

THE IMPACT OF RAILWAY STATION INTERIORS ON USER USABILITY CASE STUDY OF COLOMBO RAILWAY STATIONS

ABEYSEKARA W.A.V.S.^{1*} & SAMARASINGHE A.M.²

¹National Innovation Centre - NIBM, Colombo, Sri Lanka.

²University of Moratuwa, Moratuwa, Sri Lanka.

¹write2vishmini@gmail.com, ²ajanisamarasinghe@gmail.com

Abstract: This research investigates the usability of railway station interiors in Colombo, specifically focusing on Colombo Fort, Maradana, and Slave Island. Using the System Usability Scale (SUS) and questionnaires, the study assesses the impact of main four areas in a railway station (core area, peripheral area, transition area and administrative area) on both passengers and staff. The methodology involves distributing detailed questionnaires to gather insights on layout design, lighting, furniture, accessibility, and maintenance. The findings reveal significant usability issues, with poor scores indicating a need for modernization. The results highlight that both passengers and staff experience considerable challenges in these areas, underscoring the necessity for improvements to enhance overall usability and operational efficiency.

Keywords: "Usability", "Interior of Railway Station", "Sri Lankan Railways", "Railway users"

1. Introduction

Railways were first developed in Britain in the 1630s and quickly spread, becoming a significant mode of public transport globally, including in British colonies (Binney, 1995; Powell, 1994). The Ceylon Railway Company was established in 1845 to construct a railway line from Colombo to Kandy. Trains were initially used to transport coffee, and later tea, from factories to Colombo and major harbours. The railroad also became an affordable mode of transport for the locals (Nayak, 2009). Today, Sri Lanka Railways operates as a government department under the Ministry of Transport & Civil Aviation (MOTCA). It manages around 1,500 kilometres of rail tracks, maintains approximately 180 locomotives of 21 different types, 800 passenger coaches, 1,500 freight wagons, and a signalling network (the Project Management Unit of SLR, 2018). Sri Lanka Railway Department (SLRD); which is the major transport organization in Sri Lanka, provides transportation for about 0.29 million passengers daily (Ferdinandes et al., 2015). In 2017, Sri Lanka Railways operated around 126,900 trains over 11.2 million train-kilometres, transporting approximately 138.7 million passengers over 7.5 billion passenger-kilometres, which accounted for 95.5% of SLR's train-kilometres. Railway transport is the most affordable mode of intercity travel, with 66% of intercity journeys starting or ending at Colombo Fort station (Railway Efficiency Improvement Project (RRP SRI 49111-005), n.d.).

This research on the impact of railway interiors in Sri Lanka on customer usability, particularly concerning main four areas in a railway station-core area, peripheral area, transition area, and administrative area (Kandee, n.d.) The design and functionality of these spaces can significantly affect user satisfaction, efficiency, and accessibility, thus influencing users' perceptions of the railway system. Investigating factors such as layout, signage, seating arrangements, ticketing processes, and amenities within these areas can provide valuable insights into how to enhance usability and improve the overall quality of rail travel in Sri Lanka. The case study of this research is mainly focused of the main railway line of Sri Lanka. The specific places are Colombo Fort railway station, Maradana railway station and Slave Island railway station. The usability of railway station interiors in Sri Lanka is essential for improving passenger and staff experiences, transportation efficiency, and overall societal well-being. However, several challenges and limitations may arise, including data collection difficulties during peak hours, bureaucratic processes within government departments, resource constraints, potential sample biases, and the dynamic nature of railway stations. In the next chapter, it will delve into a comprehensive literature review to explore existing studies, frameworks, and best practices related to railway station usability. This literature review will provide a solid foundation for the research by examining prior work in this field and identifying gaps that this study aims to address.

2. Literature Review

In 1864 December 27, a special train for the Duke of Brabant travelled from Colombo to Ambepussa. Although this journey is often referred to as the 'First Train,' public services to Ambepussa did not begin until October 2, 1865. This date is officially

*Corresponding author: Tel: +94767798206 Email Address: write2vishmini@gmail.com

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recorded in the Way and Works Book as the day the line was 'opened for traffic.' Initially, the line in Colombo started from a station called Colombo Terminus, located opposite the current Maradana Technical College, where the National Railway Museum is now situated (Nayak, 2009). Sri Lanka has 338 railway stations, 175 of which are major ones. Colombo Fort Railway Station serves as the central hub of the railway system and the main transit point. Additionally, the main control centre is located at Maradana Railway Station (De Silva & Manel, 2023).



Figure 1 & 2 – Colombo Terminus railway station in 1867 (Source: (Faviell, n.d.)

Colombo currently has two main railway stations: Colombo Fort and Maradana. Both were constructed during the middle stages of railway development and are not the original termini of the Main or Coast Lines. Historically, there have been two previous stations named Fort, and the current Maradana station is also not the first at or near its location. The area where Colombo Fort Station and D.R. Wijewardena Mawatha (formerly McCallum Road) now stand did not exist back then, as it had not been reclaimed from Beira Lake. The original Fort station, built in 1877, was located almost exactly where the present Secretariat Halt is situated. This station featured a single platform without a passing loop (Hyatt, 2021). A station called "Maradana" first appeared in passenger returns in the Administration Reports immediately after the Coast Line was constructed in 1877. It seems that the early "Maradana" on the Coast Line was a platform almost adjacent to Terminus (the first railway station in Colombo), effectively serving as a detached through platform at Terminus. Given this, there is a building later known as the Outward Goods Shed that is a strong candidate for being the original Maradana station. By 1889, there was definitely a station at the present Maradana site. It was reported that Maradana Junction was a "tiny, temporary, wooden station" with three lines, two of which served a single island platform. A "new" Maradana station opened on June 12, 1893, likely referring to improvements in access and buildings proposed in 1889. This station featured a roof over two lines of rails and platforms, while a third platform outside the roof existed when the station was rebuilt in 1906 (Hyatt, 2021). Situated in a commercial hub, Slave Island Railway Station, also known as Kompanna Vidiya Railway Station, is a prominent emblem of British heritage. Originally part of the coastline rail track extending from Fort to Moratuwa in the 1870s, which was later extended to Matara, the station was strategically built through Slave Island instead of crossing Galle Face, as per public requests. Constructed on a more elaborate scale than its predecessors at Colpetty and Wellawatte, Slave Island Railway Station is renowned for its architectural significance. It showcases Victorian artistry through its stylish arches, intricate woodwork, neo-modern metal installations, and the distinctive blend of iron and stone. As one of the oldest remnants of British influence, the station holds considerable historical and aesthetic value (Jayawardene, 2010).

2.1. USABILITY IN RAILWAY STATION

Usability refers to how easily and effectively people can use a system or tool to achieve their goals with satisfaction (Tucker, 2002). Most people use railway stations as essential hubs for their daily commutes and travel, making these spaces crucial to public transportation networks. Improving passenger facilities at these railway stations has been recognized as a long-standing priority. This effort aims to better accommodate passengers and address the challenges they face using the current facilities, which are in poor condition due to inadequate management and maintenance. Many of these facilities were constructed during colonial times and have not been updated to meet current needs (the Project Management Unit of SLR, 2018).

A strong relationship between railway stations and their communities fosters commercial opportunities and stimulates economic growth. There are Functional Standards of Four Main Areas in a Railway Stations (Kandee, n.d.). The Core Area is the central hub where passengers and staff engage in activities such as departing and arriving, with essential services concentrated here. The Peripheral Area includes platforms and tracks, supporting departing, arriving, and operational tasks for both passengers and staff. The Transition Area connects different sections of the station, housing public facilities like washrooms, shops, and restaurants, catering to passenger comfort and convenience. Lastly, the Administrative Area is a restricted space for station management, focusing on operations, security, and staff coordination, with features like offices and control rooms. More details of these four areas in a railway station is shown in the table.

Table 1: Functional Standards of Four Main Areas in Railway Stations (Source: Kandee, n.d.).

Area	Activities	Area Requirements	Users
Core Area	<p>Departing</p> <ul style="list-style-type: none"> • Checking train schedule. • Ticketing • Baggage handling • Fare Collection • Gate check-in • Waiting <p>Arriving</p> <ul style="list-style-type: none"> • Meeting and greeting. • Reclaiming baggage 	<p>Main Hall</p> <ul style="list-style-type: none"> • Information • Ticket office • Ticket machine • Ticket counters <p>Departure Hall</p> <ul style="list-style-type: none"> • Automated fare collectors or staff <p>Arriving Hall</p> <ul style="list-style-type: none"> • Meeting point or seating. • Baggage reclaims. 	<p>-Passengers & guests -Railway Staff</p> <p>-Railway Staff</p> <p>-Passengers & greeters. -Railway Staff</p>
Transition Area	<p>Departing, Arriving, Working & Visiting</p> <ul style="list-style-type: none"> • Using public facilities. • Walking to vehicles or waiting around before boarding • Shopping or eating 	<p>Connecting Area or Main Circulation</p> <ul style="list-style-type: none"> • Public service facilities, restrooms, Public lockers etc. • Amenities, shops, restaurants and snack bars. 	<p>-All users: Passengers and their guest, Railway staff, and visitors.</p>
Peripheral Area	<p>Departing, Arriving, Working</p> <ul style="list-style-type: none"> • Boarding • Loading and un-loading • Maintenance 	<ul style="list-style-type: none"> • Platforms. • Tracks. • Workshops or vehicle service areas • Traffic signal 	<p>-Passengers -Railway Staff</p>
Administrative Area	<p>Working & controlling Traffic System</p> <ul style="list-style-type: none"> • Working. • Controlling traffic systems and functions in the stations. 	<ul style="list-style-type: none"> • Management office. • Traffic controlling office. 	<p>-Passengers -Railway Staff</p>

2.2. INTERIOR OF RAILWAY STATIONS

A well-designed railway station facilitates smooth passenger flow from entrances to waiting rooms to platforms by using clear signage and well-designed timetables, ticket vending machines, and notice boards. Lighting is also a crucial function. In large stations, the architectural and structural design plays a vital role in lighting, with the best solutions utilizing natural light through glass in the roof and walls (Kido, 2006). Light is essential for a station to fulfil its function. Daylight is preferable during the day, so incorporating glazing enhances the penetration of natural light into the station. Artificial lighting is also important as it can enhance the station's visual appeal. Effective lighting relies on a mix of lighting levels and types of fixtures (Ewa Maria KIDO, n.d.). Equipment and furniture for users in railway stations are crucial for both efficient railway operations and passenger comfort. Station facilities include ticket offices, separate waiting areas, short-term waiting areas, refreshment points, stores, shops, and other supplementary commercial activities (Havlena et al., 2014).

2.2.1. Core Area and Peripheral Area

Both core area and peripheral are for arriving and departing in a railway station. The core area handles ticketing and information services with ticket counters and information desks, while the peripheral area focuses on platform access for boarding and disembarking. The ticket counter in a railway station is vital for providing passengers with ticketing services, travel information, and assistance, ensuring a smooth and efficient travel experience. If railways were considered 'Britain's gift to the world', then Edmondson's ticket system was nearly as universally adopted. As a skilled cabinet maker, Edmondson produced issuing racks, storage cabinets, and related furniture to railway stations. (Pendragon, 2008). The use of Edmondson tickets by British Rail declined during the 1980s as computerized systems replaced them. However, some countries like Sri Lanka, Japan, and India still use Edmondson tickets. Steel barriers are used at almost every railway station in world to effectively manage and control crowd flow, ensuring safety and organized movement of passengers. The first ticket barriers were in place at London termini by the 1870 (Fisher, 2020).

In Sri Lanka, Fort Railway Station is the main hub, serving 0.2 million commuters daily. It has 10 platforms and 17 ticketing counters, with each counter issuing an average of approximately 1,360 tickets. Passenger traffic at the ticketing counters is particularly high until 7:00 p.m. on weekdays (Ferdinandes et al., 2015). Maradana Railway Station is the second busiest railway station in Colombo, featuring five ticketing counters. Sri Lankan railway stations still use a fully manual ticketing system and employ semi-online technology for train seat reservations. This combination creates many difficulties for both passengers and railway officers (Jayasuriya et al., n.d.). According to Jayasuriya's study, "Challenging Issues of the Railway Ticketing System of Sri Lanka," many passengers frequently miss their trains. The study identified several reasons for this, including the time taken for ticketing, heavy traffic on main roads, long queues at ticket counters, delays in purchasing tickets, lack of visible train details, and various other factors. Consequently, many passengers encounter this issue regularly (Jayasuriya et al., n.d.). Passengers have to interact with train ticket issuing officers at the Railway Department, spending time in queues to buy their tickets. Additionally, the distribution of train tickets is a significant effort and results in a daily waste of money to maintain a stock of tickets (De Silva & Manel, 2023).



Figure 3 – A metal dating press and ticket rack
(Source: Pendragon, 2008)



Figure 4 – Interior of ticket office in UK
(Source: Pendragon, 2008)

When discussing the furniture in ticketing offices, the ticketing room is designed with a wide space to maximize working capacity. The furniture in this area primarily focuses on functionality. Tabletop facilities are allocated based on staff usability, with tables at a height that matches the counter level. Notably, these tables do not have any decorative motifs (Samarasinghe AM & Jayasinghe S, 2019). In De Silva and Manel's research on the "Need for a Passenger Information Management System for the Department of Railways in Sri Lanka," De Silva and Manel emphasized that implementing a passenger information management system would be beneficial for both passengers and staff. Further inquiries revealed that officials at the Colombo Fort Railway Station ticket counters believe that the main reason for Sri Lanka Railways' financial losses is the failure to modernize the Railway Department. An efficient ticketing system is needed for Sri Lanka's railway services, and its implementation could help reduce revenue losses in public transport. A newspaper report in the Daily News on August 13, 2019, stated that Dilantha Fernando, the General Manager of Sri Lanka Railways, announced plans to introduce an electronic ticketing system for passengers. The e-ticketing service is expected to be implemented using QR code systems, smart cards, and automation machines. Once the automatic train ticketing system is activated, it is expected to alleviate the long queues, allowing passengers to purchase tickets through mobile applications, vending machines, electronic cards at the gates, or over the counter (De Silva & Manel, 2023). All these facilities are crucial and should be introduced to Sri Lanka Railways for the benefit of ordinary train passengers, as well as local and foreign tourists. This includes the implementation of a mobile application and a web application using advanced technology (Jayasuriya & Nimesha, n.d.).

To enhance usability and attract more passengers to railways, it is recommended to expand online ticketing options, provide accurate information displays to lead to right platform, synchronize bus and train schedules, reduce access distances, and ensure safe access pathways. Implementing these improvements will significantly benefit the overall user experience (Yaparathna & Ratnajeewa, 2018). Ticket Vending Machines (TVMs) should be available for purchasing and dispensing various types of tickets, as well as for the top-up and validation of smartcards. For space planning, conventional TVMs typically have dimensions of 500 x 900 mm. Their design should prioritize ease of reading, understanding, and use, featuring screens with good contrast and clear fonts. TVMs should be positioned to reduce glare and reflections from both natural and artificial light sources, with surrounding lighting providing a minimum of 200 lux (Anthony Dewar & Frank Anatole, 2022). Ticket gates are also an important component as they significantly reduce fare evasion and help manage passenger flow onto platforms during peak congestion. Ideally, gates should be aligned in a straight line. Usually, all gate lines required constant staffing; however, some train operators now utilize CCTV and remote operation for managing secondary gates. Integrating gate-mounted QR code readers can facilitate passengers with print-at-home or mobile tickets and enhance gate throughput. Gates should be fully integrated with broader ticketing IT systems and software to ensure compatibility and functionality (Anthony Dewar & Frank Anatole, 2022).

2.2.2. Transition Area

Transition area in railway stations include waiting areas, information desks, and retail outlets. These areas are designed to provide comfort, accessibility, and convenience for passengers, facilitating smooth movement and enhancing the overall travel experience. All waiting areas should be easy to locate, comfortable, and welcoming to station users. The layout and provision of furniture should be adapted to the station's constraints and available space. Additionally, all station furniture, including seating, should visually contrast with its background and feature rounded edges to prevent injury (Anthony Dewar & Frank Anatole, 2022). Seating on platforms and in waiting areas should offer comfort and visual appeal, enhancing the overall user experience. Every element, from individual fittings to entire pieces of equipment, should be thoughtfully designed to complement both its own form and the station's overall aesthetic (Frederick Francis Charles, 2016). In the study by M.A. & Akdemir on "Public Interiority Through Urban Mobility: Design Approaches for Railway Stations in Istanbul," is highlighted that directive signs and information boards play a crucial role in creating a strong brand identity and improving user navigation within the station. Effective signage can significantly enhance passengers' ability to find their way. However, the study also points out that many railway stations fall short in providing adequate signage, announcements, and tactile flooring for individuals with disabilities. The historical elements of some stations are not well perceived, rendering the buildings somewhat ordinary and unattractive. This lack of attention to the atmosphere and identity of the stations can be attributed to the overall low ratings for these aspects. Therefore, any additions or improvements to historical railway stations should be carefully planned to address these shortcomings, ensuring that lighting, flooring, furniture, and materials are of high quality and visually distinct (Thesis & Akdemir, 2019). This situation is quite similar in Sri Lanka as well. Passengers have reported that the sanitary facilities at Sri Lankan railway stations are poorly maintained. Issues include broken doors in some male toilets, unclean facilities, and inadequate maintenance of women's restrooms. Many passengers have expressed a willingness to pay for better-maintained toilets. Additionally, there is a demand for improved cleanliness in waiting rooms and canteens, where food quality is also criticized. Women passengers have noted a shortage of waiting chairs during peak hours (the Project Management Unit of SLR, 2018).

When discussing the furniture at Sri Lankan railway stations, it's noted that some pieces were imported from England while others were locally manufactured. In England, the movable waiting room benches used in the ladies' and gentlemen's waiting rooms at Settle-Carlisle stations were categorized as Victorian commercial furniture. This style is characterized by highly simplified forms of historical designs and was produced in large urban centres. In waiting rooms, and storerooms, early twentieth-century British railway stations featured birch and plywood chairs (David Jones and Sarah Medlam, 2000). In Sri Lanka many railway stations which are in main line, still use these historical furnishings, and some stations have updated their furniture with new, locally manufactured pieces, while others retain the original Victorian-style elements.



Figure 5 – Bench of waiting room in UK station. (Source: David Jones and Sarah Medlam, 2000)

2.2.3. Administrative Area

A major component of railway stations is the administration, which serves as the core of the station facility. The administration is responsible for the operation of the station and acts as the interface between the public and the station. It manages all business affairs related to the station, which include three primary activities: administration, accounting, and public relations (Fauzee Lokman, 1991). Although there is limited research on railway offices and their usability, existing studies generally focus on basic technical aspects while neglecting acoustic comfort, quality, and atmosphere. Notably, research indicates that 54% of staff members report that station noise contributes to their stress levels, compared to 40% of travellers. This higher stress level among staff is likely due to their prolonged exposure to noise (Eberhardsteiner et al., 2006). Studies have found that the current work environment is inadequate for delivering high-quality service. Employees have suggested upgrading the environment with advanced technology to improve outcomes for both staff and the organization. Quality of work life is a crucial factor in determining employee-related outcomes in modern organizations (Opatha & Pushpakumari, 2018).

In Sri Lanka, railway offices have not widely adopted modern technology and current facilities. They remain deeply rooted in historical practices and hierarchical structures. Railway station furniture often mirrored railway architecture, with the 1870s seeing a broad acceptance of what became known as 'railway style' (David Jones and Sarah Medlam, 2000). In Sri Lanka, some railway station furniture was imported from the United Kingdom, while others were locally manufactured. Despite their origins, all of this furniture reflects a colonial identity, featuring the ornate Victorian middle-class style. In storerooms and areas used by staff, tables tend to be minimalistic, with simple wooden frames and little ornamentation.

Occasionally, highly decorative discarded tables are repurposed for minor staff use. However, in the administration staff rooms, the furniture often features excessive ornamentation with elaborate motifs (Samarasinghe AM & Jayasinghe S, 2019). Effective lighting greatly influences how activities are carried out in office spaces. While direct lighting can be useful in certain contexts, excessive lighting may cause glare and eye strain. Achieving the right mix of ambient and direct lighting is crucial. Additionally, natural sunlight plays a significant role in the space, comparable to the effects of artificial lighting (Fauzee Lokman, 1991). Additionally, the primary issue contributing to the complexity of SLR administration is the lengthy procedures involved in assigning responsibilities. The organization's bureaucratic structure has also been highlighted as a significant problem. Outdated guidelines, procedures, and regulations for procuring rail equipment and mobile assets have resulted in reduced technological adaptation and performance within the industry (Kumara & Bandara, 2021).

2.3. RELATIONSHIP BETWEEN RAILWAY STATION INTERIORS AND USABILITY OF USER

User perspectives significantly influence the design and functionality of railway station interiors, particularly in enhancing usability for both passengers and staff. Passengers experience railway stations as more than mere transit points; they are integral to the overall travel experience. The interior design of a station affects passengers' perceptions of safety, comfort, and accessibility. A well-designed station interior can facilitate easy navigation, reduce stress, and enhance satisfaction. For instance, clear signage, comfortable waiting areas, and amenities like shops and cafes contribute positively to the passenger experience (Grayson Bailey, 2022).

Overall, studies have shown that Sri Lanka Railways customers are not highly satisfied with the services and facilities provided at railway stations (M. A. K. N. Perera et al., 2023). In Sri Lankan railway stations, wheelchair access to trains remains an unresolved issue for disabled individuals. The term "disabled" includes not only those using wheelchairs but also those who are blind or partially sighted, deaf or hard of hearing, and those with learning disabilities. While addressing physical barriers such as steps, curbs, stairs, long walkways, steep ramps, and narrow doorways is essential, psychological barriers also need to be identified and addressed in the design process. This issue continues to persist and needs to be resolved to improve accessibility for all passengers (Kandee, n.d.). Also, tourism is a rapidly growing industry in Sri Lanka and stands as the third-largest source of foreign earnings. International tourists show a notable preference for using railway services for travel within the country compared to other modes of transport (R. A. S. A. Perera & Bandara, 2016). Railway transportation in Sri Lanka, known for being the most affordable, reliable, and reaching nearly all significant tourist destinations, is underutilized for tourism purposes. Many tourists, particularly those from Thailand, the Philippines, Brazil, and Russia, are dissatisfied with the current services and facilities at railway stations (Pradeep Randiwela, 2007).

Apart from passengers, it is crucial to enhance employee usability by creating a more effective work environment. Office staff working within railway stations also benefit from a user-centered interior design. Their work environment impacts not only their productivity but also their ability to assist passengers effectively. A well-organized station interior with designated workspaces can enhance staff efficiency and morale. Features such as adequate break areas, clear communication systems, and accessible facilities are essential for staff performance. Furthermore, when staff members feel comfortable and supported in their work environment, they are more likely to provide better service to passengers. Engaging staff in the design process ensures that their needs are met, which can lead to improved operational efficiency and a higher level of service for users (Li et al., 2005).

Railway stations are consistently noisy environments, requiring employees to endure high levels of noise throughout their shifts. Addressing this issue is crucial, as acoustic comfort is essential for their well-being. While some traditional acoustic treatments may improve sound quality, they may not always align with user preferences. Additionally, demographic factors often have minimal impact on acoustic evaluations. Further research into how acoustic environments affect work-related issues such as stress and fatigue would be valuable in finding effective solutions for enhancing employee comfort and performance (Eberhardsteiner et al., 2006). Station concourses should be designed as flexible and inclusive spaces that cater to passengers, staff, and the local community. Applying inclusive design principles is essential to ensure that the diverse needs of all individuals are met effectively (Anthony Dewar & Frank Anatole, 2022). Maintaining a safe and secure environment for station users is crucial. The installation of CCTV cameras can help prevent theft in railway stations. Summary departure and arrival screens should be placed in areas where passengers are likely to gather, such as waiting areas, retail spaces, and lounges, without obstructing views of the main departure boards. A sustainable railway station should incorporate a non-heated hall to minimize heat loss and maximize solar gain. Additionally, implementing environmentally friendly features like rainwater harvesting, solar hot water systems, and solar photovoltaic technology can help reduce energy costs and promote conservation (Rzecznička & Załuski, 2017). All these findings and suggestions are crucial because, beyond serving as a gateway to or from a town, a railway station is a significant civic building. It acts as the reception room of a town, where visitors arriving by rail form their first impression of the place they have reached (Frederick Francis Charles, 2016). And the importance of user perspectives in railway station interior design cannot be overstated, as they are vital for creating functional, safe, and welcoming environments that enhance the overall experience for both passengers and staff.

3. Research Methodology

Nielsen describes usability as a measure of how easily users can interact with a display. According to the International Standard, usability refers to enhancing a product or service so that specific users can accomplish specific objectives more effectively (Ratnawati et al., 2020). In evaluating users' usability of railway stations, it is suggested to sample a significant portion of SLR users. In this context, quantitative surveys are the best option if the researcher aims to draw conclusions from a representative dataset (Rouse, 2017). Therefore, the quantitative research approach was used to conduct the study. As many researchers have noted, a sample size between 30-500 is sufficient for collecting data through a quantitative questionnaire survey. This sample size is also appropriate for selecting a sample using the random sampling method (Delice, 2002). To assess usability, one effective method is the System Usability Scale (SUS). This scale consists of 10 items that evaluate users' perceptions of a product's or service's usability. Developed by John Brooke in the 1980s, SUS is a quick and free tool for usability measurement (Holden, 2020). The SUS questionnaire uses a 5-point Likert scale (Ratnawati et al., 2020). The Likert scale is a widely used method in research for respondents to indicate their level of significance based on their experience. The five points on the Likert scale are typically defined as follows: 1 = Strongly Disagree, 2 = Disagree, 3 = Neutral, 4 = Agree, and 5 = Strongly Agree. For a System Usability Scale (SUS) score to be included in the "Acceptable" category, it must be more than 70 score. The general guideline for interpreting the SUS score, as outlined in the table below. (Alathas, 2018)

Table 2: SUS Score interpretation (Alathas, 2018).

SUS Score	Grade	Adjective Rating
>80.3	A	Excellent
68-80.3	B	Good
68	C	Okay
51-68	D	Poor
<51	F	Very Poor

To align the research methodology with the study's focus on user usability, a questionnaire was developed to capture the perspectives of railway station users. The questions were designed based on key themes identified in the literature review, particularly those emphasizing the importance of user satisfaction, comfort, and interaction with the station's facilities. This approach ensured that user perspectives were central to the research, providing a comprehensive understanding of the usability challenges faced by diverse groups, including commuters and office staff. A total of 60 questionnaires were completed by users, with 30 from passengers and 30 from employees at the mentioned railway stations. The next chapter will present the research findings.

4. Research Findings

The questionnaires were divided into three sets, each tailored to specific areas within railway stations in Colombo, focusing on current conditions. The first set consisted of 10 questions about core area and peripheral area, covering layout design, lighting, furniture, accessibility, ease of use, cleanliness, and maintenance. These questions were distributed to passengers. Both the core area and peripheral area, involved in arriving and departing activities, are assessed using a single questionnaire set due to their similar functions and user interactions. The second set of 10 questions addressed transition areas, such as restrooms, canteens, and washrooms, with a similar focus on layout design, lighting, furniture, accessibility, ease of use, cleanliness, and maintenance. This set was also distributed to passengers. The final set of 10 questions focused on administrative areas, covering the same key points and was distributed to employees.

The questionnaire sets were then categorized into odd-numbered (1, 3, 5, 7, 9) and even-numbered (2, 4, 6, 8, 10) groups. For the odd-numbered questions, the responses were summed and a value denoted as xx was obtained by subtracting 5 from this total. For the even-numbered questions, a value yy was calculated by subtracting the sum of these responses from 25. The final SUS score was determined using the formula $SUS\ Score = (x+y) \times 2.5$, this score ranges from 0 to 100, with higher scores indicating better usability. The final SUS scores and grades for each area are presented in the table below.

Table 3: Usability levels of selected areas in the current conditions of railway stations.

Area	User	Final SUS Score	Usability Level
Core area and Peripheral area	Passenger	52.75	Poor
Transition area	Passenger	34.9166	Very Poor
Administrative area	Staff	53.41	Poor

According to table 3, the Core and Peripheral area, which included passenger-centric spaces such as waiting areas and ticket counters, achieved a SUS score of 52.75. Classified as poor, this score suggests substantial inadequacies in supporting passenger comfort and efficiency. These deficiencies likely stem from outdated layouts, inadequate lighting, and suboptimal furniture arrangements. As these areas are fundamental to passenger flow and dwell time, their usability directly impacts passenger satisfaction and operational efficiency. Apart from those questions, each passenger was asked about improving the layout, lighting, and furniture for better usability. In response, 43% of passengers strongly agreed, and 43.3% agreed that such improvements are necessary to enhance functionality and the overall experience.

The transition area, which includes essential facilities such as washrooms and canteens, received the lowest SUS score of 34.91, indicating very poor usability. This extremely low score reflects significant deficiencies in the design and functionality of these spaces, which are critical for passenger comfort and convenience. Feedback on improvements was gathered through a dedicated question, with 76.7% of passengers strongly agreeing and 16% agreeing on the urgency of modernizing these facilities. The current state of the Transition area, which includes washrooms and canteens, fails to meet user expectations, significantly impacting passenger comfort and the overall experience.

In the administrative area used by staff, the SUS score was slightly higher at 53.41 but still falls under the poor category. This finding points to inadequacies that hinder staff productivity, such as cramped layouts, insufficient lighting, and non-ergonomic furniture. Efficient administrative operations are essential for the overall functionality of railway stations, and these poor usability conditions can directly impact service delivery and staff well-being. Among employees, 54.8% strongly agreed and 35.5% agreed that improvements to layout, lighting, and furniture are necessary. This consensus among staff underscores the functional and ergonomic deficiencies currently present in administrative spaces.

The findings emphasize the significance of addressing usability challenges in Sri Lankan railway station interiors, particularly in lighting, furniture arrangements, and the ticketing system, as reflected through user perspectives. The analysis highlights the need for balancing modernization with the preservation of historical value, ensuring that the design meets the practical and emotional needs of users. These insights serve as a basis for the recommendations in the conclusion, aiming to bridge the gap between traditional practices and contemporary usability expectations.

5. Conclusion

In conclusion, the findings from this research highlight significant usability challenges within the key areas of the railway stations, particularly in the Core, Peripheral, Transition, and administrative areas. The analysis of the System Usability Scale (SUS) scores and the feedback from both passengers and staff underscores a pressing need for modernization in these spaces. The low SUS scores—especially in the Transition area—indicate that the current station design is not meeting the expectations of users in terms of functionality, comfort, and efficiency.

The substantial agreement among both passengers and staff on the necessity of improving the layout, lighting, and furniture in these areas suggests a clear direction for future design interventions. Upgrading these spaces would not only enhance the overall usability of the stations but also contribute to a more positive travel experience for passengers and a more efficient working environment for staff. By addressing these identified shortcomings, railway stations can significantly improve both operational efficiency and user satisfaction, fostering a more effective, functional, and welcoming environment for all. Therefore, this research highlights the critical importance of user-centred design in the development of railway station interiors to meet the evolving needs of users and ensure a seamless, stress-free experience for all.

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