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ARCHITECTURE ON TRACK: REIMAGINING THE FUTURE OF RAIL TRAVEL

Okafor Chibuike Emmanuel and Eze Chukwudi Obinna

Department of Architecture, Faculty of
Environmental Sciences, Nnamdi Azikiwe
University, Awka, Anambra State, Nigeria
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Abstract: In the developed world, the railway transport sector is well-established and is currently enjoying a notable renaissance following a period of decline. The appeal that railroads have rediscovered is supported by its ability to transport large amounts of people or cargo in an environmentally responsible and energy-efficient manner. This paper discusses various architectural strategies which can be implemented into the planning and design of railway stations not just as a means of improving this means of transportation but also to reignite the interest of people in using the train as a means of everyday transportation, serve as a symbol of national identity as train stations being public buildings should be iconic and symbolic while also connecting other forms of transportation where the need might arise. By analyzing successful international examples, the article proposes strategies such as the redesign and proper planning of circulation, designing multi functional train stations as well as introducing new technological advancements for enhanced passenger experience and operational efficiency. These strategies not only address current challenges but also lay the foundation for a resilient and future-proof rail transportation system.

Keywords: Rail Transportation, Modern Railway Stations, Architectural Strategies, Circulation and Navigation

INTRODUCTION

It has become very important to find more effective ways to transport people especially in a world where people are continually attempting to travel longer distances and beat the clock in order to get to work and other gathering spots. The capacity to move a lot of people at once makes rail transportation one such option that works well for this purpose. Because of this, cities all over the world are continually reviving their current rail networks and building new ones to meet the 21st century's expanding need for travel. (Mtembu,2008). Rail stations, acting as multifaceted hubs where individuals traverse, work, shop, and socialize, represent a captivating and rapidly evolving architectural typology. The contemporary landscape is characterized by emerging transportation modes and business paradigms, digital-centric lifestyles, shifting retail dynamics, and pressing economic, environmental, and health considerations. These factors prompt a crucial inquiry into the ideal form and function of modern train stations, as well as the strategic approaches that can effectively address these multifaceted challenges (Nille, 2020).

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Central to the revitalization agenda are the architectural strategies that underpin the transformation of the Rail infrastructure. Far from being mere utilitarian structures, rail stations are poised to become vibrant, dynamic spaces that catalyze urban regeneration and redefine the passenger experience. This article embarks on a scholarly exploration of the architectural interventions that promise to rail stations into iconic landmarks of functionality, sustainability, and aesthetic appeal.

AIM

The Aim of this study is to Investigating and suggesting architectural solutions to improve the overall user experience, aesthetics, and functioning of railroad transit terminals is the main goal of this research study.

RESEARCH METHODOLOGY

The research methodology employed in this study is qualitative in nature, utilizing a descriptive research approach. This methodology incorporates case studies and analysis of available documents to comprehensively investigate architectural strategies for enhancing railway transportation stations. Careful selection and examination of case studies from diverse global locations provide insights into the planning, design, and operational aspects of railway stations. These case studies illuminate general design principles and concepts, as well as the climatic and physical characteristics of the infrastructure which influences its planning and design and most importantly highlights the various architectural strategies employed in these train stations. The indepth qualitative descriptions that are frequently generated in case studies aid in both exploring or characterizing the data in a real-life setting and in explaining the intricacies of real-life circumstances that may not be fully reflected in survey or experimental research (Zaidah,2007).

FINDINGS

A railway network can be seen as lines irrigating a geographical area in the same way as a network of arteries nourish and keep alive a body and living being. Stations are the nodes and beating hearts of this network, and sustain it by injecting and managing the movements of all the travelers which are its lifeblood (UIC,2013). During the nascent stages of railways, the concept of a station's design and appearance was nebulous, serving primarily as a functional space for accommodating staff and passengers awaiting trains. At times, repurposed older buildings were pressed into service to fulfill station requirements. In their inception, early stations were often modest yet functional edifices. These stations often served as the principal offices of railway companies, sometimes doubling as headquarters or repair facilities. However, as the evolution of passenger and freight traffic began to significantly influence the development of nations and societies, railway enterprises assumed greater significance and necessitated increased investment. Consequently, the station, serving as the railway's public face to the city, needed to adopt a more imposing presence to instill confidence in investors and attract additional funds to bolster this transformative mode of transportation (UIC,2013).

Public transportation use has skyrocketed due to a multitude of factors, including rapid worldwide urbanization. All parts of the world are expected to see a threefold increase in the demand for passenger transportation between 2015 and 2050, from 44 trillion to 122 trillion passenger kilometers (ITF, 2019). Building larger or more stations won't be adequate to meet this demand; instead, intelligent design techniques that control population flows, influence behavior, and boost operating capacity will be needed. This will enhance the station experience for a much larger range of users in addition to passengers (Nille, 2020). To further understand these growing problems

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and concerns, a series of case studies were conducted across diverse locations, encompassing both local sites within Nigeria and international contexts. These investigations significantly enriched our understanding of train station planning, design, and operational practices.

MOBOLAJI JOHNSON STATION, LAGOS

The Mobolaji Johnson Train station, also known as the Ebute Metta train station, stands as a monumental achievement in railway infrastructure within West Africa. Located along the 156km Lagos-Ibadan standard gauge railway line in Lagos, it holds the distinction of being the largest train station in the region, with a capacity to accommodate up to 6,000 passengers. In the design of this station, several strategies were adopted and we would focus on the circulation and way finding strategies. The station comprises of a combination of both vertical and horizontal means of circulation. It includes the use of ramps and lifts as well as stairs to facilitate movement between various vertical levels. Also, the use of a linking bridge that connects the two sections of the station flowing from the general public zones like the concourse and ticketing areas to a more private zone containing waiting areas as well as the platforms. Other strategies includes the integration of the human-centric design principles by providing provisions for the physically challenged to access all parts of the building without obstruction.

NAPOLI AFRAGOLA TRAIN STATION, NAPLES

Napoli Afragola station, a masterpiece designed by the renowned architect Zaha Hadid, stands as a pivotal element within a broader plan envisioning 13 new stations along Italy's highspeed rail network. This station, aptly nicknamed the 'gateway to the south,' serves as a crucial transportation hub and regional gateway for Naples, epitomizing a modern, forward-looking approach to rail infrastructure. Located on a sprawling 190,000sqm land area, 12km north of Naples, Napoli Afragola station is strategically positioned, surrounded by the city of Afragola to the west and the Murillo Fatigati metropolitan area to the south.

The station's design minimizes travel times for passengers boarding and alighting at Napoli Afragola as well as those connecting to other train services. It is intended to serve as an urbanized public bridge linking the communities on either side of the railway. The public walkway is expanded over the eight railroad tracks in such a way that it serves as the primary passenger concourse for the station. It is a bridge that houses all of the amenities and services needed for passengers to arrive, depart, and connect, and it provides direct access to all of the platforms below. The spatial configuration of the station is a direct response to the flow of passengers, influencing the layout of its internal spaces. Striking entrances at both termini of the station not only serve as welcoming portals but also function as navigational aids, channeling visitors towards the elevated public zones featuring an array of shops and amenities. Converging at a central atrium above the railway tracks, visitors from either side of the station are united. This atrium, overlooked by cafes and restaurants, serves as a pivotal new public space for Afragola. The main concourse, where rail passengers descend to the platforms, is also situated within this central hub, further enhancing its significance (Fernanda, 2018). In terms of its sustainability strategies, The station's main concourse is designed to support the ecological sustainability of the structure. The station can minimize its energy usage by utilizing ground source heating and cooling systems, natural light and ventilation, and integrated solar panels on the roof. (Fernanda, 2018).

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ROTTERDAM CENTRAL STATION, ROTTERDAM

The station is located in Rotterdam, Netherlands and was designed by a team of architecture studios created for the renovation of the railway station. The Benthem Crouwel architects, MVSA architects and West 8 (landscape architecture studio based in Netherlands). The layout of the new Rotterdam central station is excellent and this was made possible by abiding by a single tenet: trains and all station amenities and services had to be housed under one roof. As a result, there is now a welcoming, transparent, and open hub for public transit that serves as a gathering spot for both travelers and locals in Rotterdam. The station combines and unites many other aspects of the city to create a cultural hub since it is now intricately linked to the city's urban transit system (MSVA, n.d).

In the design of this station, the Human Centric Design Strategy was employed where the activities of residents on either sides of the station heavily influences its design decisions. The different urban nature of the north and south sides of Rotterdam Central station posed one of the station's primary issues. Given the smaller passenger volume and the neighborhood's nature, Provenierswijk, the north side entry has a basic design. The city progressively becomes connected to the entryway. The Provenierswijk enhances the essence of the Dutch provincial town from the 19th century. On this side of the station, there are less large architectural expansions, more green space, and transparency throughout the station (Archidaily, 2015).

CONCLUSION

The burgeoning growth of the rail transportation industry, coupled with the evolving needs of modern passengers, has prompted a paradigm shift in the planning and design of railway stations. Through the strategic integration of architectural strategies, we are presented with a unique opportunity to address these challenges effectively. Embracing a human-centered design approach, coupled with meticulous planning of circulation and wayfinding, we can enhance not only the functionality and efficiency of railway stations but also contribute significantly to the overall sustainability and appeal of rail transportation. This approach, when combined with the thoughtful integration of sustainability strategies, will not only meet the demands of today but also lay a robust foundation for the future of rail travel, making it a more attractive and sustainable mode of transportation.

RECOMMENDATIONS

In advancing the rail transportation industry, it is imperative to advocate for increased investment in rail infrastructure and the adoption of new technologies. These endeavors not only enhance user satisfaction but also facilitate smoother and more efficient travel experiences. Additionally, directing resources towards research and development within the industry is essential for driving innovation and progress. Moreover, the integration of architectural strategies is key for seamless coordination between architectural design, technological advancements, and sustainable practices ensuring that they complement each other synergistically. Addressing these emerging challenges necessitates the implementation of meticulously planned architectural strategies. These strategies encompass a range of considerations, including circulation and wayfinding, sustainability, and human-centric design principles.

Architectural Strategies for Improving Rail Transportation Stations.

The transportation architecture wraps up the continuous movement of the people and vehicles. It provides a static shelter to the constant kinetic structure of the people in there. These structures are very different from other typologies of architecture as there is always an influx of people either leaving a place or reaching the destination.

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Not only do they have to provide a space for the arrival and departure of people, but it has to work on a more practical and emotional level as well (Muskan,2022). There are various architectural strategies that can be implemented to improve the rail transportation terminal and rail transport in general and this includes: circulation strategies, sustainability, human centric design principles and advancement in technology. **Circulation and Wayfinding**

The viewpoint thread that unites or connects a collection of indoor or outdoor places is called circulation. We experience architecture through these channels, and the way these pathways are designed greatly influences whether a development succeeds or fails. Effective circulation is a prerequisite for good architectural design. Similar to how blood flows through a body, circulation functions best when the path is free of obstacles. After all, if you don't know where to go or keep running into difficulties, how can you appreciate beautiful spaces? (Knorr, 2009)

Circulation can be vertical (examples include elevators, staircases, escalators, ramps) and horizontal (examples include: pathways, aisles, corridors).Through meticulous placement of these architectural elements and functionalities, the trajectory of human movement within the station can be orchestrated with precision. Space optimization strategies, achieved through sophisticated visual design, signage, and wayfinding interventions, must be complemented by the seamless integration of an inclusive digital overlay. Central to this approach are user-centric design principles and the human-scale ethos, emphasizing the station's adaptability and suitability to the individual user's needs. These considerations, alongside the principles of rightsizing and flexibility, will be pivotal in the planning and design of modern stations (Nille, 2020).

Sustainability

Train station design must support sustainable operation throughout the building life cycle, including final disposal. In addition to needing to be highly practical and aesthetically pleasing, the space must be built with the goal of ensuring long-term resource and energy efficiency. (Barker, 2023). It includes all structures and built environments that offer information about sustainability or have sustainable elements. A wide range of topics are covered in this information, including the components of buildings, such as building materials and systems, as well as sustainable design tools and techniques, like life cycle assessments, environmental impact assessments, and LEED and BREEAM building evaluation systems. Additionally, there are general discussions about the connections between the built environment and environmental and social issues, such as how to address social benefits and environmental concerns in planning policies or architectural programming (Sant, n.d). In the pursuit of sustainability in the design of rail transportation stations, a comprehensive approach can be adopted, encompassing various strategies. These include the promotion of energy efficiency through the implementation of advanced lighting, heating, ventilation, and air conditioning systems. Additionally, the choice of environmentally friendly materials, such as those with recycled content or low embodied energy, can significantly reduce the environmental footprint of these structures.

Human Centric Design Principles

A "good service" is no longer sufficient for the next generation of rail travelers. I believe that train operators and transportation planners need to concentrate on placing passengers at the center of design in order to meet the growing demands of passengers (Stephen, n.d). As human interactions with stations undergo continual evolution, future stations will inherently incorporate technology adoption, digital transformation, and automation. However, it remains crucial to establish an omnipresent foundational infrastructure that is inherently human-centered,

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ensuring that station users have the most optimal experience possible. Future stations will be welcoming spaces for people of all ages, abilities, and backgrounds by taking into account their unique needs and usage patterns. This encompasses individuals with disabilities, populations spanning many generations, individuals with diverse gender identities, people from varied socioeconomic and cultural backgrounds, and those traveling with heavy loads (such as strollers, bags, etc.) (Nille, 2020). Issues with inclusion are already being addressed in Singapore. At least two barrier-free access paths are available at more than 80% of the city's Mass Rapid Transit stations, and 40% of them have additional elevators to make them more accessible for users with limited mobility (LTA, 2017).

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