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Optimizing Circulation in Heritage Buildings: A Study of Key Parameters and Their Impact on User Experience and Sustainability

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ABSTRACT **Original research paper**

Circulation is a fundamental element in heritage buildings, directly impacting user experience, safety, inclusivity, and sustainability while heritage itself is the cultural and natural inheritance that is transferred from one generation to another. This study is an investigation of the optimization of circulation within heritage buildings by examining key parameters such as size, accessibility, flow, and safety. Employing a qualitative approach, the research analyzes multiple case studies from Nigeria, Tanzania, Zimbabwe, and Benin Republic, alongside a comprehensive literature review. It further explores the integration of adequate circulation in heritage centre design, focusing on its impact on user experience and conservation of cultural and natural heritage. This study identifies key design principles and elements for integrating effective circulation systems. The study examines the relationship between circulation, wayfinding, and user engagement, highlighting the importance of intuitive navigation, spatial hierarchy, and contextual relevance. The findings reveal that circulation elements such as corridors and hallways, entrances and exits, elevators, staircases, signage and wayfinding as well as ramps are very crucial in the implementation of adequate circulation system in heritage centres. The findings provide valuable insights for architects, designers, and heritage professionals seeking to create engaging and accessible heritage centres that promote cultural understanding and appreciation, and to foster universal design in the built environment. It also highlights the challenges and best practices in integrating circulation systems in heritage contexts, emphasizing the balance between conservation imperatives and functional requirements. The study concludes with recommendations for enhancing circulation design to promote heritage preservation and sustainable, inclusive user engagement.

Keywords: Circulation, Heritage Conservation, Inclusive User Engagement, Sustainability, Universal Design.

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1.0 Introduction

Heritage buildings represent the cultural, historical, and architectural legacy of societies. They preserve identities, traditions, and collective memories while serving educational, social, and economic functions. However, these buildings face unique challenges, particularly in accommodating modern circulation needs without compromising their integrity (Alnaim, M. M., 2024).

Circulation, the movement of people within and through a building is essential for the functionality of any public space, including heritage centres. It encompasses horizontal pathways such as corridors and lobbies, and vertical connections including stairs and elevators (Ching, 2007).

Proper circulation ensures efficient user flow, maximizes safety in emergencies, and enhances the overall visitor experience.

Heritage can be defined as a vital component of the present we live in and the past we intend to preserve (Rouhi, J., 2017). Heritage, however, goes beyond conserving, displaying, or re-establishing an assortment of inherited items; it includes our acquired traditions, norms and values, religion and beliefs, social collectives, language, food, music, art, literature, traditional marriages, political culture, clothing and dressing culture, and other elements that comprise a people's way of life and identity, as well as how they distinguish themselves (Jafar Rouhi, 2017).

1.1 Statement of the Problem

Despite the cultural richness of heritage sites, circulation within many heritage buildings remains inadequate and poorly coordinated (Mekonnen, H., et al, 2022). In many Nigerian and African Heritage Sites, conservation efforts are often fragmented, lacking centralized management and sufficient resources. Many heritage buildings suffer from limited accessibility, particularly for physically challenged users, due to insufficient ramps or elevators (Laurìa, A., 2016). Circulation spaces may be undersized, poorly located, or unsafe, which leads to congestion, decreased user satisfaction, and potential damage to fragile historic fabric.

This fragmented approach to circulation compromises not only the usability of heritage buildings but also their sustainability and ability to attract visitors. Therefore, there is a critical need to systematically investigate circulation parameters in heritage buildings, identify challenges, and develop optimized design strategies that balance preservation with inclusivity and functionality.

1.2 Aim and Objectives

The specific aim of this study is to investigate the optimization of circulation within heritage buildings.

The primary objectives of the study are:

i. To identify key parameters of circulation in heritage buildings
ii. To assess the adequacy of circulation spaces in selected heritage building case studies.

2.0 Literature Review

2.1 Concept of Heritage and Conservation

Heritage encompasses tangible and intangible cultural assets passed from one generation to another (Jafar Rouhi, 2017). Tangible assets include buildings, artefacts, and landscapes, while intangible heritage covers traditions, language, and rituals (UNESCO, 2003). Preservation and conservation efforts aim to protect these resources against decay, development pressures, and neglect.

Architectural heritage in Nigeria and similar contexts includes vernacular, colonial, Brazilian/Afro-Brazilian, and postcolonial buildings (Okpalanozie and Adetunji, 2021). Conservation efforts have traditionally focused on physical restoration, often with limited use of innovative technologies. However, integrating new methods such as laser scanning, nanotechnology, and bio-conservation can enhance documentation, diagnosis, and treatment of heritage structures.

2.2 Circulation in Heritage Buildings

Circulation is the physical and conceptual movement of users within buildings. It involves the design and layout of corridors, entrances, staircases, elevators, ramps, and signage that facilitate smooth, efficient, and safe movement (Kianen et al., 2022).

Circulation in building can be referred to as the way people interact with and within spaces (Fig. 2.5). It is a fundamental requirement in the architectural design process, such that it forms part of the conceptualization of any design proposal. Circulation includes both the space provided for circulation and the mechanism that is put in place to facilitate both the vertical and horizontal movement of both people and goods from one point to another (Kianen et al., 2022).

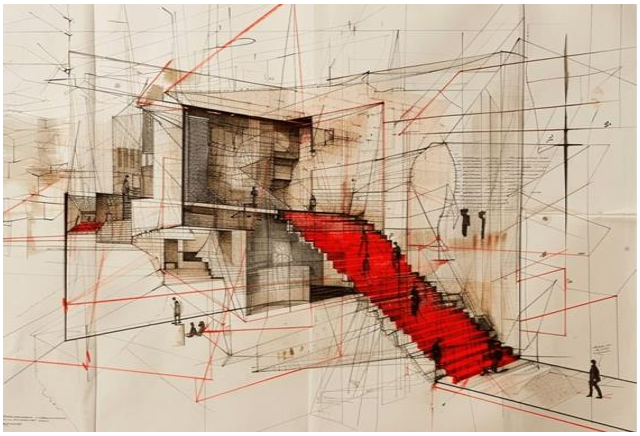

Fig. 2.5: Circulation within Spaces.
Source: Carla Paulus, 2024

As posited by Kianen et al. (2022), in heritage centres and other public buildings, circulations are designed in such a way that users and visitors have no choice but to pass through the business areas, even as they walk towards the anchor points. More so, architects, in their ways of being creative have not only made circulation elements feature in internal spaces, but have also brought them out to be part of the building external elements, forming a major part of the landscape are, both hard and soft, and this for sure, add to the aesthetic value of the indoor and outdoor environment. Hence, the issue of circulation, as it concerns architectural practices, can never be over emphasized (Kianen et al., 2022).

Heritage buildings pose unique circulation challenges due to preservation constraints and historical construction methods. Older buildings often lack features like ramps and elevators, limiting universal access.

In most definitions of circulation, two words are critical, orderliness and movement. Therefore, it is pertinent that the design of any circulation spaces or techniques must be done with orderliness and should be able to ease the movement of the prospective users. This is more paramount in the planning of public spaces or buildings, in such that circulation must be given the most deserved priority in the planning process.

2.3 Components of Circulation

In a real life situation, architects usually consider a type of circulation system that uniquely fits their design, which off course, interplay with one another and the overall concept of planning. Some of these considerations that influence the choice of circulation design include:

i. Direction of movement: horizontal or vertical
ii. Type of use: private or public
iii. Frequency of use: common or emergency
iv. Time of use: day, evening or continuous
v. Physical fitness of user: able or disabled

The architectural considerations of each of these circulation parameters may vary from one to another. Consequently, in all of these types of circulation, direction and usage type are often outstanding and critical to building layout (Kianen et al., 2022).

2.4 Key Elements of Circulation in Heritage Buildings

In any type of public building, there are certain elements of circulation that needs to be considered, depending on the configuration, size and concept of the building, and such elements includes;

i. Corridors and Hallways
ii. Entrances and Exits
iii. Elevators
iv. Staircases
v. Signage and Wayfinding

2.5 Key Parameters of Assessing Circulation in Public Buildings

For the purpose of this study, the following parameters have been identified for assessing the adequacy of the circulation in the selected heritage centres for case study;

i. **Size and Capacity:** Ensuring that circulation routes can accommodate the expected number of users.
ii. **Location and Accessibility:** Ensuring that the building is accessible to everyone, including people with disabilities.
iii. **Safety:** Providing safe and secure circulation routes, including emergency exits and fire safety measures
iv. **Flow and Efficiency:** Designing circulation routes to minimize congestion and reduce travel time, and to ensure that the circulation spaces helps to maintain adequate connectivity within spaces by managing the flow of people through the building to prevent congestion and ensure smooth movement.

2.6 Importance of Adequate Circulation in User Experience and Sustainability

Circulation stands as a pivotal component in every piece of architecture, orchestrating the movement and flow within spaces. It's not merely about pathways or corridors but a comprehensive system that includes entry points, exits, and transitions between spaces. Architectural circulation diagrams serve as a blueprint, visualizing how spaces connect and the journey occupants take through them, whether they're moving horizontally across a single level or vertically between floors.

Efficient circulation enhances the visitor experience by reducing bottlenecks, providing intuitive wayfinding, and ensuring comfort and safety (Gwilliam, 2016; Jung & Shim, 2017). Moreover, circulation that complies with accessibility standards such as the Americans with Disabilities Act (ADA) facilitates inclusive use by all community members (Aline, 2021).

Sustainability in heritage buildings benefits from circulation systems that reduce wear on delicate fabric, optimize space usage, and promote economic viability through increased visitation and repeat patronage (Newman et al., 2018). Integrating circulation design into heritage conservation plans supports long-term preservation and community engagement.

i. Enhanced User Experience: Efficient circulation systems contribute significantly to users' satisfaction in public buildings or urban centres. Users tend to seek hassle-free access to various sections, facilities, and attractions within these structures. (Dibie, 2023). Well-designed circulation routes minimize congestion, reduce wait times, and promote a seamless flow of people, ensuring visitors can fully engage in the activities they came for (Gwilliam, 2016).

By strategically designing circulation paths, architects can significantly enhance how individuals interact with a space. Effective circulation goes beyond mere movement, encompassing the creation of intuitive pathways that guide users to their destinations effortlessly while ensuring comfort and safety (Carla, 2024).

ii. Safety and Security: Adequate circulation design directly influences safety and security within public spaces. Efficient and strategic traffic and crowd management strategies, such as clear pedestrian paths, proper signage, reduced pedestrian-vs-vehicular intersection and/or congestion, and well-organized queues, help prevent overcrowding and mitigate potential safety hazards (Jung & Shim, 2017). Furthermore, well-illuminated spaces and strategic placement of security personnel contribute to a secure environment for all categories of users, including visitors.

iii. Improved Economic Benefits: A seamless functioning circulation system can have a positive impact on the economic viability of public spaces like heritage centres

(Newman et al., 2018). Efficient accessibility encourages higher traffic and repeat patronage, attracting both residents and tourists. By ensuring seamless circulation, centres can enhance users' satisfaction and promote increased spending on visitation, tourism, and ultimately boosting the local economy.

iv. Innovation and Compliance with Building Codes: Compliance with building codes is a non-negotiable aspect of architectural process, including circulation. These codes ensure safety, accessibility, and efficiency, setting minimum standards for paths, width of corridors, escape routes and configuration of stairs and ramps among others. Our expertise allows us to not only meet these essential requirements but also to leverage them as a foundation for innovation in circulation design (Carla, 2024). For example, accessibility standards guide us in creating inclusive designs that cater to all users, including those that are physically challenged. Incorporating features such as wide corridors, gentle ramps, and tactile guidance not only adheres to codes but also promotes a universal design mindset, making buildings more navigable and comfortable for all. Additionally, we embrace the challenge of blending safety with aesthetics. Fire exits and emergency stairs, when thoughtfully integrated into the design, can complement the architectural narrative of a space rather than detracting from it. Our innovative approaches ensure that safety features are seamlessly woven into the fabric of the design, maintaining both the integrity of the aesthetic vision and the paramount importance of building users' safety (Carla, 2024).

2.7 Strategies for achieving optimum Circulation

i. Universal Design Approach

Incorporating features such as wide corridors, gentle ramps, tactile guidance and signage not only adheres to codes but also promotes a universal design mindset, making buildings more navigable and comfortable for all categories of users.

ii. Parking Management

Implementing smart parking management systems, including real-time occupancy monitoring and digital signage, enables visitors to quickly locate available parking spaces. Additionally, introducing off-site parking facilities with convenient shuttle services can alleviate parking congestion within the heritage centre (Dibie, 2023, U.S. Department of Transportation, 2020).

iii. Integrated Way-Finding Systems

Clear and intuitive wayfinding systems play a crucial role in enhancing circulation efficiency (Teller, 2020). Comprehensive and user-friendly way-finding systems, comprising digital signage, maps, and smartphone applications, can guide visitors to desired destinations within urban entertainment centres. Clear and easily understandable signage helps minimize confusion and facilitates efficient movement (Calori and Vanden, 2007).

iv. Demand-Based Traffic Control

Dynamic traffic control systems that adjust traffic signal timings based on real-time traffic conditions can significantly reduce congestion and improve traffic flow efficiency. These systems utilize sensors and algorithms to optimize signal timings and prioritize high-demand routes (Tao et al., 2020).

v. Crowd Management

Efficient crowd management techniques are essential to mitigate congestion and ensure a smooth flow of visitors (Gwilliam, 2016). This includes well-designed queuing systems, capacity management protocols, and crowd-monitoring technologies. Real-time data analysis and crowd flow simulations can assist in optimizing space utilization and informing decision-making for timely interventions (Dibie, 2023).

vi. Stakeholder Collaboration

Efficient circulation management requires collaboration among various stakeholders, including city planners, transportation authorities, public spaces operators, and local businesses. Regular meetings, information sharing, and coordinated planning efforts help ensure a holistic approach to circulation efficiency (Maturana et al. 2016).

3.0 Methodology

3.1 Research Design

This study adopts a qualitative research design to explore the optimization of circulation in heritage buildings. Qualitative methods are appropriate here, as they allow an in-depth understanding of spatial, cultural, and experiential aspects associated with circulation in heritage contexts (Abatan, 2024). The approach integrates primary data collection through site observations and secondary data via systematic literature review.

The study employs a case study method to examine existing heritage buildings with diverse architectural styles, conservation challenges, and circulation systems. Case studies are essential in architecture research to reveal detailed insights into design processes, user interactions, and contextual adaptations. Four heritage sites were selected based on historical significance, availability of data, and relevance to circulation challenges:

i. Arusha Cultural Heritage Centre, Tanzania
ii. Amagugu International Heritage Centre, Zimbabwe
iii. Sukur Cultural Landscape, Adamawa, Nigeria
iv. Royal Palaces of Abomey, Benin Republic

3.2 Data Collection Methods

i. Site Visits and Field Observations: Physical visits to selected heritage centres enabled direct observation of circulation elements such as corridors, entrances, stairs, and signage.

ii. Architectural Plan Analysis: Gathering and studying architectural drawings and floor plans helped to assess spatial

organization, corridor widths, vertical and horizontal circulation paths, and accessibility features.

iii. Literature Review: Extensive review of scholarly articles, policy documents, and conservation charters provided theoretical frameworks and best practices related to circulation and heritage conservation.

iv. Key Parameter Assessment: Circulation elements were evaluated against defined parameters such as size, location, flow, and safety (Tables 3.2). A rating scale from Very Adequate to Not Available was used to quantify adequacy.

3.3 Case Study Selection Criteria

Sites were chosen based on:

- Historical and cultural significance relevant to heritage conservation.
- Availability of data and accessibility for observation.
- Diversity in architectural style and conservation approach.
- Representation of both built heritage (museums, palaces) and cultural landscapes.

The selected cases offer comparative insights across different African heritage contexts.

3.4 Data Analysis

Data from observations, plans, and literature were synthesized to evaluate circulation adequacy and its impact on user experience and sustainability. Comparative analysis across case studies identified common challenges and exemplary strategies.

3.5 Case Studies Analysis

3.5.1 Case Study 1: Arusha Cultural Heritage Centre, Tanzania

The Arusha Centre was established in 1987 to preserve and celebrate the diverse cultures of over 120 tribes in the region. Designed by architect Saifuddin Khanbhai, it features a curvilinear, modern design inspired by traditional symbols such as the spear, shield, and drum (Plate 9).

i. Site Planning: The centre's open-plan layout integrates landscaped gardens, artisan workshops, and multiple entry points, promoting engagement with nature and culture (Plates 3.1–3.3).

ii. Circulation: Spacious corridors, multiple entrances/exits, staircases, and elevators facilitate smooth movement for visitors of all abilities (Table 3.2). Clear signage and wayfinding reduce confusion, enhancing the visitor experience.

iii. Materials: Reinforced concrete, stone cladding, and glass dominate, blending contemporary construction with traditional motifs.

iv. Impact: The centre successfully combines aesthetic appeal, inclusivity, and functionality, serving as a model for circulation optimization in heritage buildings.

Plate 1: The well landscaped premises of the Arusha Cultural Heritage Centre.

Plate 2: Approach Entrance to the Galleries.

Plate 3.4: Bird's Eye View of Arusha Cultural Heritage Centre Tanzania, showing the curvilinear concept and landscape.

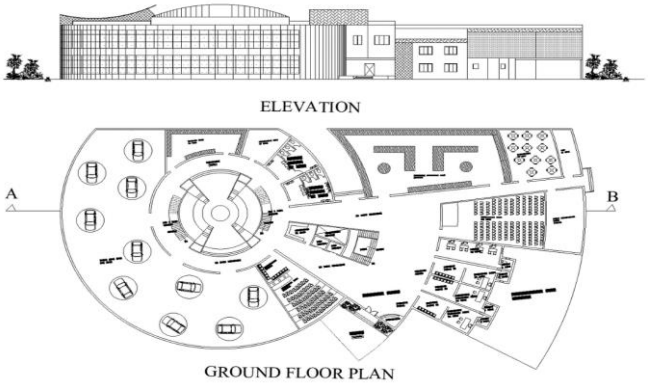

Fig. 3.1: Elevation and Ground Floor Plan of Arusha Cultural Heritage Centre Tanzania, showing the Curvilinear Concept.

Plate 8: The Central Museum showing contemporary architectural features.

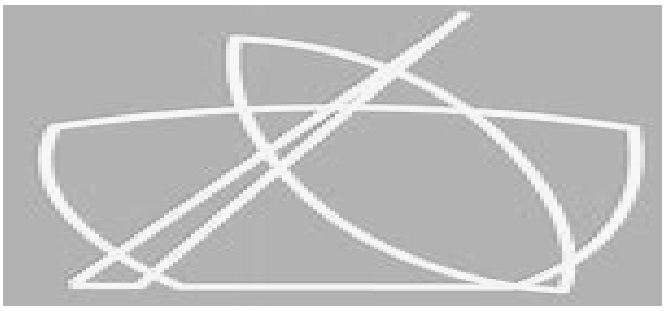

Plate 9: Schematic Design of the Centre, showing the spear, shield and drum.

Plate 3.8: Approach View of Arusha Cultural Heritage Centre Tanzania, showing building envelope and sculptures of various wildlife.

3.5.2 Case Study 2: Amagugu International Heritage Centre, Zimbabwe

Founded in 2010, Amagugu supports cultural education and rural women's participation in traditional culinary expositions. It complements national efforts to conserve intangible heritage.

i. **Site and Landscape:** The site retains a natural landscape with minimal architectural landscaping, preserving the rural character.
ii. **Building and Materials:** Structures use local stone and thatch roofing, reflecting vernacular architecture (Plates 3.9–3.12).
iii. **Circulation:** Being a single-floor complex, circulation relies on natural terrain without ramps or elevators, limiting accessibility for physically challenged users (Table 3.2).
iv. **Cultural Role:** The centre plays an important role in community engagement and heritage education despite circulation limitations.

Plate 3.9: Approach View of Amagugu International Heritage Centre, showing some school students on tourism, and the thatch roofed structure in the background.

Plate 3.10: View of Amagugu International Heritage Centre, showing some of the monuments, built from stone construction.

Plate 3.11: Interior View of Amagugu International Heritage Centre, showing a souvenir shop.

Plate 3.12: Interior View of Amagugu International Heritage Centre, showing some women during a cultural display.

3.5.3 Case Study 3: Sukur Cultural Landscape, Nigeria

A UNESCO World Heritage Site, Sukur encompasses terraced agricultural fields, circular stone dwellings, and iron-smelting furnaces.

i. **Site Planning:** The settlement is integrated into naturally terraced hillsides, creating a unique spatial organization (Plate 3.13).

ii. **Construction:** Dry stone walls and clay structures preserve traditional building techniques (Plates 3.14–3.17).
iii. **Circulation:** Movement follows natural slopes; formal circulation elements such as stairs or ramps are absent, posing physical access challenges (Table 3.2).
iv. **Conservation Challenges:** Material vulnerability to erosion and fire hazards require careful management.

Plate 3.13: Aerial View of Sukur Cultural Landscape.

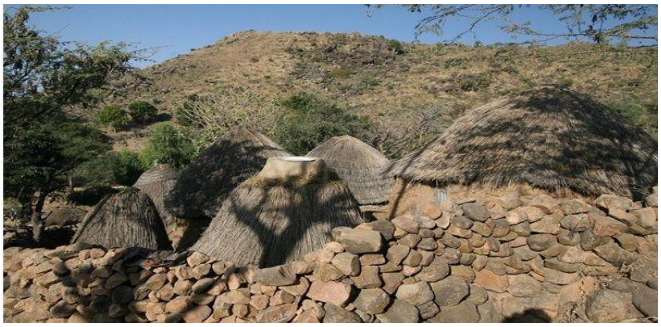

Plate 3.14: View of Sukur Cultural Landscape, showing the naturally designed terraced-landscape showing the conical structures with locally sourced materials.

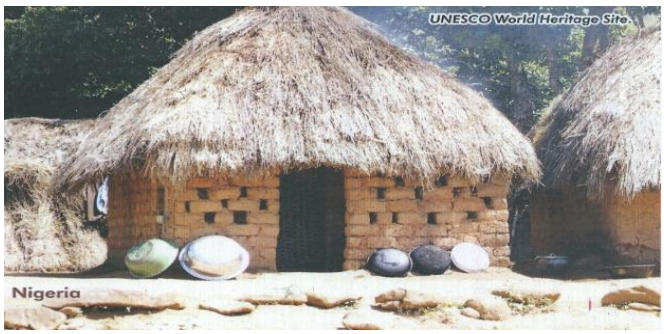

Plate 3.15: View of Sukur Cultural Landscape, showing the clay blocks and thatched-roof, promoting Nigerian traditional architecture.

Plate 3.16: View of Sukur Cultural Landscape showing the stone wall fence.

Plate 3.17: Aerial View of Sukur Cultural Landscape, Adamawa, Nigeria, showing structures with typical Hausa Traditional Architectural styles, using thatch and woven mats for construction.

3.5.4 Case Study 4: Royal Palaces of Abomey, Benin Republic

Dating from 1625 to 1900, the palaces are built with mud bricks, wooden frameworks, and corrugated iron roofs, blending African, European, and Brazilian influences (Plates 3.18–3.22).

i. **Site:** The palaces cover 47 hectares with multiple enclosures, courtyards, and symbolic gates.
ii. **Circulation:** Corridors and entrances are adequate; however, the bungalow-type structures lack elevators and ramps due to typological constraints (Table 3.5).
iii. **Cultural Significance:** The palaces symbolize political power and resistance and now house a historical museum.

Plate 3.19: View of the Palace Buildings from the courtyard, showing some wooden post columns.

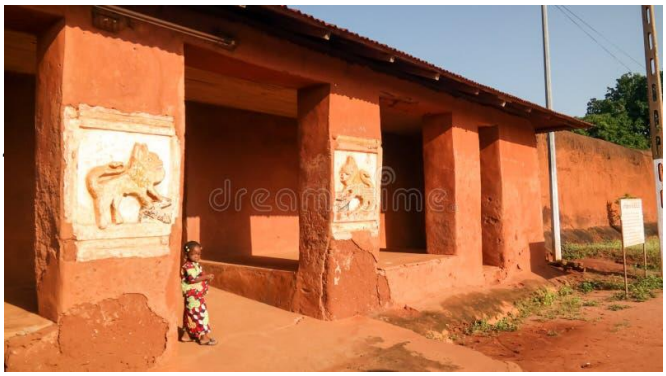

Plate 3.20: View of the Palace Buildings from the courtyard, showing the mud walls.

Plate 3.21: View of the Palace Buildings, showing the some wall corridor and some wall decorations with moral.

Plate 3.22: View of the Palace Fence, showing decorations with moral and painting.

4.0 Results And Discussion

Using a critical analysis of the case studies, the results of the findings are reported as follows:

Table 3.2 Assessment of the Key Parameters of Circulation from various Case Studies

			Arusha Cultural Heritage Centre, Tanzania					Amagugu International Heritage Centre, Zimbabwe					Sukur Cultural Landscape, Nigeria					Royal Palaces of Abomey, Benin Republic				
S/N	**Circulation Elements**	**Parameters for Assessment**	**VA**	**A**	**I**	**VI**	**NA**	**VA**	**A**	**I**	**VI**	**NA**	**VA**	**A**	**I**	**VI**	**NA**	**VA**	**A**	**I**	**VI**	**NA**
	Corridors and Hallways	Size and Capacity	*						*					*				*				
		Location and Accessibility	*						*					*				*				
		Flow	*						*					*				*				
		Safety		*					*					*				*				
	Entrances and Exits	Size and Capacity		*					*					*					*			
		Location and Accessibility	*					*						*					*			
		Flow	*					*						*					*			
		Safety		*					*						*					*		
	Elevators	Size and Capacity	*									*					*					*
		Location and Accessibility	*									*					*					*
		Flow		*								*					*					*
		Safety	*									*					*					*
	Staircases	Size and Capacity	*									*					*					*
		Location and Accessibility	*									*					*					*
		Flow	*									*					*					*
		Safety	*									*					*					*
	Signage and Wayfinding	Size and Capacity	*									*			*					*		
		Location and Accessibility	*					*					*					*					
		Flow		*					*					*						*			
		Safety		*					*					*						*			
	Ramps	Size and Capacity					*					*					*					*
		Location and Accessibility					*					*					*					*
		Flow					*					*					*					*
		Safety					*					*					*					*

From table 3.2 above, it was observed that most of the circulation elements under the Arusha Cultural Heritage Centre**,** are sufficiently provided and very adequate at the centre, except for ramps that is not available at all.
From Amagugu International Heritage Centre, Zimbabwe,it was observed that circulation elements such as corridors and hallways are adequately provided, staircase and elevators are not available at all because the building is a single floor structure, ramps that are supposed to serve the physically changed users are not available at all.
Sukur Cultural Landscape, Nigeria, it was observed that circulation elements such as corridors and hallways are adequately provided, staircase and elevators are not available at all because the structures are part of an ancient settlement existing in a natural environment. Despite the sloppy topography of the site, ramps and stairs are not provided, therefore making access to be possible by following the natural gradient of the site.
Royal Palaces of Abomey, Benin Republic, it was recorded that corridors and hallways are very adequate, entrance and exits are adequate, signage and wayfinding are also adequate, but elements such as elevators, staircases and ramps and not available due to the fact that the palace structures are bungalow.

The case studies demonstrate that optimized circulation contributes significantly to heritage buildings' functionality, visitor experience, and preservation. Arusha Cultural Heritage Centre exemplifies effective integration of modern circulation elements in a heritage setting, balancing aesthetics with accessibility.
Conversely, the absence of ramps and elevators in other centres limits inclusivity and poses sustainability risks by concentrating visitor movement in limited zones, increasing wear on historic fabric.
Design flexibility and universal design principles must be prioritized to ensure heritage buildings accommodate evolving user needs while respecting conservation imperatives (Ashraf et al., 2019).

4.1 Data Interpretation: Circulation Adequacy Across Case Studies

From Table 3.2 above;

i. **Corridors and Hallways:** Rated very adequate in Arusha and Abomey, adequate in Amagugu and Sukur, reflecting design and building typology differences.
ii. **Entrances and Exits:** Well provided in Arusha and Abomey; limited in Amagugu and Sukur due to natural site constraints.
iii. **Elevators and Ramps:** Available only in Arusha, absent in other sites, highlighting a common deficiency in heritage buildings regarding universal access.
iv. **Signage and Wayfinding:** Present and adequate in most cases except limited in Sukur, affecting visitor orientation.

4.2 Impact on User Experience

Optimized circulation in Arusha facilitates seamless visitor flow, inclusivity, and safety, enhancing satisfaction and engagement. Conversely, limited circulation infrastructure in Amagugu, Sukur, and Abomey restricts access for some users and may contribute to congestion in key areas.

4.3 Sustainability Implications

Effective circulation minimizes physical stress on heritage fabric by dispersing visitor flow, supports emergency egress, and aligns with universal design, contributing to the long-term sustainability of heritage sites. Structural adaptations like ramps and elevators, while challenging in heritage contexts, are essential for inclusive sustainability.

4.4 Lessons Learned

i. Integration of traditional architectural forms with modern circulation amenities is feasible and desirable.
ii. Circulation design must respond to site topography, building typology, and cultural context.
iii. Universal design remains a critical gap in many heritage sites and requires innovative adaptation.
iv. Regular performance evaluations and stakeholder collaboration are necessary to maintain circulation efficacy.

5.0 Conclusion And Recommendations

Optimizing circulation in heritage buildings requires a holistic approach that balances preservation with functional and inclusive design. Key parameters such as size, accessibility, flow, and safety must guide circulation planning to enhance user experience, promote sustainability, and ensure long-term preservation.
This study affirms the necessity of incorporating universal design and innovative management strategies in heritage centres. The findings provide a valuable reference for architects, conservators, and policymakers committed to sustainable heritage management.
In order to achieve optimum circulation systems in heritage centres, the following recommendations are made;

i. Adopt universal design principles to accommodate all users, including the physically challenged.
ii. Integrate innovative documentation and diagnostic technologies for circulation planning.
iii. Conduct regular assessments of circulation adequacy and user feedback.
iv. Foster multi-stakeholder collaboration to coordinate circulation improvements.

v. Prioritize flexible circulation design adaptable to evolving functional requirements.

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