate that HDBRTS has become an integral component of everyday travel for a large segment of commuters, particularly students and salaried workers.

The system's well-designed stations, dedicated corridors, improved safety infrastructure, and perceived inclusiveness reflect the success of the BRT model in reducing barriers to access. The overwhelming majority of users reported reduced travel times, validating the system's operational efficiency and its ability to address long-standing congestion along the corridor. These outcomes underscore the contribution of HDBRTS in strengthening both physical and functional accessibility in an urban context characterised by rapid growth and increasing mobility demands.

However, the analysis also reveals areas requiring policy attention. Despite the overall reduction in total accidents, the persistence of fatal accidents highlights ongoing challenges related to traffic discipline and enforcement in mixed-traffic environments. In addition, affordability concerns among certain socio-economic groups, the limited uptake of service enhancements such as smart cards, and gaps in last-mile connectivity indicate that the benefits of HDBRTS are not fully realised for all segments of the population. These limitations underscore the need for complementary interventions—ranging from better enforcement and targeted awareness programmes to improved feeder networks and refined fare policies.

Overall, the Paper's analysis demonstrates that HDBRTS has delivered positive and measurable mobility gains, reinforcing its potential as a viable model for replication in other medium-sized cities in Karnataka. Its successes provide important lessons for sustainable urban transport planning, while the identified challenges highlight the importance of integrated, multi-dimensional strategies to ensure that BRT systems function effectively and equitably. Strengthening these areas will be essential for unlocking the full transformative potential of HDBRTS and guiding future transport interventions in the state.

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References

Cervero, R. (2013). Transport infrastructure and the environment: Sustainable mobility and urbanism. *Journal of the American Planning Association, 79*(3), 225–236. https://doi.org/10.1080/01944363.2013.845946

Gwilliam, K. (2018). *Cities on the move: Ten years after*. World Bank Publications.

Hidalgo, D., & Muñoz, J. C. (2014). A review of technological improvements in bus rapid transit (BRT) and buses with high level of service (BHLS). *Public Transport, 6*(3), 185–213. https://doi.org/10.1007/s12469-014-0089-9

Litman, T. (2020). *Evaluating public transit benefits and costs: Best practices guidebook*. Victoria Transport Policy Institute.

Mahadevia, D., Joshi, R., Datey, A., & Joshi, R. (2016). *Bus rapid transit system in Ahmedabad: Understanding the institutional and political economy*. Centre for Urban Equity, CEPT University, Ahmedabad.

Pucher, J., & Buehler, R. (2012). *City cycling*. MIT Press.

Suzuki, H., Cervero, R., & Iuchi, K. (2013). *Transforming cities with transit: Transit and land-use integration for sustainable urban development*. World Bank.

Tiwari, G., & Jain, D. (2012). Accessibility and safety indicators for all road users: Case study Delhi BRT. *Journal of Transport Geography, 22*, 87–95. https://doi.org/10.1016/j.jtrangeo.2011.12.011

Wright, L., & Hook, W. (2007). *Bus rapid transit planning guide*. Institute for Transportation and Development Policy (ITDP), New York.