

Walkability challenges and opportunities: A study of Kalaburagi Railway Station vicinity

C Sharanabasappa^{1,2*} , Anwar Puneekar² 

¹Visvesvaraya Technological University, Belagavi, Karnataka, INDIA

²Malik Sandal Institute of Art & Architecture, Bijapur, Karnataka, INDIA

*Corresponding Author: sharanudegoan@gmail.com

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ABSTRACT

This research assesses the walkability of the vicinity surrounding Kalaburagi junction railway station, an important transportation hub located in Karnataka, India. Employing the Ministry of Urban Development (MOUD) methodology, the walkability index was determined to evaluate factors such as pedestrian safety, comfort, and convenience. The calculated score of 0.389 reflects moderate conditions for walking. Nonetheless, challenges including congested, narrow, and obstructed sidewalks, coupled with insufficient safety measures, detract from the pedestrian experience. It is essential to address these issues to cultivate a pedestrian-friendly environment, which can contribute to decreased pollution and traffic congestion, encourage healthy and sustainable modes of transportation, and improve overall safety. The results provide significant insights for urban planners and policymakers, establishing a framework for enhancing pedestrian infrastructure in Kalaburagi and offering a basis for comparison with other cities that prioritize walkability in their urban planning efforts.

Keywords: Kalaburagi, walkability score, MOUD, safety

INTRODUCTION

Pedestrian-friendly infrastructure is now an essential part of sustainable urban mobility due to the fast urbanization and growing reliance on public transit. For pedestrians to move safely, comfortably, and easily, walkability is highly essential, particularly in the vicinity of transit hubs like railway stations. An urban environment that is healthier and more sustainable is facilitated by well-designed pedestrian facilities, which also improves connectivity and encourages the use of public transportation.

A significant transportation hub that links the city to other areas is Kalaburagi Railway Station. However, the overall commuter easily accessible local resident experience is greatly impacted by how walking is in the surrounding areas. An area's walkability is influenced by a number of factors, including pedestrian crossings, road safety, sidewalk availability, traffic congestion, and street design. A very well pedestrian infrastructure improves overall urban livability, promotes last-mile connectivity, and greatly reduces dependence on private transportation. Urban planning frequently ignores pedestrian infrastructure, despite its significance, which results in unsafe as well as inconvenient walkable conditions. By performing a walkability index analysis of Kalaburagi Railway Station as well as the surrounding area, one can evaluate the condition of the

pedestrian infrastructure presently identifies areas in need of growth. Walkability is a crucial aspect of urban mobility and sustainable transportation, influencing pedestrian comfort, safety, and accessibility. The walkability index is a quantitative measure used to assess how conducive an area is for walking based on various environmental and infrastructural parameters. This section provides an in-depth analysis of walkability indicators, methodologies for index calculation, and supporting literature. A key component of sustainable transportation as well as urban mobility, walkability affects pedestrian accessibility, safety, and comfort. A quantitative indicator of an area's suitability for walking, the walkability index considers a number of environmental as well as infrastructure factors. This segment gives a systematic investigation of walkability indicators, index calculation methods, and previous research. This study intends to offer insights into improving pedestrian mobility and assuring a more sustainable urban transportation network by assessing important factors like sidewalk continuity, safety precautions, accessibility to public transportation, and environmental quality.

As per the 2011 census of India, Kalaburagi, previously referred to as Gulbarga, recorded a population of around 543,147, the census of India is conducted by the Office of the Registrar General and Census Commissioner, India, which

functions under the Ministry of Home Affairs, Government of India.

The census scheduled for 2021 was not conducted due to the COVID-2019 pandemic, so updated official data is currently unavailable.

However, population estimates for Kalaburagi City in 2025 have been projected by various sources, showing slight variations:

1. Approximately 778,000–Census 2011 India, Macro Trends
2. Approximately 752,000–Macro Trends
3. Approximately 751,802–World Population Review

Establishing it as a significant city within Karnataka. Reflecting its importance as a regional hub, the Kalaburagi Railway Station occupies an extensive area of about 44.3 hectares (109.5 acres). This expansive space encompasses various essential components, including station buildings, platforms, railway tracks, and associated facilities such as parking areas, waiting lounges, and operational zones. The size and infrastructure of the station underscore its role in catering to the transportation needs of the city and the surrounding areas, supporting both passenger and freight services efficiently (www.censusindia.gov.in). Walking is a simple yet highly beneficial activity that serves as both a practical mode of transportation and an effective form of exercise. For many people, it is a daily means of moving from one place to another, whether for commuting, errands, or leisure. Beyond its functional role, walking is widely recognized for its significant health benefits. Regular walking can control the various physical health issues, such as various types of cancer, heart disease, diabetes, and osteoporosis, by promoting cardiovascular health, improving circulation, and strengthening bones and muscles. Additionally, walking has profound positive effects on the mental health system and controls the symptoms such as depression, anxiety and also stress. It encourages the release of endorphins, often referred to as “feel-good” hormones, and provides a calming effect, particularly when done in natural or scenic environments. Thus, walking is an accessible and holistic activity that supports overall well-being (MOUD, 2008). The concept of “walkability” has gained significant attention in recent years, emerging as a central theme in urban planning and city design research. Walkability refers to the degree to which an area is designed to be pedestrian-friendly, prioritizing ease, comfort, and safety for individuals traveling on foot. This includes factors such as well-maintained sidewalks, convenient crosswalks, proper street lighting, green spaces, and the proximity of essential amenities like shops, schools, and public transportation. A walkable environment not only encourages more people to choose walking as their primary mode of travel but also contributes to healthier lifestyles, reduced traffic congestion, and lower environmental pollution. Urban planners now view walkability as a key metric for sustainable development, recognizing its importance in order to enhance quality of life, foster social interactions, and create vibrant, livable communities (Litman, 2003). Walking is the most basic form of transportation because it’s universal, affordable, and connects people to other types of transport. It also reduces health risks and pollution. A “walkable environment” has four

key features: it is “foot-friendly” with good paths, essential places are within walking distance, it has natural elements that make the climate more comfortable, and it brings people together culturally, religiously, and regionally (Burden, 2001). A successful pedestrian network is designed with six key criteria: it connects neighborhoods to the city’s road network, links to other transport options, is carefully divided into zones for study, keeps crime and accidents low, considers the features of walkways, and includes the design, look, layout, and overall feel of the community’s streets and spaces (Bradshaw, 1993). In traditional transport planning, walking is often undervalued. Issues include difficulties in measuring it, limited funding, low cost, and benefits that are often overlooked or not taken seriously (Southworth, 2005). The “5 C’s” are a way to evaluate a location’s walkability, connectivity, friendliness, safety (crime-free), comfort, and convenience (Litman, 2003). Thirty major Indian cities were evaluated using the walkability index, with India’s average walkability rating being at 0.52 (Improving Walkability, 2005), Asian cities’ clean air initiative (Walkability in Indian Cities, 2011). Interviewed participants utilizing a questionnaire at Bangkok’s urban train terminals, and its results have been examined applying a multinomial option method. They observed the propensity of people to walk across the stations. Chalermpong and Wibowo (2007) used the AHP method to measure the importance of different factors that affect walking to urban railway stations in Bangkok (Iamtrakul & Zhang, 2014). Walkable neighborhoods offer health, sustainability, and safety benefits, but their design often neglects pedestrian and bicyclist safety. This study investigated the link between pedestrian and bicycle collisions in U.S. metropolitan areas and neighborhood walkability. Using geo coded data and multilevel models, the research found that higher walkability, measured through factors like land use, street connectivity, and transit access, correlated with increased pedestrian and bicyclist fatality rates. Conversely, overall traffic fatality rates decreased in more walkable neighborhoods. Vulnerable populations, including low-income and minority groups, faced greater safety risks. The findings highlight the need to redefine walkability by prioritizing safety and improving assessment tools to balance health benefits with reduced risks for vulnerable road users (Wali & Frank, 2024).

Assessing street walkability is essential for promoting urban sustainability, public health, and community cohesion. This study introduces a comprehensive framework that combines both subjective perceptions and objective indicators through three indices: walking preferences at the street, micro, and macro levels. Applied in Beijing, the study emphasizes the importance of both street-level and community-scale elements, as well as the interactions between these indicators. While the discussion on perceived walkability offers valuable insights, it could be further strengthened by referencing empirical studies that validate this concept and support the integration of subjective assessments into walkability evaluations.

Accessibility, or the ease of getting to places, has always been a major consideration in transportation design, and several studies have looked at how to measure and adapt it. Over the past 20 years, walkability—a mode-specific type of accessibility—has grown in popularity, highlighting how

convenient it is to walk to locations. Recently, research has shifted towards perceived accessibility—how individuals experience ease of access, which may better predict travel behavior than objective measures like elements of the built environment. Although little research has been done, observed walkability or as walk-friendly a place feels is connected to pedestrian frequency, exercising, and mental health. In this overview, research on reported walkability, proposing a conceptual model to connect it with objective measures. Additionally, it presents the A fraction Perceived Walking ability Score and makes recommendations for future study directions to advance expertise, boost walking, and further improve one's walking environment (De Vos et al., 2023). Assessing street walkability is crucial for urban sustainability, health, and community cohesion. This study introduces a framework combining subjective and objective measures through three indices: walking preferences at the street, micro, and macro levels. In Beijing, it highlights the importance of street-level as well as community elements interaction between these indicators.

The framework offers useful data for creating walkable as well as inclusive cities (Huang et al., 2024). Evaluating street walkability is essential for societal cohesion, health, and urban sustainability. Through the use of three indices—the macro-scale, micro-scale, and sidewalk walking preferences—this study presents a framework that combines subjective and objective indicators. When it is used in Beijing, it emphasizes the interplay between these elements as well as the significance of street-level community elements. This same framework provides useful information for developing walkable as well as inclusive cities (Huang et al., 2024). Walking as well as other forms of active transportation are necessary for sustainability for urban mobility refer for ancillary infrastructure. This study presents a technique for establishing a walkability index for pathways that lead to transportation hubs, like railway stations, by taking into consideration how pedestrians visualize infrastructure elements like kerb stone, greenery, as well as urban fixtures. The strategy, which has been tested in the vicinity of Milano Rumored Railway Station in Italy, helps develop policies to improve pedestrian accessibility by offering practical insights into walkability conditions as well as highlighting areas that need improvement. In order to evaluate as well as the quality, accessibility, and safety the main objective of this study pedestrian infrastructure, is to calculate walkability index for Kalaburagi Railway Station surrounding areas.

The study aims to

- (1) **assess the existing pedestrian infrastructure** around Kalaburagi Railway Station, including sidewalks, crossings, signage, and pedestrian pathways,
- (2) **evaluate the walkability index** by analyzing key parameters such as sidewalk width, surface quality, pedestrian safety, traffic density, accessibility to public transport, and overall environmental conditions,
- (3) **identify challenges** faced by pedestrians, including encroachments, lack of crossings, inadequate lighting, poor maintenance, and safety concerns,

- (4) **compared walkability levels** with standard benchmarks and similar transit hubs to understand areas of improvement, and
- (5) **provide recommendations** for enhancing pedestrian-friendly infrastructure through better urban planning, policy interventions, and design improvements.

The findings of this study will help policymakers, urban planners, and local authorities in making informed decisions to improve pedestrian mobility and promote a safer, more walkable environment around Kalaburagi Railway Station.

Enhancing walkability is a key factor in promoting accessibility, safety, and sustainability in urban areas. A well-designed pedestrian-friendly infrastructure contributes to a more inclusive and efficient transportation system, improving the overall urban experience. The following points concerns with significance of this research work:

1. Improved accessibility

- a. A high walkability index ensures that pedestrians, including commuters, elderly individuals, and people with disabilities, can navigate the area safely and conveniently.
- b. Enhancing last-mile connectivity to Kalaburagi Railway Station encourages greater use of public transport, reducing reliance on private vehicles.
- c. Well-maintained sidewalks, designated crossings, and traffic-calming measures improve ease of movement.

2. Enhanced safety

- a. Pedestrian safety is a crucial aspect of urban mobility. Poorly designed infrastructure, lack of crossings, and high-speed traffic pose significant risks.
- b. Implementing proper walkways, zebra crossings, traffic signals, and lighting reduces the likelihood of accidents and enhances security.
- c. A walkable environment discourages jaywalking and promotes safer pedestrian behavior.

3. Environmental and economic sustainability

- a. Walkable cities contribute to a reduction in carbon emissions by encouraging walking and reducing dependence on motorized transport.
- b. Increased pedestrian activity fosters local businesses and economic growth by making commercial areas more accessible.
- c. Sustainable urban planning prioritizing walkability leads to improved air quality, reduced congestion, and overall enhanced urban well-being.

By evaluating the walkability index of Kalaburagi Railway Station and its surrounding areas, this study aims to provide data-driven insights to improve pedestrian infrastructure, making the area more accessible, safe, and sustainable. The findings will help in urban policy formulation, infrastructure development, and enhancing the overall livability of the city.

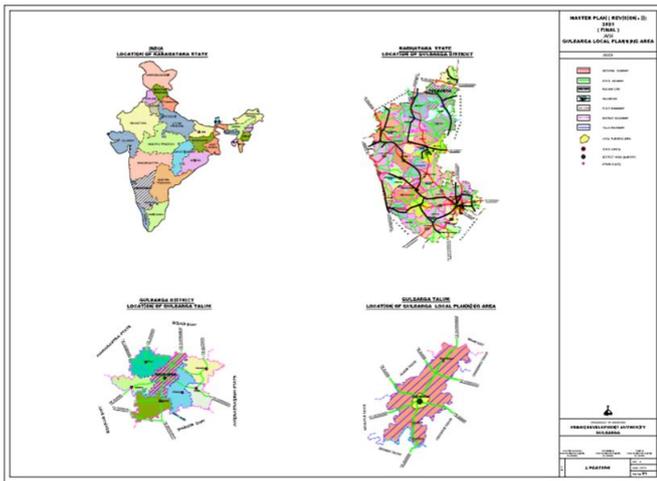


Figure 1. Location of Kalaburagi City (KUDA MASTER PLAN-2022) (Source: KUDA Kalaburagi)

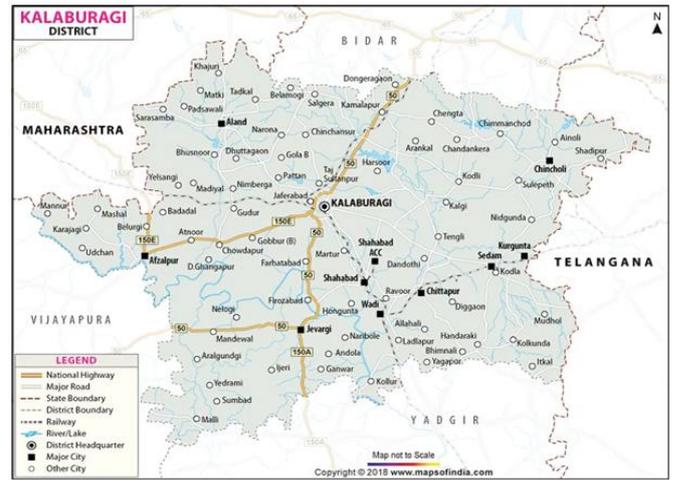


Figure 3. Kalaburagi City focusing on areas along the railway line and its surroundings (Source: KUDA Kalaburagi)

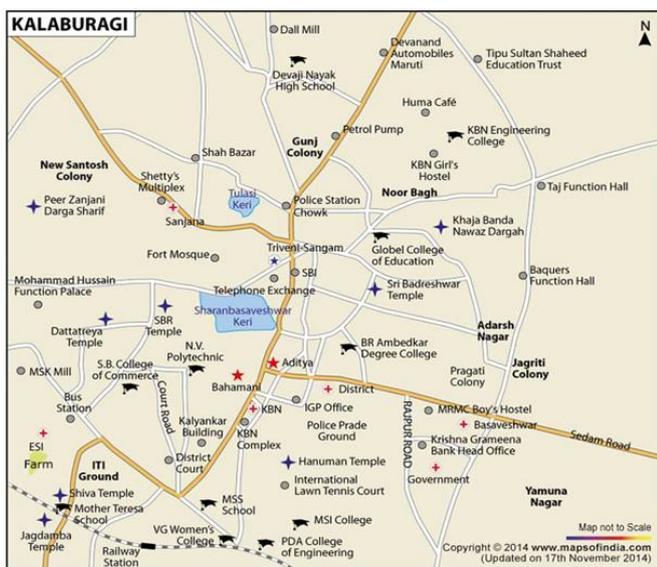


Figure 2. Map of Kalaburagi City (Source: KUDA Kalaburagi)

STUDY AREA

Bangalore, Mysuru, and Hubballi-Dharwad are the three largest cities in Karnataka, with Kalaburagi coming in fourth. There were 5, 32,031 people living in Gulbarga as per the 2011 census. The city has three outgrowths and 58 census wards, with an average of 9,673 people living in each ward. The district’s headquarters are in Kalaburagi. Situated 623 miles north of Bangalore and 230 km from Hyderabad, it is a prominent city in the Hyderabad–Karnataka Region and is regarded as one of the state’s most backward areas.

Figure 1, Figure 2, and Figure 3 demonstrate the city’s location, its position within the district, and its geographic location within the nation and the State of Karnataka.

An important railway station in the Indian State of Karnataka is Kalaburagi Junction, which is located in Kalaburagi District. “KLBG” is Kalaburagi Junction’s station code name. Kalaburagi Junction Railway Station ranks as one of the top 100 Indian railway train reservation and transportation terminals. The Great Indian Peninsula Railway

played a pivotal role in expanding India’s railway network during the 19th century. In 1865, it commenced work on extending its Mumbai–Solapur railway line, aiming to connect the key commercial hub of Mumbai with more regions in southern India.

By 1871, this ambitious project reached a significant milestone with the line being extended all the way to Raichur, located in present-day Karnataka. This development not only facilitated greater connectivity and economic integration but also marked a crucial step in linking northern and southern India, paving the way for enhanced trade, passenger movement, and regional development during the British colonial era (Northern Railway Zone, 2013; Sholapur District Gazetteer, 2013). The structure itself of the 110-kilometer-long, the railway link between Kalaburagi and Bidar constitutes a significant achievement in enhancing regional connectivity in Karnataka. After years of planning and construction, the Indian Prime Minister officially opened this important railway route on October 29, 2017. By establishing a direct route between Kalaburagi (formerly Gulbarga) and Bidar, the new link facilitates better accessibility, communication, and trade between these areas while cutting down on travel time. The project, which benefits both passenger and freight movement, has been praised as a critical step toward enhancing economic development and fortifying infrastructure in northern Karnataka (Bidar-Gulbarga Rail Service, 2012; The Hindu, 2013).

The Kalaburagi Railway Station in Karnataka, India’s Kalaburagi District is the subject of the study. The station serves as a major regional transportation hub, linking local and long-distance trains to a number of locations. The railway station will be surrounded by a clearly delineated buffer zone of 1-2 km in order to provide a comprehensive analysis. This area includes hugely important locations like bus stops, shopping malls, residential neighborhoods, and other significant public spaces that affect pedestrian flow.

Demographics and Land Use

The population density of Kalaburagi varies throughout the buffer zone.

The following make up the majority of the area around the railway station:

1. **Commercial areas:** Stores, marketplaces, and workplaces that encourage pedestrian traffic.
2. **Residential areas:** Mostly low- to medium-density neighborhoods that are walkable from the station.
3. **Transit facilities:** The central component of the transportation system consists of the railway station, bus stops, auto-rickshaw stand, and taxi services.

Since these land uses affect accessibility and pedestrian traffic, it is crucial to comprehend their spatial distribution in order to evaluate walkability.

Transport Infrastructure

The Kalaburagi Railway Station's surrounding transportation infrastructure consists of

- (1) **roads:** major roads that lead to the station include Gandhi Chowk Road, Station Road, and other smaller roads,
- (2) **footpaths:** an important factor in determining the comfort as well as safety of pedestrians on these roads is the quality, size and shape, continuity of the footpaths,
- (3) **crossings:** to ensure pedestrian safety, pedestrian crossings are crucial, particularly close to busy roads, and
- (4) **public transportation links:** access to bus stops and auto-rickshaw stands is crucial in determining pedestrian patterns, particularly for pedestrians who use both local and railroad transportation.

By examining the pedestrian-friendly infrastructure and how well it serves the commuter population, this study section seeks to evaluate the walkability of the railway station precinct.

By examining a variety of factors of compromise the walkability index of the neighborhood around the station. The main reasons and challenges are as follows:

1. Insufficient nighttime illumination

One of the biggest obstacles to nighttime pedestrian traffic in the area is the absence of sufficient lighting. Observations (Figure 4, Figure 5, Figure 6, and Figure 7) reveal poorly lit pathways and intersections, creating an unsafe environment. This deficiency increases the risk of accidents and criminal activities, particularly for vulnerable groups such as women, children, and elderly individuals. Insufficient illumination reduces pedestrian confidence and discourages evening and nighttime foot traffic, ultimately impacting the area's vibrancy.

Insufficient night illuminating has a serious issue that affects safety, security, and accessibility, while it is especially obvious at Kalaburagi Railway Station and its adjacent surroundings. Proper illumination in roadways, pedestrian paths, and public areas plays an essential role for prevention of crime, accident reducing, as well as overall urban livability (UN-Habitat, 2016). Nevertheless, Kalaburagi Railway Station as well as the surrounding area has insufficient lighting due to poor urban design, budgetary constraints, along with

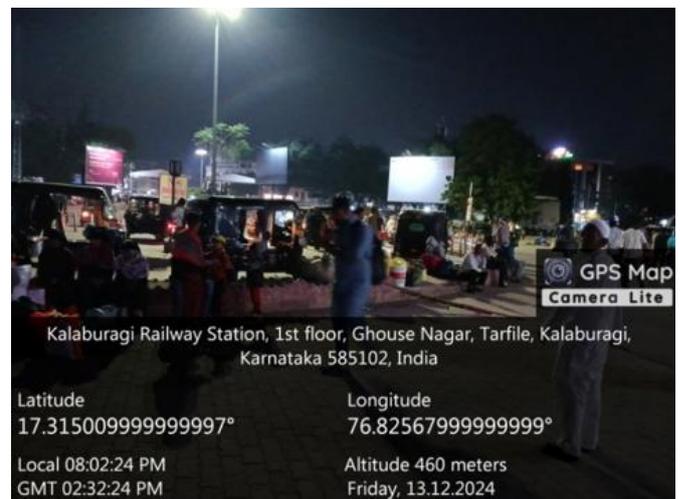


Figure 4. Lack of sufficient lighting in areas along the railway station and its surroundings-1 (Source: Field study)



Figure 5. Lack of sufficient lighting in areas along the railway station and its surroundings-2 (Source: Field study)

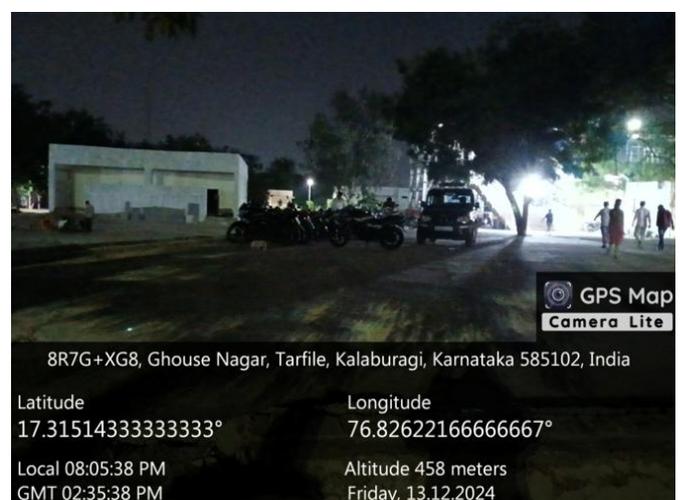


Figure 6. Lack of sufficient lighting in areas along the railway station and its surroundings-3 (Source: Field study)

inefficient maintenance mechanisms. Many lighting in the neighborhood are either poorly positioned, inoperable, or far



Figure 7. Lack of sufficient lighting in areas along the railway station and its surroundings-4 (Source: Field study)

enough apart, creating dark areas with compromise visibility as well as security (Kumar & Rastogi, 2019).

Budget limits worsen the problem, since municipalities frequently prioritize other infrastructure investments above street lighting. High energy prices and unreliable power supply make widespread illumination impractical in impoverished places like Kalaburagi, making constant nighttime visibility difficult to achieve (World Bank, 2018). Furthermore, inadequate maintenance and frequent equipment failures lead to non-functional streetlights, with many going unrepaired because of inefficient management or a lack of financial resources (UNESCO, 2020). Vandalism and theft of electrical components, including copper wiring, has also been documented in some locations, leading to the lighting crisis.

The implications of insufficient nighttime illumination near Kalaburagi Railway Station remain serious. Crime rates seem to rise in low-lit locations, leaving passengers, pedestrians, even shopkeepers at risk for theft, vandalism, even assault (Painter & Farrington, 2001). Furthermore, insufficient lighting increases the likelihood of road accidents, especially for pedestrians, cyclists, as well as motorists who have low vision at night (UNESCO, 2020). Public transportation systems operating near the train station have lower nighttime patronage because passengers prefer not to use poorly lit areas because of concerns about security (Smith et al., 2017).

The social and economic repercussions of insufficient lighting within the Kalaburagi Railway Station region are equally significant. Businesses near the station lose customer potential because people avoiding these areas during dark. Limited accessibility to well-lit public places inhibits economic activity, lowers tourism potential, and harms local companies (Falchi et al., 2016). The livability within surrounding areas is also impacted, because insufficient lighting restricts social gatherings as well as public participation, leading to higher social isolation (UNESCO, 2020).

To address such issues, Kalaburagi officials need to prioritize spending on sustainable street lighting, maintain adequate maintenance on current infrastructure, and

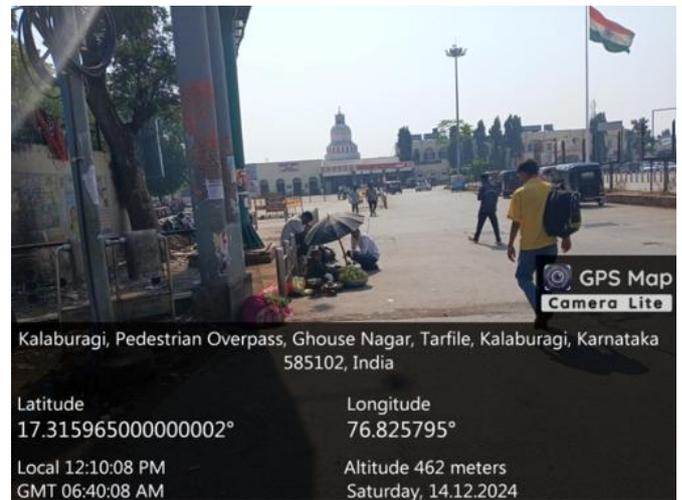


Figure 8. Limitation falls short of accessibility standards for the railway station and its surroundings-1 (Source: Field study)

investigate renewable energy options such as solar-powered lighting. Smart lighting solutions including motion sensors as well as LED technology may also enhance energy economy while increasing nighttime visibility as well as security. Enhancing urban lighting facilities is critical in making Kalaburagi Railway Station and its surrounds more secure, accessible, and economically vibrant.

To enhance the argument, comparative statistics on artificial lighting levels across urban environments could be introduced. For instance, data from the new world atlas of artificial night sky brightness (Falchi et al., 2016) provides a global benchmark for nighttime light pollution, offering valuable insight into how cities differ in their lighting infrastructure. Such comparisons can contextualize localized findings within a broader framework, illustrating whether certain areas are disproportionately over- or under-lit and how this might influence walkability perceptions and behaviors and it could be further enhanced by incorporating comparative statistics from similar urban settings. For instance, UNESCO (2020) reports on sustainable cities and communities emphasizes the role of lighting policies in shaping urban development and provides examples from diverse cities worldwide. Referencing such comparative insights would provide broader context, highlighting best practices and common challenges across urban environments, thereby strengthening the overall argument.

2. Inaccessible ramps

Accessibility is a fundamental aspect of walkability, yet the area fails to accommodate individuals with disabilities and mobility challenges. The absence of ramps at carriageway connections (Figure 8 and Figure 9) makes it difficult for wheelchair users, parents with strollers, and elderly pedestrians to navigate safely.

This limitation violates universal design principles and accessibility standards, restricting equitable access and reducing the inclusivity of the area.

Kalaburagi Railway Station as well as its surrounding regions confront major accessibility issues, particularly in terms of ramps and without barriers infrastructure for people

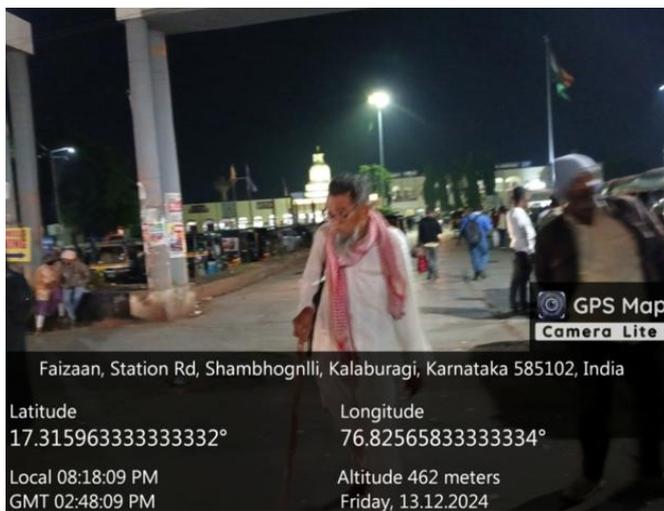


Figure 9. Limitation falls short of accessibility standards for the railway station and its surroundings-2 (Source: Field study)

with disabilities, the elderly, and those who have mobility limitations. While accessibility for urban infrastructure is critical for promoting inclusivity, Kalaburagi train station and surrounding public areas frequently lack well-designed, adequately maintained ramps, causing movement difficult for people who depend upon them (United Nations, 2016). Many of these ramps are either too steep, too narrow, or built with inappropriate surface materials, making them dangerous and difficult to negotiate (Imrie & Luck, 2014). Furthermore, inappropriate ramp design causes those who use wheelchairs and pedestrians without mobility impairment to take lengthy, uncomfortable detours, reducing their freedom as well as ease of moving (Steinfeld & Maisel, 2012).

Poor urban planning and noncompliance with international availability standards, such as the Americans with disabilities act (ADA) with universal design principles, are among the key causes of Kalaburagi Railway Station's lacking ramp infrastructure. Despite requirements requiring accessibility in public transportation hubs, enforcement is weak, allowing incompatible designs to continue. Furthermore, poor maintenance exacerbates accessibility concerns, since numerous ramps are damaged, blocked by parked vehicles or vendors, or covered in waste, making them less usable (Gupta et al., 2016a).

The lack of understanding and prioritization by politicians and urban planners in Kalaburagi has exacerbated accessibility hurdles, as accessibility improvements are frequently deprioritized with infrastructure projects because of perceived high expenses (World Bank, 2018).

The implications of inaccessible ramps surrounding Kalaburagi Railway Station are significant, causing mobility issues for disabled and elderly people who are forced to rely on assistance, reducing the independence they have as well as preventing them from using public transportation (United Nations, 2016).

Users are put at risk by poorly constructed ramps with steep grades or without adequate handrails, which raise the risk of falls and injuries (Gupta et al., 2016a). Furthermore, by restricting the employment and educational opportunities

available to Kalaburagi residents with disabilities, a lack of easily accessible facilities imposes upon those rights and promotes social exclusion (Steinfeld & Maisel, 2012).

Inaccessible ramps around Kalaburagi Railway Station have serious repercussions, making it difficult for elderly and disabled people to move around and reducing their independence. They also make it impossible for them to use public transportation (United Nations, 2016). Users are put at risk by poorly constructed ramps with steep grades or without adequate handrails, which raise the risk of falls and injuries (Gupta et al., 2016a). Furthermore, by restricting the employment and educational opportunities available to Kalaburagi residents with disabilities, a lack of easily accessible facilities infringes upon those rights and promotes social exclusion (Steinfeld & Maisel, 2012).

Inaccessible ramps in the vicinity of the railway station have a substantial financial impact in addition to social challenges. Local businesses and public services see reduced consumer traffic as people with mobility impairments avoid these places due to access concerns (World Bank, 2018). Furthermore, a lack of accessible infrastructure has an impact on tourism and urban development investment, as limited access to public transportation restricts visitors and investors. Governments and transportation organizations that refuse to provide accessible infrastructure risk legal action and reputational harm for breaking disability rights as well as human rights standards (Steinfeld & Maisel, 2012).

Addressing the accessibility concerns at Kalaburagi Railway Station and its surrounding area is critical to establishing a more equitable and resilient urban environment. Implementing good urban design, implementing accessibility rules, guaranteeing regular maintenance, and boosting policymakers' knowledge can considerably increase mobility for people with disabilities, hence improving the region's overall quality of life.

International best practices for inclusive pedestrian infrastructure

Inclusive pedestrian infrastructure guarantees that streets and public places are accessible, safe, and useable for all individuals, including those with disabilities, the elderly, and children. These best practices are supported by a number of global legislation and standards.

A. ADA–United States

1. Policy: ADA standards for accessible design (US Department of Justice)
2. Key features
 - a. Provide curb ramps at all pedestrian crossings
 - b. Provide visible warning surfaces for the visually impaired
 - c. Maintain minimum sidewalk widths and clear zones.
 - d. Accessible pedestrian signals provide auditory and tactile feedback.

B. European accessibility act (EAA)–European Union

1. Policy: Directive (EU) 2019/882 (European Parliament and the Council of the European Union, 2019)

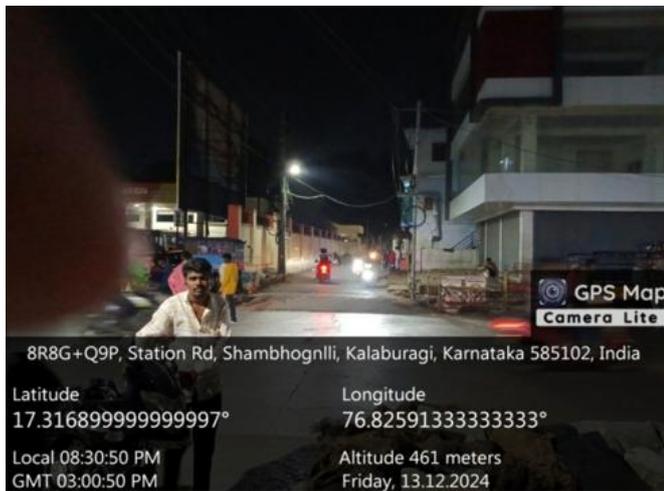


Figure 11. Safety concerns arising from the lack of designated pedestrian crossings-2 (Source: Field study)

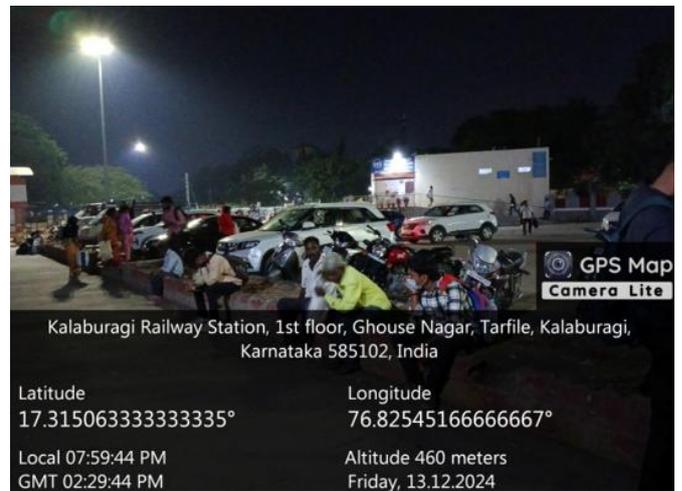


Figure 10. Safety concerns arising from the lack of designated pedestrian crossings-1 (Source: Field study)

2. Key features

- Harmonized accessibility standards among EU nations.
- Prioritizing universal design in urban infrastructure
- Integrating accessible elements into public transportation and pedestrian areas

C. United Nations convention on the rights of persons with disabilities (CRPD)

1. Policy: Article 9–Accessibility

2. Key features

- Obliges signatory countries to ensure access to the
- The agreement requires member countries to ensure access to the built environment, establish minimum accessibility standards, and
- Remove physical barriers in public spaces.

D. Global street design guide–NACTO

1. Policy tool: NACTO global street design guide (National Association of City Transportation Officials, 2016)

2. Key features

- Prioritizing pedestrians, particularly those with mobility problems, in street design.
- Recommendations for curb extensions, seating, and tactile markers.
- Focus on equitable and inclusive street design in global cities.

E. WHO and UN-Habitat–Global plan for road safety

1. Policy: Global plan for the decade of action for road safety 2021–2030 (United Nations, 2006)

2. Key features

- Promotes “safe system” and “complete streets” approaches
- Emphasizes fair mobility and safe infrastructure for all

- Encourages communities to incorporate accessibility into transportation design

3. Lack of pedestrian crossings

The scarcity of designated pedestrian crossings (**Figure 10** and **Figure 11**) forces pedestrians to cross busy streets at unmarked and unsafe locations. This issue increases the risk of accidents and endangers lives, particularly during peak traffic hours. Without proper crossings, pedestrians are left to compete with vehicles for space, highlighting a critical gap in pedestrian safety infrastructure.

The absence of pedestrian crossings is a major urban infrastructure issue, especially in high-traffic places such as Kalaburagi Railway Station as well as its surrounds, where pedestrian mobility is critical both accessibility and safety. Poor urban planning has prioritized automotive traffic over pedestrian demands, resulting in a lack of marked crossings, requiring individuals to jaywalk, and raising accident risks (World Bank, 2018).

Kalaburagi long pedestrian crossing distances disabled and elderly car-friendly infrastructure make commuting challenging, particularly for vulnerable groups like the (United Nations, 2016). The problem is made worse by budgetary restrictions, as local governments usually put road development projects ahead of pedestrian safety measures, delaying or eliminating necessary infrastructure upgrades (Gupta et al., 2016a). Additionally, unplanned growth has occurred close to the train station as a result of increased urbanization, making it challenging to integrate safe pedestrian crossings into the existing structure (Kumar & Rastogi, 2019). The issue is made worse by antiquated laws and lax enforcement, which enable pedestrian safety to be neglected in spite of growing traffic concerns (Arthur & Passini, 1992). Poor pedestrian crossings close to Kalaburagi Railway Station have serious consequences. Pedestrians frequently put their lives in danger by crossing busy roads without permission, which raises the number of accidents that result in fatalities (Painter & Farrington, 2001).

Policies and initiatives in India

Recognizing these problems, the Indian government has launched various programs to promote sustainable In order to

reduce reliance on personal motor cars and alleviate environmental concerns.

1. **Smart cities mission (2015):** This effort, which aims to promote sustainable and inclusive urban development, comprises projects that focus on establishing walkable communities, decreasing urban mobility and improving pedestrian infrastructure:
2. **National urban transport policy (2006):** This strategy prioritizes the development of non-motorized transportation infrastructure, with the goal of ensuring safe and accessible pedestrian walkways congestion, and boosting local economies, so increasing walking and lowering automobile emissions.
3. **Street design guidelines:** Cities such as Delhi have adopted criteria to prioritize pedestrians in urban development. However, implementation frequently meets obstacles because of car-centric planning approaches and administrative apathy.

Challenges in implementation

Despite these policies, on-the-ground execution encounters various challenges:

1. **Car-centric planning:** India's urban planning has always promoted vehicular transportation, frequently at the expense of pedestrian facilities. This strategy has resulted in the marginalization of pedestrian requirements in urban planning (Questions of Cities, 2024).
2. **Administrative fragmentation:** The governance system for urban mobility is frequently fragmented, with many entities assuming overlapping roles. This fragmentation creates coordination gaps and impedes the successful implementation of pedestrian-friendly projects (Tewari & Sarwate, 2023).
3. **Maintenance issues:** Even when pedestrian infrastructure exists, a lack of regular maintenance causes deterioration, discouraging use and pushing people toward auto transportation (Government of India, 2006).

Addressing the environmental impact of inadequate pedestrian infrastructure in India necessitates a multifaceted strategy. While laws such as the national urban transport policy and smart cities mission provide a framework, successful implementation requires a move toward pedestrian-centric urban planning, streamlined governance systems, and regular infrastructure maintenance. Improving pedestrian amenities can encourage walking, reduce vehicle emissions, and help to create more sustainable and livable urban environments (MoHUA, 2015).

Traffic congestion as well as wasteful road use is caused by a lack of safe walkways, which deters pedestrian's increases in reliance on public vehicles (Smith et al., 2017). Additionally, there are serious negative effects on the environment and human health because fewer pedestrian-friendly buildings result in a greater reliance on automobiles, which raises carbon emissions, and a decrease in physical activity, which raises the risk of obesity and cardiovascular disease. Businesses surrounding Kalaburagi Railway Station suffer as well, as locations without pedestrian-friendly infrastructure see

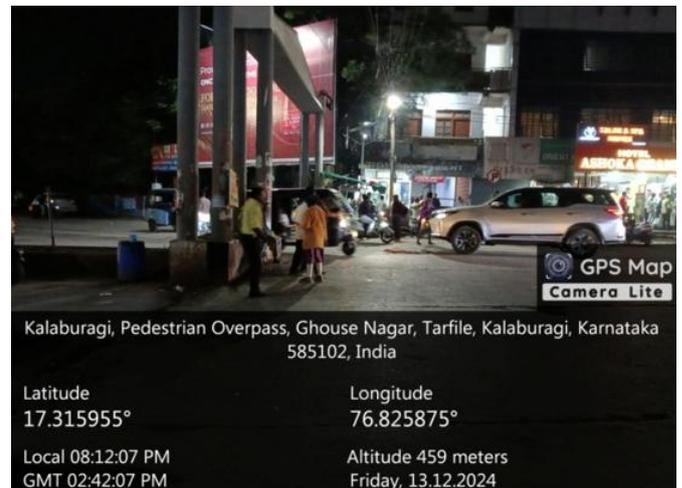


Figure 12. Navigational challenges posed by inadequate signage and way finding system-1 (Source: Field study)

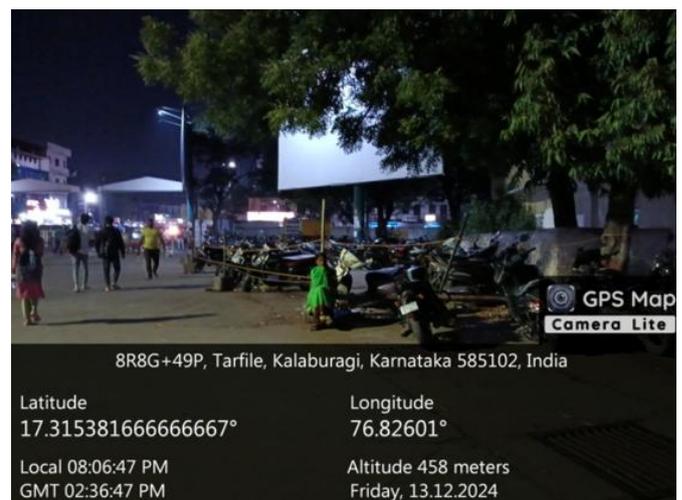


Figure 13. Navigational challenges posed by inadequate signage and way finding system-2 (Source: Field study)

decreased foot traffic, impacting local business and economic activity (World Bank, 2018). The economic burden of higher accidents, healthcare bills, and lost productivity puts additional strain on families and local governments. To address these difficulties in Kalaburagi, greater urban design, greater regulation of pedestrian safety rules, and the construction of maintained properly, accessible crossings are required to create a more secure and walkable environment.

4. Inadequate signage and way finding

Clear signage and effective way finding systems are essential for guiding pedestrians through urban spaces. However, the area surrounding the station lacks these critical elements (Figure 12 and Figure 13), leading to confusion and frustration among pedestrians.

Poor way finding increases the likelihood of disorientation, particularly for first-time visitors, and can result in unsafe behaviors, such as jaywalking or walking along vehicular routes. Insufficient signage as well as way finding systems pose significant difficulties within urban environments, especially in areas with significant traffic that include Kalaburagi Railway Station and its surroundings. Proper signage is needed for successful navigation, connectivity, and safety, but many

cities fail to build effective ways of finding rules with their urban planning (Arthur & Passini, 1992). Kalaburagi Railway Station has inadequately designed, outdated, and missing signs, making navigation difficult for passengers, particularly initially visitors, tourists, as well as those with impairments (Golledge, 1999). A lack of consistency, as well as variable font, color, along with symbol placement, adds to confusion and reduces readability along with understanding for travelers (Passini, 1996). The situation is exacerbated by poor maintenance, as many signs in and around station vanished, damaged, as well as being obstructed from environmental factors, providing them ineffective (Hara et al., 2013).

The effects of poor way finding in Kalaburagi Railway Station were substantial. Higher confusion and disorientation between passengers causes unwarranted holds, missed trains, and increased stress, especially in high-pressure situations such as crises (Arthur & Passini, 1992). Poorly marked exits and confusing directional signage can impede efficient evacuations when urgent unforeseen circumstances posing a safety risk. Another major concern is access, as the absence of braille, visual maps, and audio guidance makes navigation extremely difficult for visually impaired people, and the lack of obvious signs for wheelchair-accessible paths limits mobility over disabled travelers (Golledge, 1999). Furthermore, inadequate signage has an impact on the local economy as well as commercial landscape. Organizations around Kalaburagi Railway Station see lower foot traffic as tourists struggle to find crucial places such as shops, ticket desks, and exits (Arthur & Passini, 1992). Psychological stress and exhaustion are also increased as a result of excessive walking and dissatisfaction induced by chaotic navigation systems, which disproportionately affect the elderly and disabled (Passini, 1996).

To address such problems, Kalaburagi Railway Station requires a complete navigation strategy, which includes the placement of clear, well-lit, and uniform signs to ensure accessibility to all users. Implementing bilingual signs, digital navigation kiosks, and interactive maps can improve the user encounter and eliminate misunderstanding. Regular maintenance as well as audits of signs infrastructure need to be prioritized for readability and efficacy. Kalaburagi Railway Station can improve passenger experience, accessibility, as well as safety by implementing better navigation systems, resulting in an additional inclusive and effective urban transit environment.

5. Poor road surface conditions

Well-maintained walkways and road surfaces are crucial for pedestrian safety and comfort. In the station's vicinity, the smoothness and regularity of pathways are compromised by uneven surfaces, potholes, and poor maintenance (Figure 14, Figure 15, Figure 16, Figure 17, and Figure 18). These conditions pose tripping hazards and discourage walking. Moreover, the absence of protective features such as pipe railings or handrails separating pedestrian zones from vehicular traffic further exacerbates the risk of accidents.

Inadequate roads pavement conditions are a major threat to transportation security, effectiveness, with infrastructure sustainability, especially near Kalaburagi Railway Station with its nearby regions, wherein significant traffic as well as



Figure 14. How poorly maintained walkways and road surfaces-1 (Source: Field study)



Figure 15. How poorly maintained walkways and road surfaces-2 (Source: Field study)

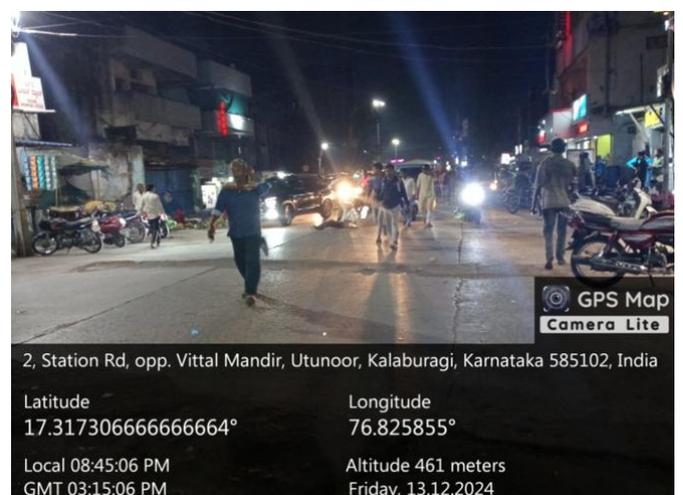


Figure 16. How poorly maintained walkways and road surfaces-3 (Source: Field study)

inadequate upkeep exacerbates the problem. Potholes, fissures, and rough pavement are common on the roads surrounding the station, making travel dangerous for



Figure 17. How poorly maintained walkways and road surfaces-4 (Source: Field study)



Figure 19. Walkway encroachment can lead to traffic congestion-1 (Source: Field study)

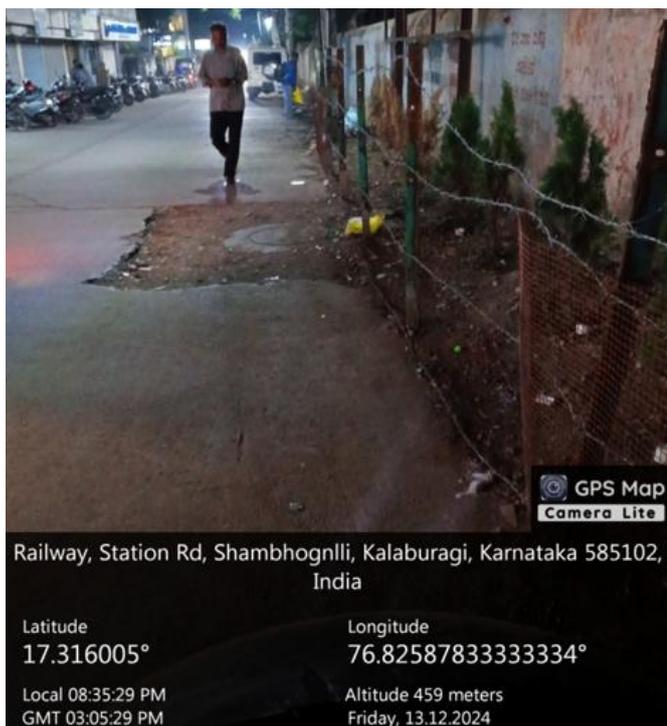


Figure 18. How poorly maintained walkways and road surfaces-5 (Source: Field study)

automobiles, bicycles, and pedestrians (Chen et al., 2019). Natural degradation, severe weather conditions, inadequate infrastructure components, and vehicle overburden all contribute to quick road degradation (Huang, 2004; Shahin, 2005). With Kalaburagi, variables temperatures, significant rainfall, with inadequate drainage exacerbate road structure deterioration, resulting in continuous destruction and expensive replacements (Dore & Zubeck, 2009). Furthermore, corruption and incompetence in investments in infrastructure lead to poor-quality construction of roads, limiting longevity and raising repair expenses (Sclar, 2000).

The implications of hazardous traffic conditions near Kalaburagi Railway Station are significant. Vehicles lack mobility on roads that are damaged, resulting in frequent

accidents and safety issues, particularly with poor weather conditions (Agarwal et al., 2017a). Cyclists along with motorcyclists have a greater chance of being injured as a result of road faults, keeping transportation unsafe. Furthermore, continual collisions with potholes increases vehicle maintenance expenses through producing fragmented suspensions, misalignments, as well as reduced fuel efficiency (Huang, 2004). Traffic congestion rises when vehicles stop to navigate deteriorated roadways, resulting in delays in travel with more consumption of fuel (Chen et al., 2019).

On an economic level, businesses near Kalaburagi Railway Station incur greater logistical costs because of problems with supply chains, whereas limited accessibility prevents investment as well as economic development (Sclar, 2000). On an ecological level, decaying roads raise emission from ineffective drive and dust pollutants, negatively damaging air quality as well as public health (Dore & Zubeck, 2009).

Resolving road infrastructure challenges around Kalaburagi Railway Station and its surrounds necessitates better urban planning, stronger construction quality control, more frequent maintenance, with higher funding from the government. Sustainability roadway materials, improved water drainage, and adequate enforcement of significant vehicular weight rules can all help to prolong the lifespan of the road along with preserve future maintenance costs. By emphasizing road infrastructure enhancements, Kalaburagi may boost safety, transportation, as well as economic development, making the city more easily accessed and livable.

6. Encroachment on walkways

Encroachment by street vendors, parked vehicles, and unauthorized structures (Figure 19, Figure 20, Figure 21, and Figure 22) significantly reduces the effective width of walkways. This issue forces pedestrians onto the road, increasing the risk of collisions with vehicles and contributing to traffic congestion. Encroachment also disrupts pedestrian flow and compromises the usability of walkways, particularly during peak hours.



Figure 20. Walkway encroachment can lead to traffic congestion-2 (Source: Field study)

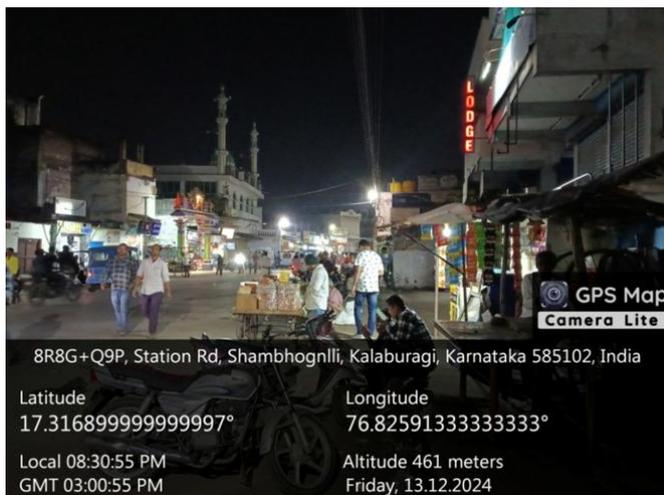


Figure 21. Walkway encroachment can lead to traffic congestion-3 (Source: Field study)



Figure 22. Walkway encroachment can lead to traffic congestion-4 (Source: Field study)

Encroachment on pathways is a common problem in Kalaburagi Railway Station as well as its surrounds, where pedestrian movement is hampered by unlawful parking, street

sellers, construction debris, as well as public utility installations. Walkways are critical to providing safe and accessible urban transportation, but poor urban design, lax enforcement of legislation, and fast urbanization have all led to their unauthorized usage (Bhowmik, 2005; Hasan & Alam, 2017). Street vendors occupy sidewalks near Kalaburagi Railway Station due to a lack of established commercial spaces, whereas motorcycles, auto-rickshaws, as well as cars are frequently parked on pedestrian paths, forcing people to commute on roads and increasing the likelihood of accidents (Gupta et al., 2016b; Singh & Mitra, 2020a). Furthermore, current infrastructure projects regularly block walkways with building materials, causing lengthy pedestrian discomfort (Patel & Shah, 2019a). Poorly designed utility poles, advertising boards, and unlawful company expansions all use additional walking space, aggravating congestion and lowering accessibility (Hasan & Alam, 2017).

The repercussions of the walkway encroach near Kalaburagi Railway Station are serious. Pedestrians, mainly women, children, elderly people, as well as the disabled, struggle to cross congested walkways, making urban areas less inclusive (Hasan & Alam, 2017). The enforced movement of pedestrians into roadways exacerbates traffic congestion as well as increases the danger of accidents, placing additional burden on the transportation system. The lack of pedestrian-friendly places discourages walking, resulting in sedentary lifestyles and greater exposure to automobile fumes, which raises respiratory health issues (Hasan & Alam, 2017). Furthermore, the visual congestion of encroached walkways detracts from Kalaburagi aesthetic appeal, limiting its potential for tourism and communicating poor urban governance (Hasan & Alam, 2017). The economic impact is also considerable, as businesses that depend upon pedestrian foot traffic see lower client satisfaction, while the expenses of accidents and sidewalk upkeep put a strain on municipal governments (Gupta et al., 2016b). To remedy this issue, Kalaburagi Railway Station should strictly enforce pedestrian space laws, define specific areas for marketplaces, and improve public parking services. In addition, urban planners should incorporate smart walkway designs, remove obstructive public utilities, as well as ensure effective construction management to avoid long-term pedestrian obstacles. By emphasizing walkway accessibility as well as pedestrian rights, Kalaburagi can promote urban mobility, increase safety, as well as foster a better livable city environment.

Effectiveness of enforcement measures for sidewalk encroachment at Kalaburagi Railway Station

1. The limitations of enforcement-based approaches: Fines, penalties, and eviction drives are frequent deterrents for sidewalk encroachment. Anecdotal data and preliminary surveys in Kalaburagi show that such interventions are inconsistently implemented and frequently have a short-term impact. Vendors usually return to the same sites once enforcement is lifted, which is consistent with broader findings in Indian cities that punitive measures alone do not address the core causes of encroachment (Bhowmik, 2012; Mahadevia & Vyas, 2012).

Furthermore, enforcement without approved vending zones or alternate sources of income disproportionately affects the urban poor, pushing informal workers into even more precarious situations. This has been witnessed in a number of Tier II Indian cities, where “clearing drives” frequently precede official visits but fail to provide long-term, sustainable solutions (Anjaria, 2006).

2. Structural and socio-economic drivers: The high pedestrian traffic near Kalaburagi Railway Station makes it an attractive location for vendors because of the access to potential customers. However, the lack of formalized hawking zones or vending infrastructure—such as demarcated vendor spaces, waste disposal facilities, or shelter—drives informal occupation of sidewalks.

In such cases, enforcement alone fails because it views encroachment as a law-and-order problem rather than a result of poor spatial planning and socioeconomic necessity (Batra & Mehra, 2008).

3. Alternative strategies for greater impact: Alternative solutions that have been successful in other Indian towns that could be implemented for Kalaburagi are as follows:

- (a) Designated vending zones: The street vendors act 2014 requires cities to identify and allocate vending zones through participatory processes. These zones should be located near high-traffic areas such as stations while still allowing for pedestrian movement (Ministry of Housing and Urban Affairs [MoHUA], 2019).

- (b) Urban design interventions: Incorporating inclusive design, such as “shared spaces” or broader sidewalks with designated vending bays, can lessen conflict between vendors and walkers (ITDP, 2018). This is consistent with notions of tactical urbanism and placemaking.

- (c) Vendor ID and management systems: Cities like Bhubaneswar and Ahmedabad have implemented computerized vendor registers and smart cards to govern vending while delivering perks like microcredit and insurance (WIEGO, 2020).

- (d) Community-based monitoring: Instead of top-down policing, organizing local vendor committees and street management groups (made up of merchants, vendors, and citizens) has shown it to be more sustainable and equitable.

4. Recommendations for Kalaburagi: A hybrid model of participatory planning, design-led regulation, and minimal enforcement may be more impactful. Specifically

- (a) conduct a micro-level mapping of vendors near Kalaburagi Railway Station,
- (b) identify safe vending zones within 100-150 m of the station,
- (c) incorporate vending zones into future street improvement proposals (e.g., through AMRUT or smart cities mission), and



Figure 24. Poor state of maintenance and cleanliness—(Source: Field study)

- (d) implement soft enforcement with incentives (clean vending practices and vendor ID cards) and penalties for non-cooperation or obstruction).

7. Poor maintenance and cleanliness

The lack of regular maintenance and cleanliness in the area creates an unappealing and unhealthy environment for pedestrians (Figure 23, Figure 24, Figure 25, Figure 26, and Figure 27). Accumulated garbage, broken infrastructure, and unkempt surroundings discourage walking and harm the area’s aesthetic appeal. Poor maintenance also signals neglect, reducing public confidence in the area’s safety and usability.

Poor public space upkeep and cleanliness are important concerns in Kalaburagi Railway Station along with nearby areas, where abandoned garbage, malfunctioning infrastructures and inadequate sanitation have a severe detrimental effect on inhabitants, commuters, as well as organizations. Public areas necessitate frequent maintenance to preserve hygiene, safety, including urban livability; yet inadequate sanitation, budgetary constraints, and poor governance have all led to the area’s degradation (Hoornweg & Bhada-Tata, 2012; UN-Habitat, 2016).

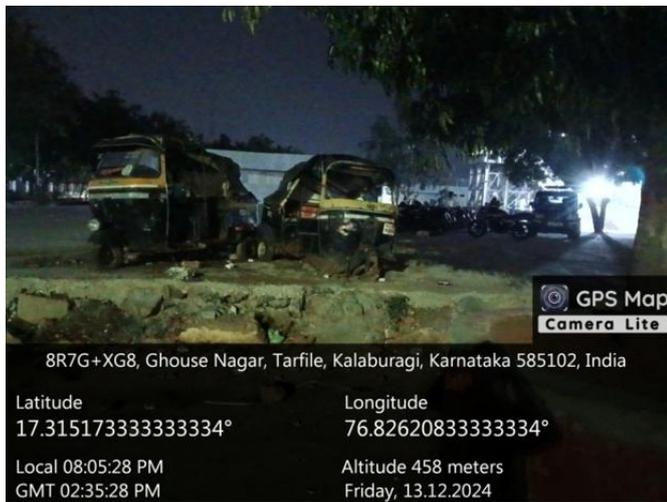


Figure 26. Poor state of maintenance and cleanliness-4 (Source: Field study)

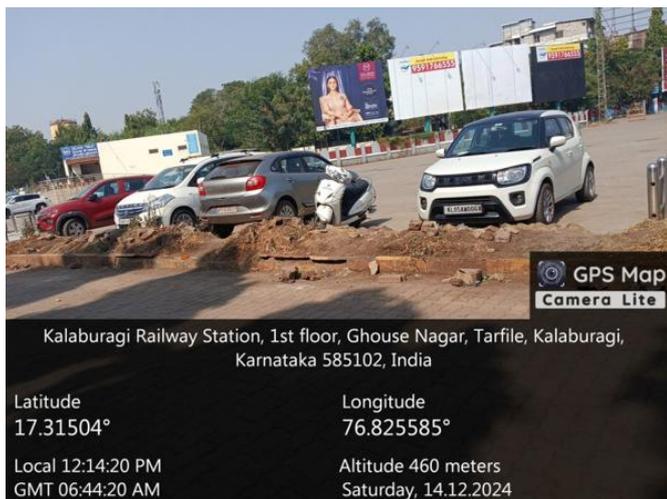


Figure 27. Poor state of maintenance and cleanliness-5 (Source: Field study)

In the vicinity of Kalaburagi Railway Station, garbage accumulates owing to sporadic collection of waste and a lack of garbage bins, generating unhealthy conditions, whereas wrecked sidewalks, pothole-ridden roads, as well as malfunctioning streetlights constitute potential hazards for pedestrians as well as motorists (Gupta et al., 2016b).

Furthermore, inadequate funding from the government and shortage of staff maintenance workers lead to delayed maintenance along with inadequate cleaning firms, thereby becoming worse infrastructure quality (Das & Tiwari, 2020). Insufficient civic participation with public knowledge also contribute towards the problem, since littering and sabotage continue because of a lack of accountability for the environment and inadequate implementation of cleanliness (Nanda et al., 2017). The repercussions of inadequate upkeep and cleanliness around Kalaburagi Railway Station are significant. Risks for health increase as collected garbage attracts flies and transmits diseases such as dengue as well as cholera, whereas poor sanitation causes increased pollution of the environment and water, which contributes to asthmatic and gastrointestinal problems (Hoornweg & Bhada-Tata, 2012).



Figure 28. The scarcity of toilets and urinals (Source: Field study)

The aesthetically pleasing and financial worth of the area are declining since filthy and poorly preserved infrastructure inhibits tourism, diminishes business tourists, as well as lowers property values (UN-Habitat, 2016). Traffic congestion as well as pedestrian security hazards rise as damaged roads and restricted sidewalks drive pedestrians across busy roadways, resulting in more collisions (Gupta et al., 2016). Moreover, the damage to the environment is accelerating, with plastic garbage blocking the drainage systems therefore enhancing the potential of urban flooding, whereas harmful pollutants intend ecosystems in the area (Hoornweg & Bhada-Tata, 2012).

Including particular waste management solutions and citing successful case studies can considerably improve the relevance and practical usefulness of urban sustainability debates. For example, India's Swachh Bharat mission (urban) emphasizes door-to-door garbage collection, source segregation, and decentralized waste processing. Indore has retained its position as India's cleanest city through programs such as 100% segregation, public-private partnerships, and community engagement in trash reduction (MoHUA, 2020). San Francisco has achieved over 80% landfill diversion as part of its Zero Waste by 2030 objective by implementing extensive waste diversion measures, including obligatory recycling and composting (SF Environment, 2021). These illustrations show that strong policy frameworks alone are insufficient for efficient waste management; ongoing implementation, community involvement, and infrastructure investment are all necessary.

To enhance the state of cleanliness and preservation of Kalaburagi Railway Station and the surrounding areas, government must improve the disposal of waste, increase

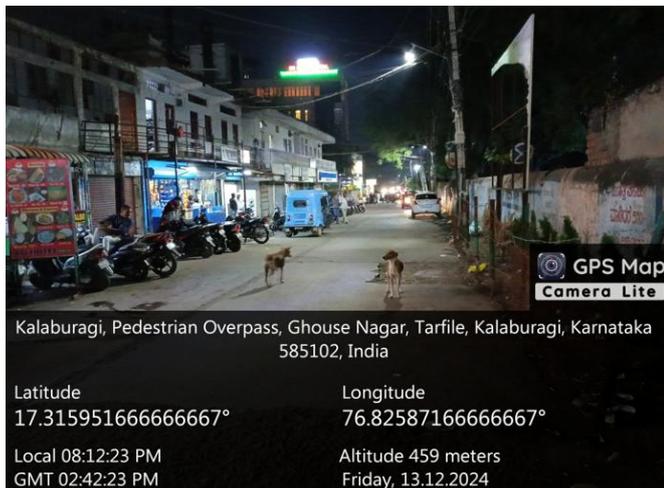


Figure 29. Absence of public lounges forces people to rest and sleep in unsafe and unsanitary conditions-1 (Source: Field study)



Figure 30. Absence of public lounges forces people to rest and sleep in unsafe and unsanitary conditions-2 (Source: Field study)



Figure 31. Absence of public lounges forces people to rest and sleep in unsafe and unsanitary conditions-3 (Source: Field study)

municipal funds towards infrastructure upkeep, as well as impose stronger restrictions to prevent pollution and vandalism. Enhanced involvement of communities, public education advertisements, and relationships between business and government players can all help to promote long-term urban cleanliness. Kalaburagi can promote public health, safety, along with overall urban livability by focusing on clean and well-maintained public spaces, resulting in an increasingly desirable and functioning environment for both inhabitants and visitors.

8. Inadequate amenities

The absence of sufficient public amenities, such as toilets, urinals, and rest areas, compromises the comfort and convenience of pedestrians (Figure 28, Figure 29, Figure 30, and Figure 31). The lack of public toilets forces individuals to use roadside walkways for such purposes, leading to unhygienic conditions. Similarly, the absence of public lounges or resting areas results in individuals using sidewalks as makeshift resting spaces, creating an unsafe and disorderly environment.

Insufficient public utilities have a substantial impact on urban accessibility, convenience, with safety, and the Kalaburagi Railway Station and neighboring regions are prime examples of these issues. To be usable, public places have to include clean water supplies, restrooms, areas to sit, lighting, and shelters; nevertheless poor urban design, limited finance, and weak administration have resulted in a serious absence of such amenities in this area (Mehta, 2014). Municipal budgets are limited, therefore major infrastructure projects takes precedence over important public facilities, resulting in decaying or lacking infrastructure (Das & Tiwari, 2020). Corruption and mismanagement impede effective application of funding, although insufficient policy enforcement permits infrastructural neglect to continue (Transparency International, 2019). Furthermore, rising urbanization as well as increased commuter footfall at Kalaburagi Railway Station placed an increase on existing utilities, making public areas cramped along with poorly administered (UN-Habitat, 2016). Vandalism and misuse of facilities, such as ruined seats and vandalized restrooms, exacerbate the scarcity and inadequate condition of public assets. The repercussions of inadequate amenities around Kalaburagi Railway Station are significant. The lack such seating areas, water distribution places, and shaded spots renders public spaces uncomfortable, particular to the elderly and disabled, that restrict accessibility (Mehta, 2014). An absence of maintained properly public restrooms leads to poor cleanliness, increasing the chance of illness and health threats, whilst a lack in drinking water compels commuters to survive on potentially hazardous alternatives (Das & Tiwari, 2020). Poor illumination, inadequate pedestrian crossings, and a shortage of places to stop all impede pedestrian mobility and safety, making travel challenging and raising crime risks (Gupta et al., 2016). Revenue generation diminishes primarily as a result of decreased foot traffic in regions which lack public amenities, which discourages tourists and local business (Nanda et al., 2017). The degradation of the environment intensifies, with litter and pollution on the rise as a result of a lack of waste bins as well as recycle stations, introducing to urban ruins (Hoornweg & Bhada-Tata, 2012).

The degradation of the environment intensifies, with litter and pollution on the rise as a result of a lack of waste bins as well as recycle stations, introducing to urban ruins (Hoornweg & Bhada-Tata, 2012). To cope with all of these problems, Kalaburagi Railway Station needs better urban design, more financing for public amenities, and more challenging implementation of policies. Authorities should focus on the development of sanitary facilities, proper lighting, drinking water places, as well as seating places, whereas community involvement programs should promote responsible usage as well as maintenance existing public infrastructure. Kalaburagi can improve public comfort, safety, and livability by investing in significant amenities, resulting in an improved friendly and sustainable community.

These factors collectively contribute to a poor walkability index, compromising the safety, accessibility, and overall experience of pedestrians in the area surrounding the station. Addressing these issues is crucial to creating a more pedestrian-friendly environment.

Study of Experimental Design

We require ratings for pedestrian amenities and the availability of footpaths in order to compute the walkability index. A survey is designed to collect feedback on the design and usage of the pedestrian facilities in the region. A city map, measuring instrument, or Google Maps can be used to determine the length of the main roads and walkways that surround a train station and the surrounding region.

A survey must be carried out in order to ascertain the pedestrian facility grade. The following elements are considered in the survey:

1. Height and width of the walkway
2. Smoothness and regularity of the walkway surface
3. Continuity of the walkway
4. Ramps connecting the walkway to the road
5. Lighting at night
6. Barriers like pipe railings or handrails separating traffic
7. Obstructions on the walkway
8. Maintenance and cleanliness
9. Raised crossings for continuous walking
10. Walkways are available on the correct side of the road
11. The walkway is located on the appropriate side of the carriageway
12. Connectivity
13. Zoning and way finding
14. Safety and security
15. Walkway characteristics

The Ministry of Urban Development (MOUD) method considered 15 factors. The height of the walkway and whether it is on the right side of the road are also included in this pedestrian survey form. For pedestrian facilities to be used effectively, these are essential. The aforementioned elements must be rated by pedestrians on a 5-point scale, with 1 denoting "not usable at all" and 5 denoting "very usable." They must rate as well as the importance of each factor on a scale of 0 to 100 to show how important it is for providing and using

the facility. Furthermore, details such as gender, age, the occupation, and yearly revenue from the household are helpful in gaining a deeper understanding of the user's viewpoints and experiences. A survey was conducted with 200 people, including 50 students (25 males and 25 females), 25 employees, and 25 non-employees. The average pedestrian facility rating was calculated based on their responses. The area's walkability index was then determined by utilizing this average rating in the formula.

While the study's use of the MOUD paradigm provides useful insights into walkability at Kalaburagi Junction, its breadth is limited to a single urban zone and does not reflect walkability patterns throughout the city. Furthermore, seasonal variability, potential sampling problems, and the absence of longitudinal data may all have an impact on the findings' general liability. Recognizing these limitations can help frame the findings more correctly and guide future study.

Limitations of the Study

While the study provides useful insights into the walkability conditions surrounding Kalaburagi Junction train station, certain limitations must be considered in order to interpret the findings.

1. **Geographic limitation:** The evaluation only considers the immediate area around one transit hub, which might not accurately reflect walkability conditions throughout the entire cityscape (Frank et al., 2010). Diverse pedestrian environments are frequently seen in urban settings, determined by infrastructure quality, socioeconomic variables, and land use.
2. **Temporal constraints:** Since seasonal fluctuations like monsoons or intense heat have a big impact on walkability and pedestrian comfort in Indian towns, it is possible that the data collection was done in a short amount of time (Singh et al., 2016).
3. **Sample size and representativeness:** The study's sample size and demographic diversity might not be enough to adequately represent the variety of pedestrian demands and experiences if it depended on user surveys or observational data (Saelens & Handy, 2008).
4. **Subjectivity of perceptions:** Even while the MOUD walkability index includes objective measurements, several of its components—like comfort and safety—involve subjective assessments that can differ from person to person (Leslie et al., 2007), which could introduce bias.
5. **Lack of longitudinal analysis:** The study's capacity to influence sustainable long-term planning is limited because it only examines a cross-sectional picture and does not evaluate how walkability evolves over time as a result of policy interventions or urban growth (Forsyth, 2015).

METHODOLOGY

To evaluate the walkability of Kalaburagi Railway Station and its surrounding areas, a **walkability index** will be

developed, incorporating key indicators related to pedestrian infrastructure and safety. This strategy will prioritize pedestrian comfort, safety, and access to necessary services through the use of a scoring system based on weighted criteria. To address the unique urban challenges in India, the MOUD developed the walkability index approach. As a government organization, the MOUD enhances housing, transportation, infrastructure, and governance to significantly influence urban development. In order to create pedestrian-friendly spaces, the walkability index method assesses key components like the availability of walkways, pedestrian facilities, security, and general comfort. The primary goal is to provide urban planners with a measurable framework to design walkable environments that promote walking, reduce traffic congestion, and improve public health and the overall quality of urban life. By focusing on these factors, the method supports the creation of sustainable and livable cities across India. It measures how easy it is to walk in an area by looking at the availability of footpaths and facilities for pedestrians.

$$Index\ of\ walkability = (W_1 \times \text{The\ presence\ of\ a\ walkway}) + (W_2 \times \text{The\ ratings\ of\ pedestrian\ facilities}), \tag{1}$$

where W_1 and W_2 stand for weights, both set for fifty percent. Here, W_1 and W_2 are weights, each given an equal value of 50%. **The presence of a walkway** is the length of the pathway/the entire length of the Kalaburagi Railway Station’s surrounding areas and **rating of pedestrian facilities** is a rating determined on how people perceive the standard of pedestrian amenities.

RESULTS AND DISCUSSION

In compliance with MOUD’s process in **Figure 32**, the GIS map was used to estimate the length of the roads in the vicinity of Kalaburagi Railway Station, and the result was 3,250 meters. A 30-meter tape was used to measure the walkway’s length.

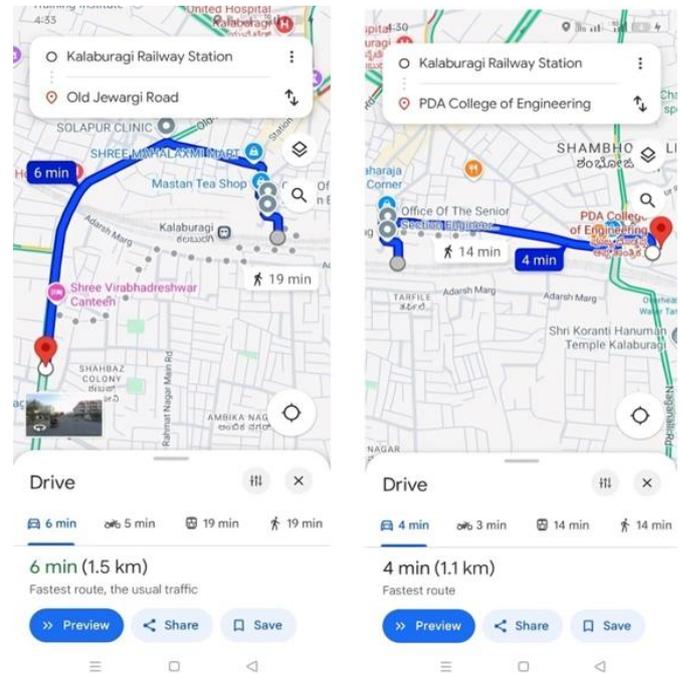


Figure 32. Length of roads in the surrounding parts of Kalaburagi Railway Station by GIS map (Source: GIS maps)

The result was 1,300 meters. On a scale of 1 to 5, pedestrians scored 15 variables based on their opinions.

Table 1 displays the average ratings of each of these groups that can be classified based upon pedestrian attributes. On a 5-point scale, the average rating for pedestrian facilities was 2.98. This must be divided into 5 in order to be converted to a 1-point scale.

Eq. (1) is then used to determine the walkability index.

$$W_1 = [(0.5 \times (650 / 3,250)) + (0.5 \times (2.98/5))] = 0.398.$$

Consequently, the MOUD technique yields a W_1 of 0.398 for the Kalaburagi Railway Station’s surrounding regions. Based on thorough user ratings, the walkability evaluation of the Kalaburagi Railway Station area offers important insights

Table 1. Average pedestrian ratings for each group based on a survey

No	Attribute	O	Average rating on a scale of 1 to 5							
			Gender		Student		Occupation		Age	
			F	M	G	B	BM	E	25+	25-
1	The height of the walkway is suitable.	3.01	2.34	3.36	2.90	3.40	2.56	3.50	2.67	3.40
2	The path is wide enough.	3.39	3.15	3.77	3.10	3.45	3.00	3.97	3.00	3.75
3	The surface is flat and smooth.	2.84	2.45	3.66	3.00	1.75	2.00	3.54	2.80	3.50
4	The walkway is uninterrupted.	3.73	3.32	3.76	4.50	3.70	3.45	3.83	3.50	3.78
5	Ramps are provided for connection to the carriageway.	2.42	2.33	2.90	2.10	2.50	2.10	2.60	2.20	2.60
6	Nighttime illumination is adequate.	2.39	2.16	2.45	2.10	2.40	1.95	2.80	2.40	2.90
7	A traffic separator, such as a pipe railing, is installed.	2.91	3.20	3.76	2.30	3.40	2.50	2.75	2.40	3.00
8	The entire width is unobstructed and fully accessible.	3.52	3.00	3.66	2.70	4.00	3.15	4.00	3.70	4.00
9	The walkways are well-maintained and regularly cleaned.	3.60	3.50	4.40	1.20	4.50	3.67	4.00	3.50	4.00
10	A raised continuous crossing is available.	2.01	1.50	2.33	1.60	2.00	1.66	2.00	2.00	3.00
11	The walkway is found on the carriageway’s proper side.	3.49	2.50	3.66	3.20	3.60	3.54	4.00	3.40	4.00
12	Connectivity	3.06	3.50	4.30	4.60	1.30	3.67	4.00	3.50	4.00
13	Zoning and way finding	2.27	2.40	2.17	2.40	2.50	1.70	2.60	2.10	2.30
14	Safety and security	2.67	3.57	2.20	3.10	1.90	2.20	3.55	1.40	3.50
15	Walkway characteristics	3.50	2.50	3.66	3.30	3.60	3.54	4.00	3.40	4.00
	Average	2.98	3.16	3.33	2.80	2.93	2.71	3.40	2.79	3.44
	Walkability index	0.389	0.416	0.34	0.38	0.39	0.32	0.44	0.379	0.449

Note. O: Overall; F: Female; M: Male; G: Girl; B: Boy; BM: Businessman; E: Employee; 25+: Above 25 years; & 25-: Below 25 years

about the condition of the local pedestrian infrastructure as of right now.

Scoring System

A weighted scoring system will be used to evaluate each indicator based on its importance in ensuring pedestrian comfort and safety. The weighted index will allow for a comprehensive evaluation of the walkability of Kalaburagi Railway Station's surrounding areas.

The evaluation examined 15 essential parameters, each rated on a scale from 1 to 5, where a score of 5 signifies excellence in meeting pedestrian needs and standards.

Criteria For Scoring

Every indicator will be assigned a number between 1 and 5, where

- (1) poor condition (severe problems or extremely limited availability),
- (2) fair condition (still usable despite some problems),
- (3) average state (acceptable, requires some work),
- (4) in good condition (satisfies expectations), and
- (5) outstanding state (above average and completely optimized).

These criteria were selected in order to thoroughly evaluate the walking atmosphere's convenience, safety, and quality. Crucial elements like sidewalks, surface condition, cleanliness, as well as the presence of basic amenities like seating lighting were all included in the analysis. Safety features like pedestrian crossings, signage, as well as barriers that protect pedestrians from cars were also considered in the evaluation. Along with components that enhance user comfort, like shaded walkways and visually appealing landscaping, accessibility features for people with disabilities, such as tactile paving and ramps, were evaluated. A wide range of strengths and weaknesses were revealed by the analysis. Although users gave moderate satisfaction ratings to certain aspects, such as walkway dimensions and basic safety features, other areas showed significant shortcomings. The absence of accessible facilities for people with disabilities, uneven or damaged sidewalks, and inadequate lighting were the main issues. These findings highlight how urgent infrastructure improvements are needed to make the area safer, more convenient, as well as pedestrian-friendly with all users. The information gathered can help urban planners as well as legislators prioritize upgrades encourage a more walkable, sustainable neighborhood surrounding Kalaburagi Railway Station. Important information about pedestrian infrastructure is highlighted by the user-rated walkability assessment of the Kalaburagi Railway Station area. 15 parameters were evaluated, and scores ranged from 1 to 5.

Based on user ratings, the walkability assessment around Kalaburagi Railway Station provides important information about the pedestrian infrastructure. With scores ranging from 1 to 5, where 5 denote the highest quality, the evaluation covered 15 parameters.

Demographic factors such gender, age, and occupations significantly shape individual perceptions of walkability, which, in turn, should influence how urban planners prioritize

pedestrian infrastructure interventions (Giles-Corti et al., 2016). In the context of Kalaburagi Railway Station—a high-footfall, mixed-use urban node—these perceptual differences are particularly relevant due to the diversity of its users, including daily commuters, vendors, students, elderly residents, and tourists.

Gendered experiences often reveal specific vulnerabilities in public spaces. Women, for instance, tend to value safety, adequate lighting, and surveillance more highly than men, due to a higher perceived risk of harassment (MoHUA, 2014). In Kalaburagi, the lack of well-lit and obstruction-free sidewalks near the station has been flagged by female respondents as a critical concern in local surveys, pointing to the need for gender-sensitive planning—such as integrating passive surveillance through active frontages and public visibility.

Age is another key determinant. Older adults are more likely to prioritize comfort, shaded walkways, availability of seating, and smoother pavement conditions (MoHUA, 2018). Conversely, younger individuals might tolerate infrastructural deficiencies more readily but prioritize faster, uninterrupted paths for daily commutes. In areas near the railway station, where elderly citizens navigate congested paths and risky crossings, prioritizing tactile paving, curb ramps, and resting zones could directly respond to their needs.

Occupational status influences walkability perception in terms of time sensitivity and route choice. For instance, street vendors may prioritize flexible, accessible public space to conduct business, while salaried workers seek uninterrupted and predictable walking routes. These conflicting interests imply the need for differentiated spatial strategies—such as designated vending areas that do not obstruct major pedestrian flows—especially in transit zones like the railway station (MoHUA, 2019).

By incorporating these demographic variations into walkability assessments and infrastructure prioritization, planning in Kalaburagi can move beyond a one-size-fits-all model toward a more inclusive, context-aware urban design approach. Participatory planning tools—such as gender audits, age-friendly city checklists, and occupation-based mobility surveys—can further institutionalize this demographic sensitivity in long-term infrastructure development (Sarkar et al., 2017).

The following are the main conclusions.

Strengths

1. **Walkway height (3.01):** According to this score, the walkways' height is generally appropriate, though there might be some variation or irregularities in some places. Overall, it shows that pedestrians can move around comfortably, though small adjustments could improve consistency.
2. **Walkway width (3.39):** The walkways' moderate score indicates that they are typically wide enough for pedestrian traffic. The walkways may feel small or crowded in places with a lot of pedestrian traffic, though, suggesting that they might need to be expanded to better handle bigger pedestrian crowds.

3. **Walkway continuity (3.73):** Maintaining pedestrian flow requires most walkways to be uninterrupted, which is indicated by a relatively high score. However, there might be some openings or impediments that make it less convenient for pedestrians.
4. **Unobstructed walkway access (3.52):** With this score, it is evident that most walkways are clear of obstacles, making mobility easier. Nevertheless, there might still be sporadic obstructions that could impede pedestrian traffic.
5. **Maintenance and cleaning (3.6):** The walkways are generally in good condition, as indicated by this score, which suggests that they are regularly cleaned and maintained. However, there might be infrequent cases of neglect, especially in places that are frequently visited or that are not regularly inspected.
6. **Walkway location (3.49):** According to this score, most walkways are placed in position on the right side of the road, allowing pedestrians to move more safely. Walkways may, however, occasionally be placed improperly or not sufficiently in line with pedestrian needs.
7. **Connectivity (3.06):** A moderate degree of connectivity between different pedestrian zones is indicated by this score. While some walkways are successfully connected to important locations, others might have connectivity gaps that make it difficult for pedestrians to reach crucial spots.
8. **Walkway characteristics (3.5):** In this category, a moderate rating indicates that the majority of walkways have respectable qualities, like sufficient width and necessary amenities. Nevertheless, there is room for improvement, such as adding seating areas or better landscaping.

Moderate Aspects

1. **Surface quality (2.84):** This rating suggests that there is a serious problem with the walkways' state. In some places, the surface might be uneven or poorly maintained, which puts pedestrians, especially those with mobility impairments at risk. Improvements are necessary to create level, smooth walkways for safer travel.
2. **Traffic separators (2.91):** Although traffic separators, like railings or barriers, are present in some places, this score suggests that they are either insufficient or not totally effective. These components are essential for protecting pedestrians from cars, and a more consistent installation could improve security.

Weaknesses

1. **Nighttime illumination (2.39):** This low rating suggests inadequate lighting, which can potentially harm nighttime pedestrian safety. An unsafe environment is exacerbated by inadequate lighting, especially for people who are walking after dark.
2. **Ramps for carriageway connection (2.42):** According to this score, ramps which are essential for accessibility are either nonexistent or insufficient. For people with

disabilities as well as those who use wheelchairs walkers, this poses a serious obstacle. To guarantee accessible transitions between as well as the carriageway walkway, significant upgrades are needed.

3. **Raised continuous crossing (2.01):** Raised crossings are either nonexistent or insufficient, based on the category's extremely low score. The absence of these crossings makes crossing streets more hazardous and challenging. They are crucial for pedestrian safety.
4. **Zoning and way finding (2.27):** A low score in this category indicates that finding and signage are insufficient, making it more difficult for pedestrians to navigate. Better zoning and signage would make it easier for pedestrians to find their way around and improve mobility.
5. **Safety and security (2.67):** Concerns about pedestrian security and safety are reflected in this score. Even though there may be some safety precautions in place, they don't seem to be enough or aren't properly implemented, which leaves pedestrians open to mishaps or criminal activity.

The findings indicate that while the Kalaburagi Railway Station area exhibits strengths in connectivity, walkway placement, and maintenance, several areas require urgent attention. The lack of raised crossings and ramps for seamless transitions across roadways significantly impacts pedestrian safety and accessibility, particularly for vulnerable users. The moderate scores in walkway width, lighting, and safety suggest inconsistencies in design and infrastructure across different sections of the area. Furthermore, the low scores for surface quality and traffic separators highlight potential safety hazards that could deter pedestrian activity.

Case Study

1. A case study on Mumbai's suburban railway station precincts, focusing on Church Gate, Dadar, and Andheri, evaluated pedestrian infrastructure and safety in high-density areas using GIS-based spatial analysis, field surveys, and pedestrian volume counts. Findings highlighted issues such as narrow sidewalks (< 1.5 m) obstructed by vendors, poorly maintained footpaths with potholes and encroachments, high pedestrian risk due to unregulated crossings and jaywalking, and unsafe walking conditions caused by heavy traffic congestion. While accessibility to public transport was strong, pedestrian connectivity needed improvement. In response, the Mumbai Metropolitan Region Development Authority introduced pedestrian skywalks and signalized zebra crossings, improving pedestrian safety and convenience by 20% (Patel & Shah, 2019b). These insights are highly relevant to Kalaburagi, where similar challenges—including narrow sidewalks that fail to accommodate high footfall, forcing pedestrians onto busy roads—create safety hazards and hinder mobility. The lack of regulated crossings and pedestrian signals further exacerbates the risk of accidents, particularly in areas with heavy vehicular traffic.

Table 2. Comparative analysis of case studies

No	Walkability factor	Mumbai	Chennai	Tokyo	London	Kalaburagi (expected challenges)
1	Sidewalk width & quality	Poor	Moderate	Excellent	Good	Narrow & discontinuous sidewalks
2	Surface maintenance	Poor	Moderate	Excellent	Good	Uneven & poorly maintained
3	Crossing safety	Poor	Poor	Excellent	Good	Limited pedestrian crossings
4	Traffic volume & speed	High	High	Moderate	Low	High-speed vehicles near station
5	Accessibility of key services	Good	Good	Excellent	Excellent	Moderate, but needs improvement
6	Pedestrian amenities	Low	Moderate	Excellent	Good	Limited shade & seating

Vendors and parked automobiles intrude on pedestrian space, making walking hazardous and cumbersome. To improve walkability, Kalaburagi might benefit from defined pedestrian zones, broader and well-maintained walkways, traffic calming measures, and adequately signalized crossings to enable safer pedestrian travel in densely populated regions.

2. A case study of Chennai Central Railway Station, one of India's largest railway hubs, investigated pedestrian movement patterns along with obstacles to walkability through walkability index computing, pedestrian surveys, as well as analysis of observations. The study showed that, while walkways around the station entrance remained well-maintained, neighboring streets had small and obstructed routes, making it challenging for pedestrians.

Crossing major highways was especially dangerous because of poorly timed pedestrian signals and the lack of grade-separated junctions, whereas high-speed transport on Poonamallee high road endangered pedestrian safety. Furthermore, a lack of sheltered paths and inadequate lighting hampered both convenience and safety, particularly at night. In response, the Chennai smart city initiative strengthened paths for pedestrians with tactile paving, upgraded crossings, and street furniture, resulting in a 30% increase in walking traffic and a decline in collisions among pedestrians (Krishnamurthy et al., 2021). The results presented are applicable to Kalaburagi, where similar challenges, such as unsafe road crossings and insufficient pedestrian infrastructure, show the significance of well-timed pedestrian signals, shaded pathways, and increased lighting for enhancing walkability and safety near Kalaburagi Railway Station.

3. The case study for Tokyo's Shinjuku Station, the globe's busiest railway station, investigated pedestrian traffic optimization utilizing smart urban design, including GPS-based pedestrian monitoring, walkability mapping, and urban design intervention. The study found that concentrated pedestrian infrastructure, such as skywalks, underground corridors, and multifaceted pathways, improve walkability and segregate pedestrian and automobile traffic. Furthermore, vehicle-free zones in key pedestrian areas ensured safer and more effective movement, whereas incorporated transportation hubs minimized walking distances to commuters, improving the availability of services. These strategic improvements led to a forty per cent decrease in pedestrian congestion as well as substantially improved connectivity in the station

neighborhoods (Suzuki & Nakamura, 2020). The successful implementation of these approaches provides significant insights for Kalaburagi, wherein a multi-level pedestrian system or designated pedestrian-only zones might enhance walkability around the railway station, increasing commuter safety and convenience.

4. The study from London's King's Cross Station explored initiatives to improve pedestrian mobility by means of station-area renovation employing walkability index scoring, GIS spatially visualization, including pedestrian traffic analysis. According to the study, changes in sidewalk quality and width, such as boosting pedestrian routes, have led to a significantly greater walking space.

Improvements in street design, such as decreasing vehicle lanes to promote pedestrian-friendly pathways, as well as traffic management techniques such as a low-speed zone (20 km/h) along with car-free streets, helped to increase walkability and safety. Furthermore, the implementation of mixed-use developments ensured all essential facilities were within walking distance, resulting in a greater accessibility as well as a pedestrian-friendly environment.

The reintegration work resulted in a fifty per cent spike in pedestrian traffic and a significant reduction in congestion near the station (Jones et al., 2019). The success of these initiatives applies to Kalaburagi, where identical traffic control measures and broader walkways could drastically enhance the pedestrian experience encompassing the railway station, encouraging a safer and better urban movement.

Comparative Analysis of Case Studies

Table 2 shows comparative analysis of case studies.

Recommended Solution for Kalaburagi Railway Station as Well as Its Surroundings

Insufficient nighttime illumination

Enhancing nighttime lighting at Kalaburagi Railway Station as well as its surroundings is crucial in improving security, safety, and accessibility, especially in areas with significant traffic. Smart and energy-saving lighting strategies, that include LED streetlamps and motion-sensor lighting structures, may preserve energy while providing enhanced and more consistent lighting, resulting in safety pedestrian and vehicular activity (Falchi et al., 2016). Strategic designs and planning for cities must emphasize the positioning of lighting within important locations to mitigate dark spots, especially close to pathways, transit stations, including parks, so

boosting evening accessibility (UN-Habitat, 2016). Substantial funding from the government and public-private agreements are needed for lighting infrastructure as well as maintenance, with cooperation with private firms that could promote the use of smart illuminating as well as solar-powered solutions (World Bank, 2018). Routine upkeep and surveillance systems serve as essential for keeping streetlights operational, with automated identification and reporting of damaged lights allowing for faster repairs (Smith et al., 2017). Routine upkeep and surveillance systems serve as essential for keeping streetlights operational, with automated identification and reporting of damaged lights allowing for faster repairs. Community involvement activities may reinforce such initiatives by urging citizens to express streetlight concerns, which leads to faster improvements and increased evening safety. Additionally, off-grid and renewable lighting options, such as solar-powered streetlamps, could provide constant illumination in areas vulnerable to frequent power outages, which are frequent around Kalaburagi Railway Station (Gupta et al., 2016). Urban sustainability can be increased by using hybrid energy sources, which combine solar and wind power to continuously illuminate isolated or off-grid locations. By attempting to put these suggestions into practice, Kalaburagi Railway Station might very well increase nighttime visibility, reduce the probability of crime, residents and visitors.

Inaccessible ramps

For people with disabilities, the elderly, and others with mobility impairments, safe and accessible mobility depends on improving access at Kalaburagi Railway Station and the surrounding areas. Compliance using universal design as well as accessibility standards, which include the ADA and ISO 21542, must be enforced to make sure that ramps have appropriate gradients (1:12 slope or less), sufficient width (minimum 36 inches), and slip-resistant surfaces, to make them more secure and simpler to use. Periodic upkeep and obstruction clearance should be prioritized, with regular checks to fix destroyed ramps and harsh fines for illegal development, such as illegal parking or booth setups, which are frequent near Kalaburagi Railway Station (Gupta et al., 2016).

A greater expenditure on accessible amenities is critical, with budgets set aside for both new building and retrofitting current facilities (Gupta et al., 2016). Promote public-private partnerships in order to construct accessible public areas and transit facilities. Furthermore, efforts to promote awareness that urban planning must be promoted to ensure that urban planners, architects, as well as policymakers are educated in accessibility principles, while efforts to educate citizens on the importance of maintaining ramps readily apparent and functional (Imrie & Luck, 2014). Sensor-based ramps that modify slope angles over better usability, as well as digital mapping systems that provide real-time accessible data, can help people with impairments move further easily. Implementing such measures at Kalaburagi Railway Station and its adjacent regions would considerably increase accessibility, resulting in an even more inclusive as well as pedestrian-friendly atmosphere for all passengers and locals.

Lack of pedestrian crossings

Resolving the pedestrian infrastructure difficulties at Kalaburagi Railway Station and its surrounding area will necessitate an integrated urban planning approach, infrastructure investment, as well as greater implementation of pedestrian-friendly rules. Cities should promote pedestrian-friendly designs to improve mobility and safety, including well-kept walkways as well as crossings in high-traffic areas (Transparency International, 2019). Increased investment in pedestrian infrastructure improvements would help to address numerous concerns associated with poor walkability (Litman, 2020). The development of pedestrian bridges as well as underpasses in high-traffic zones near Kalaburagi Railway Station would provide safe crossing choices, minimizing pedestrian-vehicle disputes and enhancing road safety (ITF, 2018; Pucher & Buehler, 2017). Furthermore, smart as well as signalized crossings with LED illumination and sensors can improve pedestrian accessibility, while optimal traffic signal timing assures safe passage for people (Gehl, 2011; Pucher & Buehler, 2017). Another critical task is to strengthen regulations and enforce them. Authorities should apply stronger fines for jaywalking and driver noncompliance, and traffic laws should require frequent pedestrian crossings in areas with high traffic (WHO, 2021). Public participation is also critical—community-led awareness initiatives can increase pedestrian and vehicle comprehension of road safety, while integrating local stakeholders in urban design ensures infrastructure fits actual user demands (Rosenbloom, 2004; UN-Habitat, 2021). Furthermore, increasing sustainable mobility options such as walking and cycling can help to reduce pollution, congestion, and accident hazards (Litman, 2020). Developing pedestrian-only zones surrounding Kalaburagi Railway Station could dramatically enhance safety and accessibility, resulting in an even more inclusive and successful urban environment (Gehl, 2011). Implementing such suggestions would make Kalaburagi Railway Station a safer, better-connected transit hub for visitors and locals alike.

Inadequate signage and way finding

Enhancing signage and way finding techniques at Kalaburagi Railway Station and nearby areas is critical for improving navigation, availability, and commuter comfort. Implementing universal design concepts, such as uniform fonts, colors, and symbols, can result in consistent and easily identifiable signage in multiple locations (Hara et al., 2013). Furthermore, accommodating various users by including Braille, audio cues, and tactile maps increases accessibility for those with disabilities, enabling navigation easier for all (Golledge, 1999). Digital as well as smart way finding technologies, such as interactive kiosks, mobile navigation apps, and augmented reality systems, can improve real-time guiding and mobility in complicated environments like Kalaburagi Railway Station (Arthur & Passini, 1992; Hara et al., 2013).

Routine inspections should be performed to replace damaged or out-of-date signs, and appropriate lighting should be supplied for optimal visibility at night or in low-light settings (Falchi et al., 2016; Golledge, 1999). Proper signage placement at critical points, such as junctions, exits, and

significant landmarks, can enhance navigation and reduce confusion, particularly for visitors and tourists (Passini, 1996). Information should be succinct and clutter-free, so that important directives are easily comprehended (Dingus et al., 1997). Finally, public education efforts and community involvement programs can teach users how to successfully interpret and comprehend signage, as well as assist authorities in identifying places where improvements are most required (Arthur & Passini, 1992; Golledge, 1999; Passini, 1996). By implementing these solutions, Kalaburagi Railway Station may significantly boost wayfinding efficiency, access, and general user experience, resulting in a more commuter-friendly transportation hub.

Poor road surface conditions

Enhancing the road surface at Kalaburagi Railway Station and its surrounds is critical to providing safer, smoother, better, more efficient traffic. Regular maintenance and timely repairs, such as crack sealing and resurfacing, can considerably increase road lifespan by preventing small flaws from progressing into big problems (Shahin, 2005). Governments have to provide adequate funding for routine inspections and prompt interventions, as ignoring early symptoms of degradation leads to higher long-term maintenance expenses (Sclar, 2000). Furthermore, using excellent components and building processes, such as improved asphalt and concrete combinations, improves road longevity and resistance to bad weather (Huang, 2004). Proper systems for drainage should be implemented in regions such as Kalaburagi Railway Station to minimize water collection and erosion, which lead to potholes as well as surface degradation (Chen et al., 2019).

By identifying early deterioration as well as prioritizing high-risk repair regions based on traffic patterns weather conditions, smart road tracking preventative care can increase the lifespan of infrastructure (Agarwal et al., 2017b; Chen et al., 2019). Additionally, to prevent exorbitant road wear from heavy trucks—a common issue in high-traffic train station areas—strong enforcement of load limitations and traffic control metrics is necessary (Papagiannakis & Masad, 2008). The most vulnerable sections of the road network can be less overwhelmed with the help of efficient traffic management and road-use planning strategies (Dore & Zubeck, 2009).

Road resilience can be increased while lowering environmental impact by implementing eco-friendly innovations and sustainable construction techniques, such as retrofitted parts like rubberized asphalt, highly permeable pavements, and regeneration materials (Chen et al., 2019; Huang, 2004). By attempting to put these suggestions into practice, Kalaburagi Railway Station may create a more resilient and sustainable road system, which would enhance connectivity, reduce maintenance expenses, and boost safety for all users of the road.

Encroachment on walkways

A multifaceted approach involving community involvement, urban planning, and strict enforcement is required to address sidewalk encroachment at Kalaburagi Railway Station and the surrounding area. Municipal authorities must enforce penalties against unauthorized encroachment, including fines and the removal of illegal

constructions, in order to maintain pedestrian routes' accessibility (Patel & Shah, 2019a). While expanding regulated parking facilities reduces the amount of illegal vehicle parking on sidewalks, establishing designated vending zones and granting licenses to unlicensed businesses can help street vendors operate without obstructing sidewalks (Bhowmik, 2005; Singh & Mitra, 2020b). By creating widening walkways with physical barriers such as bollards to restrict vehicle penetration, effective urban planning and infrastructure management may help prevent encroachment (Hasan & Alam, 2017). Retractable barricades are one example of a smart pedestrian facility that can help control walkway usage and keep walkways clear for pedestrians. Additionally, community engagement and public education campaigns can inform users to report about the importance of maintaining sidewalks free and inspire encroachments such that officials can act promptly (Gupta et al., 2016). Technology-driven solutions that automatically detect and punish encroachment offenses, such as Surveillance cameras and AI-powered surveillance, can enhance enforcement (Patel & Shah, 2019a). The enforcement process may be sped up by citizens reporting blocked routes to local authorities directly through mobile applications. Kalaburagi Railway Station may significantly improve pedestrian mobility, reduce traffic, as well as create a more organized accessible urban environment by implementing these solutions.

Feasibility of Implementing AI-Powered Surveillance and Smart Pedestrian Infrastructure in Kalaburagi

Introduction: Urban technology aspirations vs. ground realities

The global push for smart city solutions includes AI-powered surveillance, adaptive traffic lights, and sensor-driven pedestrian infrastructure. These tools have promise benefits, including real-time surveillance, data-driven enforcement, and pedestrian safety. However, their implementation in medium-sized Indian cities such as Kalaburagi must be carefully evaluated in terms of technological readiness, financial sustainability, and institutional capacity (Bhan et al., 2021; Datta, 2018).

Technological feasibility

AI-powered systems require a solid base of

- (1) high-speed internet infrastructure,**
- (2) integrated command centers,**
- (3) trained personnel, and**
- (4) reliable electricity.**

While Kalaburagi has received some digital enhancements through the smart cities mission, it still lacks extensive fiber optic networks, CCTV coverage along pedestrian corridors, and urban data integration systems—all of which are required for intelligent monitoring (MoHUA, 2022). Most footpaths and pedestrian crossings also lack fundamental features such as signage and tactile tiles, which are required before to adding “smart” components.

Financial constraints

The cost of implementing smart pedestrian systems is significant. For instance,

1. A 100-camera AI-based video analytics system costs between ₹3-5 crores (without maintenance).
2. Smart traffic signals and IoT-based pedestrian sensors have significant upfront and ongoing costs for data storage, repairs, and staffing.

Given the **budgetary limitations** of Kalaburagi City Corporation and the priority given to essentials (like water, sanitation, and roads), such systems may not be feasible without **state or private-sector support** (World Bank, 2020).

Socio-technical readiness

There are also human-centered challenges as follows:

1. **Low digital literacy** among local officials may hinder effective use.
2. **Lack of local AI expertise** in smaller cities makes maintenance reliant on external vendors.
3. Residents may **resist surveillance** due to privacy concerns or mistrust in authorities.

Hence, capacity-building programs are necessary before deploying smart tools at scale (Roy, 2020).

Phased or hybrid alternatives

Given the above constraints, a **phased approach** is more feasible as follows:

1. **Short term:** Invest in basic pedestrian infrastructure (footpaths, crossings, and signage) and mobile apps for community reporting.
2. **Medium term:** Introduce **smart CCTV at high-risk zones** (e.g., railway station, schools), integrated with existing traffic control centers.
3. **Long term:** Adopt AI analytics for traffic prediction, encroachment monitoring, and pedestrian flow mapping—once data and infrastructure maturity improve.

Case examples

1. **Indore and Bhopal**, also tier-II cities, piloted smart intersections with AI cameras in select corridors—funded by smart city programs.
2. **Surat** uses AI for traffic violations but still relies heavily on manual footpath management due to resource constraints (NIUA, 2021).

While AI-based surveillance and smart pedestrian technologies offer transformative potential, Kalaburagi **infrastructural, financial, and institutional gaps** make full-scale implementation challenging. A **phased, locally adapted** strategy—prioritizing foundational infrastructure and pilot projects—is both more **realistic** and **sustainable**.)

Poor maintenance and cleanliness

Bolstering maintenance as well as sanitation at Kalaburagi Railway Station requires a multi-faceted approach which includes better waste management, increased finance, innovative solutions, community involvement. Littering can be significantly decreased and sanitation can be improved with more waste management infrastructure, such as more garbage cans and improved collection schedules. Additionally, establishing composting facilities and recycling programs can

enhance environmentally friendly waste management (Hoornweg & Bhada-Tata, 2012). Improving urban maintenance services, like routine cleaning, efficient trash disposal, and infrastructure upkeep, requires more government funding and public-private collaborations (UN-Habitat, 2016). The efficacy as well as transparency of services can be increased by working with private companies on maintenance contracts (Transparency International, 2019).

Participation by the community is also important—public awareness campaigns as well as volunteer-led cleanup initiatives can promote proper waste disposal and increase local ownership of public places (Nanda et al., 2017). Sensor-based garbage cans and AI-driven cleaning schedules are examples of technological innovations that can optimize waste collection and allow continuous tracking of maintenance needs (Gupta et al., 2016). Additionally, drones and GPS tracking can be used to quickly identify sanitation issues, allowing for speedier reaction times. Enforcing stronger regulations and punishments for littering, vandalism, as well as unlawful dumping can dissuade irresponsible behavior while also improving public cleanliness (Das & Tiwari, 2020). Furthermore, increasing accountability in local government helps prevent corruption and promote timely infrastructure upkeep (Transparency International, 2019). Implementing these steps will considerably improve Kalaburagi Railway Station's cleanliness, public health, as well as urban aesthetics, resulting in a more sustainable and living environment for passengers and locals.

Kalaburagi Railway Station Walkability Improvement

To improve walkability around Kalaburagi Railway Station, a staged approach involving both short- and medium-term evaluations is necessary. Over the short term (1-3 years), one of the top priorities ought to be expanding sidewalks to satisfy Indian highways congress (IRC) pedestrian requirements, ensuring adequate space for heaviest footfall, along with limiting pedestrian overflow into highways. Installing pedestrian lights at important intersections would increase crossing safety by limiting pedestrian traffic as well as decreasing yelling threats. Further, frequent sidewalk care, namely leveling to remove potholes and encroachments, would improve pedestrian comfort along with accessibility.

To improve safety and encourage non-motorized transportation in the short to medium term (3-5 years), traffic-calming techniques such as speed limits in high-traffic areas and specially designated pedestrian zones should be implemented. Improving street amenities, such as covered paths, enough lighting, and places to sit will considerably increase pedestrian comfort, specifically for individuals with disabilities like elderly people and kids.

Brightly illuminated pathways would improve nighttime safety, whereas covered walkways will offer comfort during adverse conditions, offering walking a more realistic and attractive option. Implementing these procedures in a systematic manner will assist Kalaburagi Railway Station become a more pedestrian-friendly and accessible transit hub.

Influence of Community Engagement and Public Education on Pedestrian Behavior and Encroachment Reporting in Kalaburagi

The rationale for community-based approaches

In cities like Kalaburagi—where formal enforcement is often weak, and informal economies dominate— Misuse of shared urban space (Joshi & Moore, 2004; UN-Habitat, 2013). The effectiveness of pedestrian infrastructure is strongly dependent on public collaboration. Community participation and awareness programs are viewed as critical strategies for increasing ownership, changing behavior, and lowering it.

Public education activities have been successful in increasing civic participation and behavioral change, particularly in urban sanitation and traffic safety. These programs educate people on pedestrian rights, the dangers of encroachment, and how to report violations or unsafe conditions (World Bank, 2017).

Pedestrian behavior and socio-economic factors

In Kalaburagi, pedestrian behavior is driven by practical restrictions such as poverty, a lack of options, and a lack of understanding about rights and civic channels. For example,

1. Pedestrians are often compelled to walk on roads due to occupied sidewalks.
2. Lack of faith in institutions discourages reporting encroachments.
3. Many people may not have access to traditional awareness venues, such as newspapers and digital portals.

Thus, specialized and inclusive outreach tactics are required. This involves utilizing local languages, visual media (e.g., street dramas, murals), and peer educators from the community (Desai & Mahadevia, 2018).

Global and national examples of effective engagement

1. **Surat, India implemented ward-level awareness campaigns to promote garbage segregation, demonstrating that consistent messaging at the local level fosters accountability (Vyas & Bapat, 2019).**
2. In Bogotá, Colombia, public campaigns using signage, citizen engagement, and humor successfully reduced jaywalking and encroachment (Montezuma, 2005).
3. **Bangalore's tender SURE** The initiative utilized public outreach and street displays to increase support for pedestrian-friendly street design and lessen public opposition to roadwork disruptions (ITDP, 2018).

Strategies for Kalaburagi: Recommendations

To maximize the benefits of community engagement in influencing pedestrian behavior and incursion reporting, the following measures can be implemented:

1. **Neighborhood engagement programs:** Create local street user groups (vendors, pedestrians, and RWAs) to jointly monitor and manage public space. This promotes shared accountability.

2. **Civic education campaigns:** Use visible roadway signage, school-based modules, and short videos in Kannada and Urdu to teach about pedestrian safety and encroaching hazards..
3. **Mobile reporting tools:** Create simple, multilingual platforms or help lines for reporting sidewalk encroachments, potentially in partnership with the Kalaburagi City Municipal Corporation.
4. **Partnerships with local NGOs/youth clubs:** Community-based organizations can serve as intermediates in building trust and raising awareness, particularly in low-income neighborhoods.

Constraints and considerations

1. In some locations, limited digital literacy and mobile availability may limit the use of technology solutions.
2. Ensuring transparency can reduce public distrust of authority and promote engagement.
3. Continuous engagement is more beneficial than one-time participation.

Recommendations for Improvement

1. **Improved lighting:** Use energy-efficient LED streetlights and promise uniform illumination along pathways, crossroads, and high-traffic areas for enhanced nighttime safety.
2. **Accessibility improvements:** Build ramps across all carriageway links and comply with universal standards of design for all users.
3. **Pedestrian crossings:** To ensure safe street crossings, design and install prominent pedestrian crossings using traffic signals or zebra stripes in important locations.
4. **Enhanced signage:** Place clear and visible signage and navigation systems in important locations to help people navigate and prevent uncertainty.
5. **Road surface maintenance:** Correct unequal walkways, fix potholes, and adhere to periodic maintenance plans to offer smooth and safe pedestrian paths.
6. **Encroachment control:** Implement tight regulations including enforcement actions to prevent improper encroaching on walkways, thereby safeguarding pedestrian space.
7. **Preservation and cleanliness:** Develop a comprehensive maintenance and cleaning strategy, including waste disposal methods, to maintain the location neat and attractive.
8. **Amenities:** Provide enough public restrooms, urinals, and rest places to improve pedestrian comfort and hygiene.

Table 3. Stakeholder policy matrix: Sidewalk usage and encroachment management

Stakeholder	Primary interests	Concerns	Policy needs
Street vendors	- Livelihood security - High foot traffic - Legal recognition	- Eviction threats - Relocation to low-traffic zones - Harassment	- Designated vending zones - Flexible licensing - Access to TVCs
Pedestrians	- Unobstructed walking - Safety from traffic - Accessible footpaths	- Forced onto carriageways - Obstructions from vendors and vehicles	- Continuous sidewalks - Clear pedestrian zones - Raised crossings & traffic calming
Municipal authorities	- Orderly use of public space - Compliance with planning norms - Revenue	- Legal ambiguity - Limited enforcement staff - Political pressure	- Vendor databases - Community policing - Infrastructure for vending and walking
Local businesses	- Accessibility for customers - Street aesthetics	- Encroachment reducing visibility - Competition from vendors	- Coordinated street management - Vendor caps based on capacity
Urban planners/NGOs	- Inclusive street design - Participatory governance	- Conflicts between users - Implementation gaps	- Pedestrian-vendor inclusive master plans - Public education campaigns

Challenges in Inclusive Urban Governance

Introduction: Competing claims to urban space

Urban sidewalks in Indian cities like Kalaburagi are contested terrains where street vendors, pedestrians, and municipal authorities negotiate access and rights. The challenge lies in balancing livelihood rights, mobility needs, and legal mandates for urban order. The street vendors (protection of livelihood and regulation of street vending) act 2014 attempts to mediate this, but on-ground implementation often falls short (Bhowmik, 2012), as represented in **Table 3**.

Key challenges in balancing interests

1. Spatial conflicts and scarcity
 - a. Kalaburagi dense commercial areas, such as near the railway station, Super Market, and Nehru Gunj, experience high pedestrian volumes and hawker concentration.
 - b. Footpaths often serve multiple informal functions—selling, resting, storage—reducing usable space for pedestrians.
 - c. Limited right-of-way makes physical demarcation of vending zones difficult without displacing either users (Bandyopadhyay, 2016).
2. Legal and institutional ambiguity
 - a. Although the 2014 act provides legal protection to vendors, municipal laws and master plans often label them as encroachers.
 - b. Town vending committees (TVCs), meant to mediate interests, are either non-functional or dominated by bureaucratic actors, sidelining vendor voices (Sinha, 2021).
 - c. Pedestrian rights are less institutionalized, leading to ad hoc enforcement that can be anti-poor.
3. Enforcement bias and marginalization
 - a. Authorities tend to favor “beautification” and “traffic decongestion” narratives that push for eviction.
 - b. Enforcement measures like fines and confiscation disproportionately impact poor vendors, often without providing viable relocation options (Doshi, 2013).
- c. Pedestrians too may suffer, as vendor removal without pedestrian upgrades simply opens space to vehicular encroachment.
4. Socio-political patronage
 - a. Vending spots in Kalaburagi, as in many Indian cities, are often linked to political patronage, making regulation a politically sensitive issue.
 - b. Vendors may pay “informal rent” to local authorities or middlemen, complicating legal recognition and zoning efforts (Anjaria, 2006).
5. Resistance to formalization
 - a. Vendors may resist designated vending zones if they’re located away from foot traffic or economic hubs.
 - b. Formalization (e.g., through fixed kiosks) may increase operating costs, reduce flexibility, and erode the adaptive, mobile nature of informal vending (Anjaria, 2006).

Balancing mechanisms and good practices

To address these tensions, planning must adopt inclusive, adaptive, and negotiated frameworks, such as

1. Participatory mapping of vending and pedestrian zones involving both groups.
2. Flexible vending hours or rotational vending rights to allow time-based usage of shared spaces.
3. Co-creation of vending zones with pedestrian-friendly design (e.g., shaded, setback stalls, clearly marked walkways).
4. Capacity-building for TVCs and support for vendors in accessing identity cards, licenses, and grievance redressed mechanisms.

In cities like Kalaburagi, creating pedestrian-friendly environments while safeguarding vendor livelihoods requires nuanced spatial planning, legal clarity, and collaborative governance. The goal is not zero encroachment, but managed coexistence of different urban users through context-sensitive design and participatory regulation.

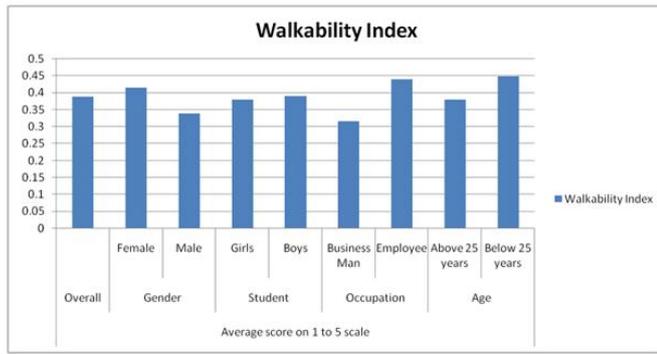


Figure 33. Graph of walkability index surrounding parts of Kalaburagi Railway Station (Source: Authors' own elaboration)

Policy Framework For Balanced Urban Sidewalk Governance

Spatial design interventions

1. Shared space planning: Include marked vending bays with buffer zones between pedestrian lanes and stalls.
2. Time-sharing: Allow vending only during non-peak hours or on specific days (e.g., Sunday markets).
3. Mobile/modular kiosks: Semi-permanent vending structures that can be folded or removed when necessary.

Legal and institutional reforms

1. Strengthening TVCs with equal representation from vendors, pedestrians, and planners.
2. Issue vending licenses linked to GPS-based location IDs to avoid unauthorized movement.
3. Update local bylaws to align with the street vendors act 2014 and IRC pedestrian norms.

Community engagement and tech integration

1. Digital reporting platforms for citizens to flag obstructions (e.g., QR code posters).
2. AI surveillance pilots at high-traffic nodes (e.g., Railway Station and Super Market) for crowd/space analysis.
3. Conduct local awareness drives with street theatre, wall murals, and workshops to promote pedestrian rights and vendor dignity.

Monitoring and evaluation

1. Develop walkability and encroachment scorecards for key zones.
2. Conduct periodic space audits with drone imagery or mobile apps.
3. Encourage third-party evaluations by academic institutions or planning students)

CONCLUSIONS

The walkability index of Kalaburagi Railway Station and its surrounding areas in Karnataka, India, was found to be 0.389,

which falls into the unsatisfactory category, indicating a significant need for improvement. A low walkability index suggests that the pedestrian infrastructure is inadequate, making walking inconvenient and unsafe. Enhancing walkability is crucial as better pedestrian conditions can encourage more people to walk instead of driving, thereby reducing traffic congestion, accidents, noise and air pollution, and associated health risks. The walkability graph in **Figure 33** further highlights disparities in walking convenience across different demographic groups. While individuals below 25 years of age, employees, and females find walking somewhat manageable, males and businessmen perceive walking as highly inconvenient, likely due to safety concerns, poorly maintained pedestrian infrastructure, or the absence of dedicated walkways.

Key issues affecting walkability in the area include the lack of traffic separators, which results in conflicts between pedestrians and vehicles, and increasing accident risks. Additionally, the absence of pedestrian-friendly crossings forces people to jaywalk, further compromising safety. Footpaths are either unavailable or poorly maintained, with encroachments, uneven surfaces, and potholes making them difficult to use. The absence of smooth walkways and proper ramps connecting roads also makes it challenging for individuals with mobility impairment to navigate the area. Addressing these issues by implementing well-maintained sidewalks, installing pedestrian crossings with traffic signals, creating traffic-separated pedestrian zones, and ensuring smooth, obstacle-free pathways can significantly enhance walkability. By making these improvements, Kalaburagi Railway Station and its surroundings can become more pedestrian-friendly, fostering a safer and more accessible urban environment.

Concluding Remark on Urban Planning Implications

The short-, medium-, and long-term infrastructure proposals for Kalaburagi, which include footpath construction, improvements to non-motorized transportation (NMT) facilities, improved road signage, and hawker encroachment management, present a comprehensive and phased approach to improving urban walkability. These measures are consistent with the fundamental objectives of the national urban transport policy (NUTP), which promotes sustainable mobility solutions that prioritize pedestrians and bikes over motorized vehicles (MoHUA, 2014).

The short-, medium-, and long-term infrastructure proposals for Kalaburagi, which include footpath construction, improvements to NMT facilities, improved road signage, and hawker encroachment management, present a comprehensive and phased approach to improving urban walkability. These measures are consistent with the fundamental objectives of the NUTP, which promotes sustainable mobility solutions that prioritize pedestrians and bikes over motorized vehicles (MoHUA, 2014).

Furthermore, the use of road markings and uniform signage reflects the need to encourage traffic discipline and user safety, especially among vulnerable road users such as schoolchildren and the elderly. Such criteria are aligned with national norms, such as the IRC regulations (MoHUA, 2014).

The research also acknowledges the difficult issue of vendor and hawkers encroachment, advocating measures consistent with the street vendors (protection of livelihood and regulation of street vending) act of 2014. This strategy tries to strike a compromise between informal workers' rights and pedestrians' mobility demands (MoHUA, 2019).

Finally, the staged proposals provide a reproducible and saleable framework for urban development in India's secondary cities. These initiatives emphasize the need for context-sensitive and evidence-based urban design by incorporating.

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