SCIENTIFIC PAPER
Published: March 22, 2024
https://doi.org/10.13167/2024.28.5

Role of spatial efficiency, layout planning, and sustainability in the success of shopping malls

Huda Riaz[1], Norheen Amina[2], Muhammad Arif Khan[3], Amna Iqbal[4], Amina Irfan[5], Hira Ishitaq[5], Sadaf Noshin[2], Habiba Mohsin[5] and Imran Shahbaz[5]

[1] *University of Engineering & Technology Lahore, Architectural Engineering and Design Department, Lahore, Pakistan*

[2] *The University of Lahore, Department of Technology, Lahore, Pakistan*

[3] *University of South Asia, Architectural Design Department, Lahore, Pakistan*

[4] *Superior University, Architectural Design Department, Lahore, Pakistan*

[5] *NAVTTAC, Lahore, Pakistan*

Corresponding author:
Norheen Amina
archiengg_noor@yahoo.com

Received:
May 24, 2023

Accepted:
October 23, 2023

Published:
March 22, 2024

Citation:
Riaz, H. et al.
Role of spatial efficiency, layout planning, and sustainability in the success of shopping malls.
Advances in Civil and Architectural Engineering,
2024, 15 (28), pp. 58-75.
https://doi.org/10.13167/2024.28.5

ADVANCES IN CIVIL AND ARCHITECTURAL ENGINEERING (ISSN 2975-3848)

Faculty of Civil Engineering and Architecture Osijek
Josip Juraj Strossmayer University of Osijek
Vladimira Preloga 3
31000 Osijek
CROATIA

Abstract:
Building multi-storey shopping malls has grown to be a very lucrative industry for investors in recent years. As a result, the success of a plaza depends on a variety of elements, including its design, security, appealing façade, and amenities. This study examined the structural systems, services, and architectural designs of a few of Lahore's prosperous plazas. Food courts and hyper malls provide essential functions that boost foot traffic and have the potential to revolutionise the way that entertainment amenities raise a mall's worth. Mixed-use multi-story spaces such as those that combine offices, apartments, and retail stores can also increase the efficiency of a mall in terms of sales and attractiveness. The assessment parameters in case studies include the gross area, circulation, parking area, toilet area, services area, and vertical transportation, with average values of 33,83 %, 22,00 %, 24,30 %,1,10 %, 3,05 %, and 4,60 %, respectively. These will assist future studies to determine the minimum threshold for success, making mall planning easier and more accurate. High-quality malls have higher occupancy because they offer better quality development, facilities, sustainable techniques, and amenities to support the overall development, along with shop sizes that suit international brands. This research defines the emerging trends and provides guidelines for the future architectural planning, structural systems, and services of shopping malls in Lahore to meet sustainable development goals and attract more shoppers.

Keywords:
multi-story shopping malls; architectural planning; spatial character; layout planning

1 Introduction

Shopping has been around for centuries. The trade of money for a service can be traced back to the time when humans first started to grow their own food. In the fifteenth century in the Middle East, shopping started to take place in bazaars. This was the start of the shopping malls we know today. The assessment of a mall is based on the utility and distinctive traits of the shopping centre [1]. When consumers have a need that is not yet fulfilled, they will seek alternatives to fulfil this need [2]. The consumer begins to evaluate the choices available to them. When their personal preferences are insufficient, family members [2] and brand awareness [3] can be used as a guide for their decision. Keller characterised the brand picture as "observations about a brand as reflected by the brand affiliations held in shopper memory" [4]. According to a survey conducted in 2006 by architects Imran Hussain and Rizwan Manzur, 70-80 % of Gulberg Lahore has been commercialised, and the remainder is destined to change as shown in Figure 1. Shopping plazas are one of the signs of the ostentatious new rich showing off their money and shifting from traditional shopping patterns [5].

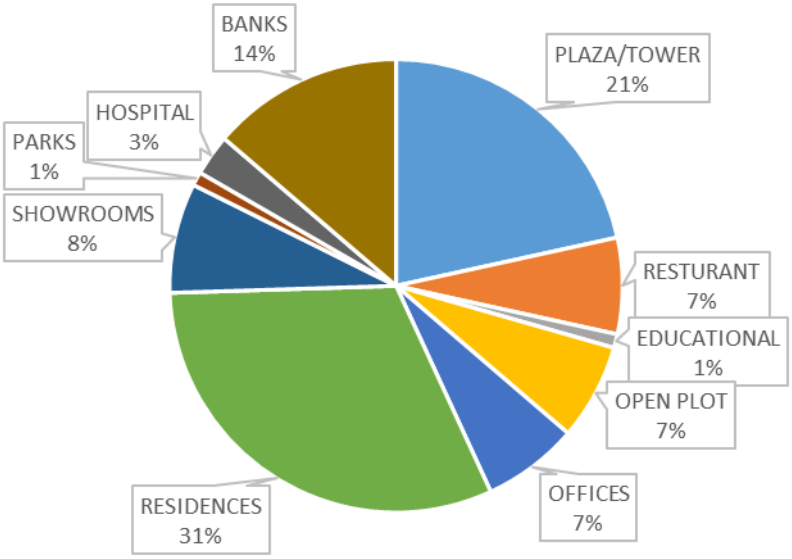


Figure 1. Comparative analysis of activities on main boulevard of Lahore [5]

Most of the malls constructed in India contain multipurpose facilities to provide benefits to consumers [6]. Bloch and Geuens described numerous factors that affect the success of a mall, such as its outlook, spatial planning, level of comfort, and the way it breaks up the monotony of the shopping experience and provides a desirable variety of products, along with a quality environment that promotes social interaction [7, 8].

Anuradha and Manohar discussed the shopping experiences of customers in two malls in Chennai (India). It was found that the motives for giving priority to an establishment included the shopping atmosphere, variety of products under one roof, the way entertainment facilities were used to achieve the best level of enjoyment for people, ample parking, an easy method to find your way during shopping, product quality, and advertisement of sales and products [9]. Spatial planning is one of the attractiveness attributes that play a vital role in the success of a shopping mall [10].

Disorientation and the feeling of being lost in a shopping mall are usually accompanied by some degree of dread and disappointment [11, 12]. Utilising clear signs provided the quickest rate of movement, and written signs were the best way to decrease navigation failures, e.g., wrong turns and the need to retrace your steps [13, 14]. It was found that a design with many sides influenced the capacity of individuals to explore a new environment [15]. Alongside the signage discussed by Smitshuijzen (e.g., "You are here maps") and any straightforward connections to a nonstop checked trail [14], scientists such as Cubukcu and Nasar have

considered other natural factors such as the design intricacy, separation, and milestones to be critical for effective wayfinding. The different components influencing wayfinding investigated by Vilar, Rebelo, and Noriega include mental factors such as the sentiment of recognition with a building [16, 17].

Malls are becoming a focal point of the local community, in part as a result of an emphasis on excellent dining and activities. Food-related space in existing buildings has increased from 5 % a decade ago to 10-15 % in several European markets (it is slightly lower in the U.S., averaging 8-9 %), but it is anticipated to reach 20 % in some of these areas by 2025.

Several advanced facade technologies have been found to be particularly effective in reducing energy consumption, including double-skin façades, building-integrated photovoltaics, façade greening systems, advanced shading systems, phase-change materials, and smart windows [18].

Another important and emerging factor that influences building users, as well as customers, is sustainability. Sustainability includes conserving natural and cultural resources for the future, averting climate change, and emphasising material sustainability initiatives like reducing the consumption of carbon and other resources, boosting biodiversity, safeguarding tangible cultural artefacts, and reviving intangible cultural traditions [19].

Conducting a study of regional stakeholders connected to the building sector in western Germany, Zabek, Hildebrand, Wirth, and Brell-Cokcan were able to identify the challenges and potential for the reuse and recycling of building materials [20]. They discovered, among other things, that important parties should work together by exchanging knowledge on recycling building materials and offering prototypes to boost consumer acceptability of used/recycled goods.

There are many different components to sustainable development. It can provide a useful framework for examining the many repercussions of urban growth. Sustainable development is regarded as the bottom line for environmental, social, and economic development. Sustainable urbanism is another name for the sustainable urban form. For the past twenty years, this wonderful idea has existed and inspired progress. Built environments and the construction industry use a significant amount of the energy and materials supplied by global resources. A sustainable shopping centre is a method of architectural design that emphasises the roles that structures play in both local and global ecosystems. Sustainable shopping seeks to minimise the negative environmental impact by enhancing efficiency and moderation in the use of materials, energy, and the development space, along with providing easy accessibility [21].

A sustainable future can be created in large part through the design of shopping malls. Design can go much beyond the process of business creation and incorporate ecological requirements. Design can enable the systematic integration of economic, social, and environmental elements within the framework of new and more sustainable patterns of production, marketing, distribution, and use by serving as a bridge between people, technology, and business. Design and location have the potential to be an effective innovation engine. It can assist companies in coming up with solutions that will encourage new social behaviours (such as accessibility versus ownership, sharing versus individual usage, and upgrade ability versus substitution), while still meeting societal and economic needs. In this way, it complies with the change in the complex world that is required from design culture, from eco-design to sustainable design [21].

A vertical functional mix results in synergies that are advantageous under the conditions of informal adaptation, but it also raises issues with privacy and security. A comprehensive grasp of the interrelated geographical, social, and economic logic involved is required to engage planners in productive dialogue [22].

The study will explore the future of the spatial planning of malls in cities like Lahore by analysing the trends through drawings, images, visual surveys, on-site observations, and comparative analyses. The objective of the study is to discover the emerging trends for shopping malls and the reasoning behind these.

2 Lahore: the study area

Regardless of interior and exterior forces like political unpredictability, energy deficiencies, and climatic debacles debilitating its financial solidity, numerous worldwide examiners stay positive about Pakistan's exponential development. For example, Jim O'Neill of Goldman Sachs considers Pakistan to be a part of his 'next eleven' economies, which he believes will be the drivers of worldwide development in future circumstances. Retail is the third biggest area in Pakistan and the second biggest employer, utilising 16 % of the work force currently available. All the components like increasing salaries, urbanisation, and buyer mindfulness allude to a conceivably vast market for products and ventures in Pakistan. Thus, no one is shocked that the retail sector, and retail exchange segment, has picked up energy in the previous decade. It can be estimated that retail advertising in Pakistan will produce changes on a large scale, as listed in Table 1, with a retail market of USD 42 billion and annual sales exceeding USD 105 billion (The Economist Intelligence Unit). Figure 2 shows the retail growth rate in Pakistan.

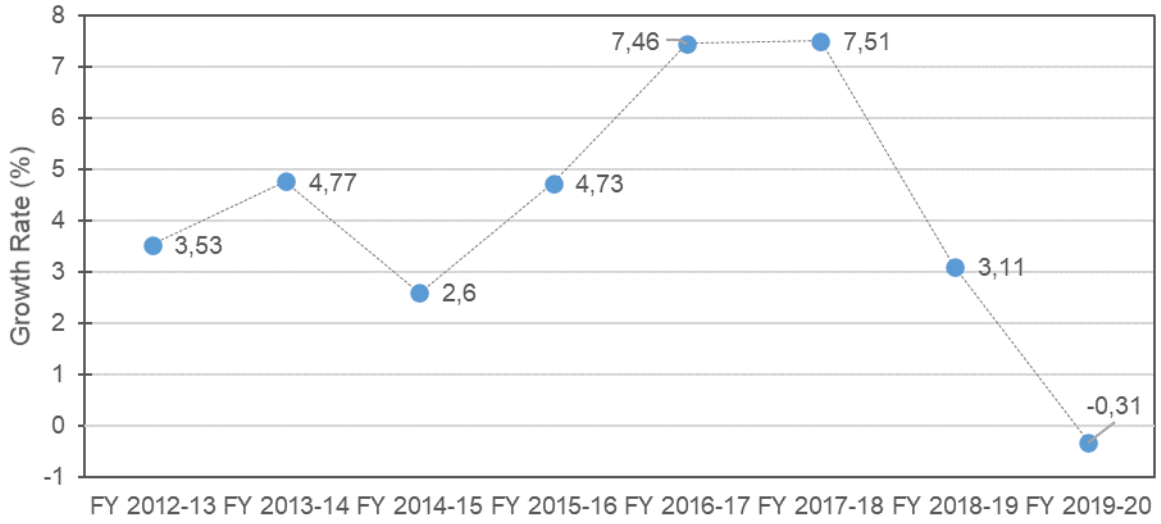


Figure 2. Growth in retail sales: State Bank of Pakistan

Conventional “kiryana” (grocery stores) have dominated purchasers' shopping for food in Pakistan. However, conventional businesses have gradually started to lose their appeal against the various options available as a result of their failure to offer grade A building structures at better rates. Among the fresher business territories and markets in Lahore that are set apart by substantial retail action, Gulberg and DHA are on top, particularly for branded stores. Yet, at the same time, they do not have the facilities required by worldwide brands. This implies that there are lucrative land speculation opportunities in existing development nationwide. In this context, the Lahore Development Authority (LDA) is giving permission for use changes from residential to commercial in areas under its control in light of the 2001 policy (since 2001, there has been rapid commercialisation). The shopping centres are not professionally managed and lack a properly planned tenancy mix concept. Only a few developments meet the international mall standards, with no anchor tenant to drive and attract major foot traffic.

Branded clothing, apparel and fabrics, electronics, and jewellery have all had average needs for store space ranging from 180 to 250 square feet. The typical lease terms provided to such renters range from three to five years. The investors/tenants have been obliged to move their businesses to more commercially viable locations as a direct result of LDA's decision to demolish illegal plazas. This has further sparked the latent desire for retail development. Figure 3 shows the current and future retail supply of various areas.

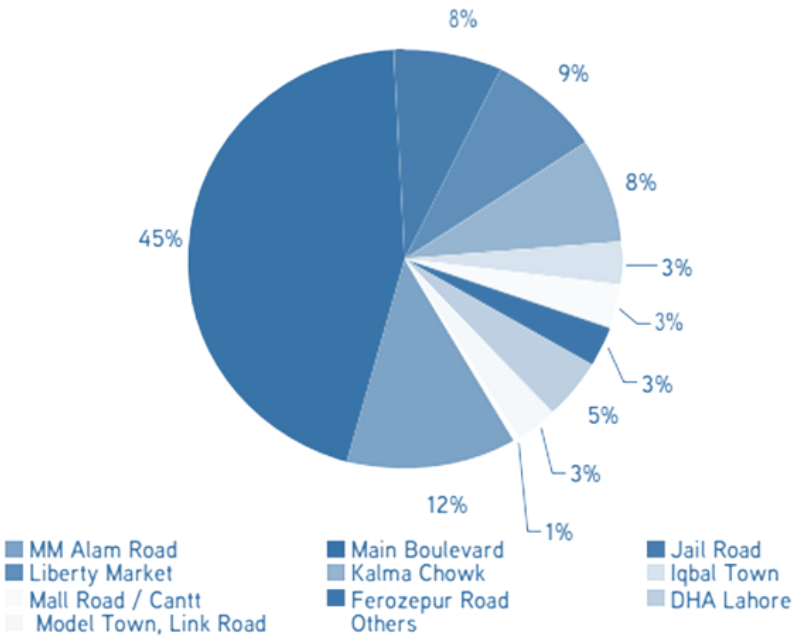


Figure 3. Area-wise existing retail supply

Like any urban area, by tradition, Lahore is home to a variety of functions, including housing, communal interaction, and the retail sales of commodities and services. The comparative significance of each of these functions has altered over time, and these alterations have shaped new demands for land, floor space, services, and a variety of associated amenities. Historically, the core of commercial activity was the walled city, Mall road, Icchra, and Anarkali. New planning concepts emerged in Lahore, resulting in changes over time from walkable congested shopping bazaars to open drive-in markets like the Liberty market, with the evolution of a better shopping environment. The major issue with walkable and drive-in shopping areas is parking. Initially, there was no planning for parking. Then, a parking plaza was built for the Liberty market, but it was insufficient to cater the load. However, a sudden change was seen with the launch of Pace in 1994. Despite that, a new culture of shopping malls has quickly advanced in Lahore, which has very distinctly become a home for glorious multi-story plazas for retail stores, along with organised parking, shopping outlets, workplaces, and even flats at times, which are typically located on the top floors.

3 Methodology

To understand the subject matter, the adopted methodology used books, research papers, theses, and other relevant material to develop a detailed strategy. As shown in Figure 4, the literature was compiled using search results from significant academic publisher databases. Scanning these databases also revealed relevant publications that were cited in the papers as references. The searches utilised a variety of keyword combinations, including space planning, layout planning, architectural planning, and sustainability in construction. The keywords and abstracts from the search results were checked to determine whether the articles had any bearing on the topic of the study.

This methodology outlined in Figure 4 was used to investigate the future spatial planning of malls in large cities with increasing populations (like Lahore) by analysing the trends through drawings, images, visual surveys, on-site observations, and comparative analyses. The objective of this study was to discover the emerging trends for shopping malls and the reasoning behind them. The selection criteria were based on the following parameters: malls that were modern and well equipped with respect to the services offered and the quality of the

environment. Malls accommodating local and international brands were selected because these have a significant impact on the spatial character of the overall shopping area.

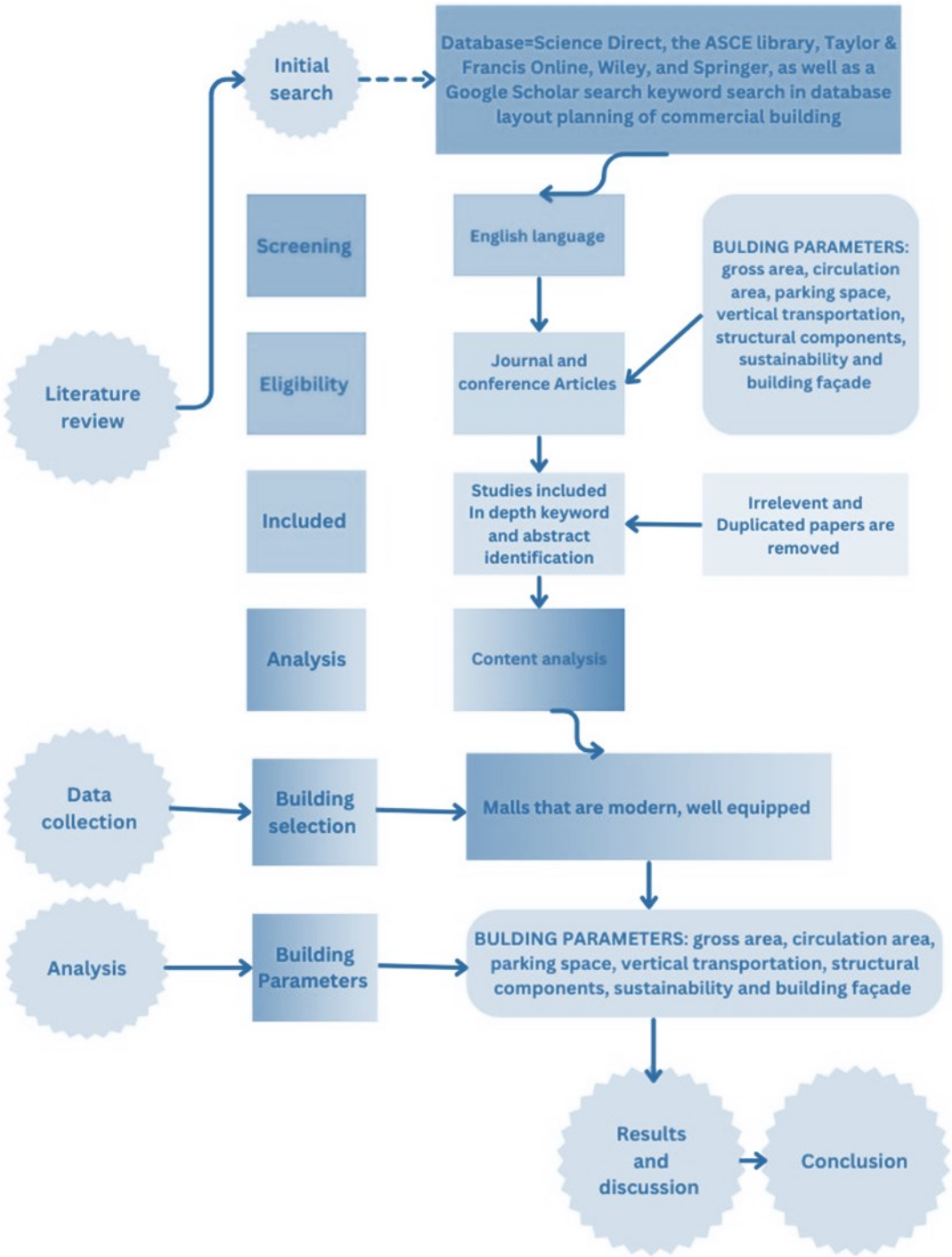


Figure 4. Framework of methodology

The data also included collected documents and drafts produced by various institutions and organisations, as listed in Table 1. The collected data show that the gross area, circulation area, parking space, vertical transportation, structural components, and building façade play key roles in the success of any mall. Some average minimum and maximum values were observed and suggested as guidelines for prevailing trends.

Table 1. Data sources for selected malls

Data source	Type of data	Utility of data	Purpose
primary source	documents & drawings. offices visits &chronological orders from authorities	to study architectural and structural aspects	to analyse spatial and structural aspects
guided interview	reports and authorities visits	interpretation of data accordingly and corroborated data from other sources	describe aspects that effect architectural and form aspects of malls
observations	observations with reference to building context	general observations made on visits of malls	changes in trends with passage of time

4 Case studies of shopping malls in Lahore

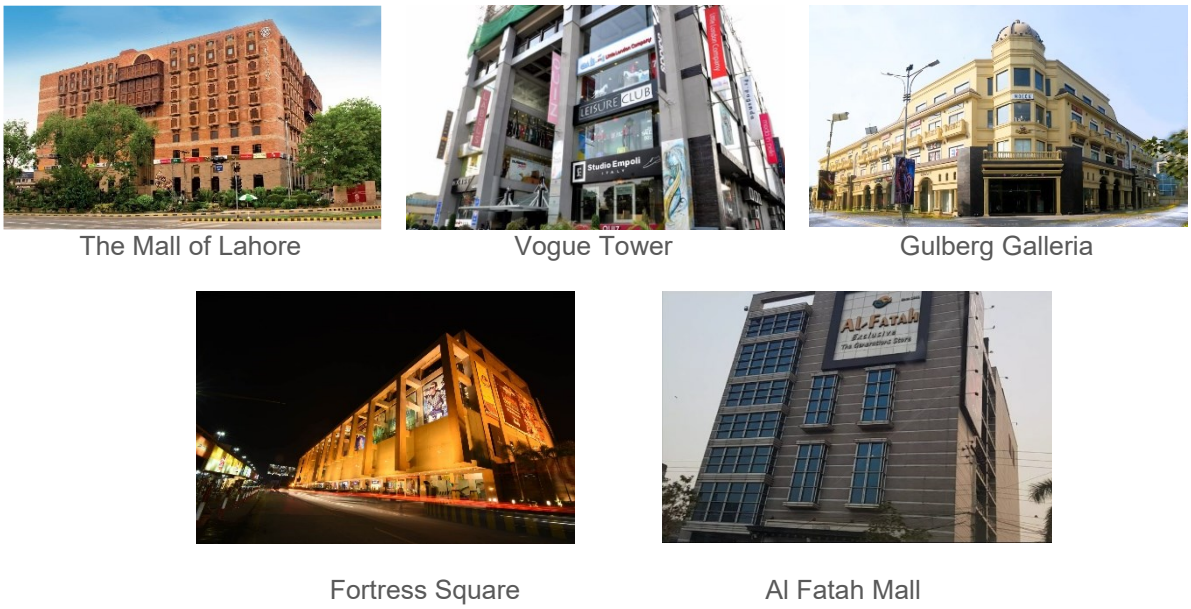
This study revolved around the leading shopping malls of Lahore, with comparative analyses of their architectural aspects, structural and facade treatments, etc. Quality malls such as the Xinhua Mall, Bahria's Mall of Lahore, and the Fortress Stadium Market benefit from the presence of most of the major brands doing business in the city and enjoy high occupancy levels as the result of the presence of an anchor tenant. Limited shopping centres have properly organised covered parking areas, with most utilising a free/paid parking area at the encroachment area in front of the shopping centre. Estimates show that approximately 148 million m^2 of mall space, equivalent to 40 % of the existing space, will be further injected into the city's retail space within the next 2 to 3 years (Colliers International Research). Table 2 contains the morphology of the case-study buildings in Lahore.

Table 2. Morphology of malls selected for analysis in Lahore, Pakistan

	Name	Architect	Type	Construction year	Proclaimed environmental benefit	Architectural style
1	The Mall of Lahore	AHR Architects	Commercial	2016	Sustainable Site	Traditional architecture amalgamation with modern style
2	Vouge Tower	Nayyar All Dada	Commercial + Residential	2013	Minimize environmental footprint by minimizing waste and energy demand	Modern
3	Al Fatah Mall	Arcop Pvt. Ltd	Commercial	2009	Reduce energy consumption	Modern
4	Fotress Square Mall	Nayyar Ali Dada	Commercial		Minimize consumption by passive cooling and sustainable site	Modern
5	Gulberg Galleria	Nazeeha Ayaz Architects	Commercial	2013	Social sustainability	Colonial

Quality malls such as the Xinhua Mall, Bahria's Mall of Lahore, and the Fortress Stadium Market benefit from the presence of most of the major brands doing business in the city and enjoy high occupancy levels as the result of the presence of an anchor tenant.

The façade features of selected buildings are illustrated in Figure 5. The Vogue Tower, Fortress Square Mall, and Al Fatah Mall were inspired by modern architecture. However, the Mall of Lahore is an amalgamation of traditional and modern styles. The Gulberg Galleria represents a colonial architectural style that inspires viewers and shoppers. The selected buildings have high user interest and are located in different areas within Lahore. Selected building views are shown.



The Mall of Lahore | Vogue Tower | Gulberg Galleria

Fortress Square | Al Fatah Mall

Figure 5. Architectural views of selected buildings

Pictures of the Mall of Lahore are shown in Figure 6. This mall is perfect in terms of its location and visibility, as well as the level of services it provides. The shops are flexible in terms of their interiors and displays.

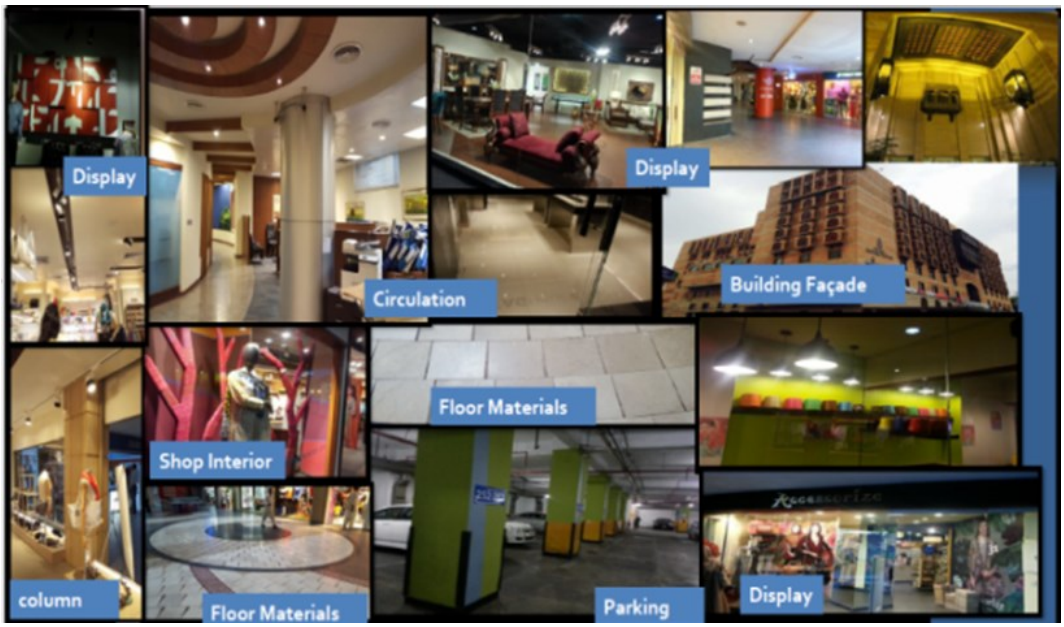


Figure 6. Architectural views of the Mall of Lahore

As shown in Figure 7, the overall space planning of Al Fatah was based on economy, with large facilities accommodated in small spaces. Different themes were developed for different floors. All of the services are sufficient because it was initially a superstore with a well-designed compact plan, where function strictly follows the structure.

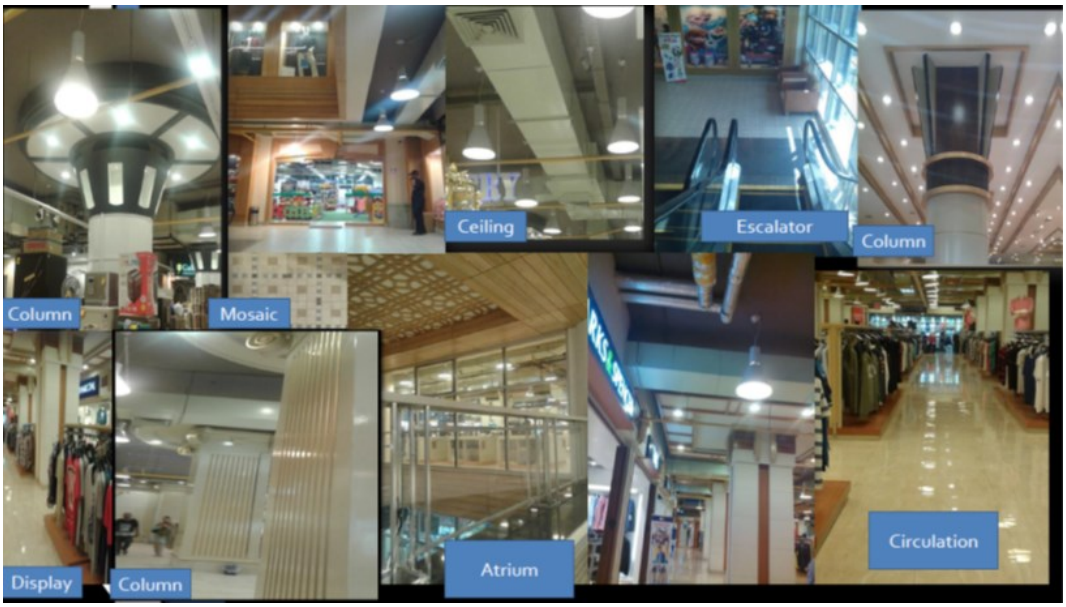


Figure 7. Architectural plans and views of Al Fatah Mall

Fortress Square Mall is shown in Figure 8. The overall shopping area is large in comparison to other malls, with the spatial planning following a grid-system design. There is an open parking concept, as well as covered parking. Parking is accommodated on the 2nd and 3rd floors so that users can view the facilities while parking their cars. Thus, it functions not merely as a service but becomes a part of the planning of the gross area.

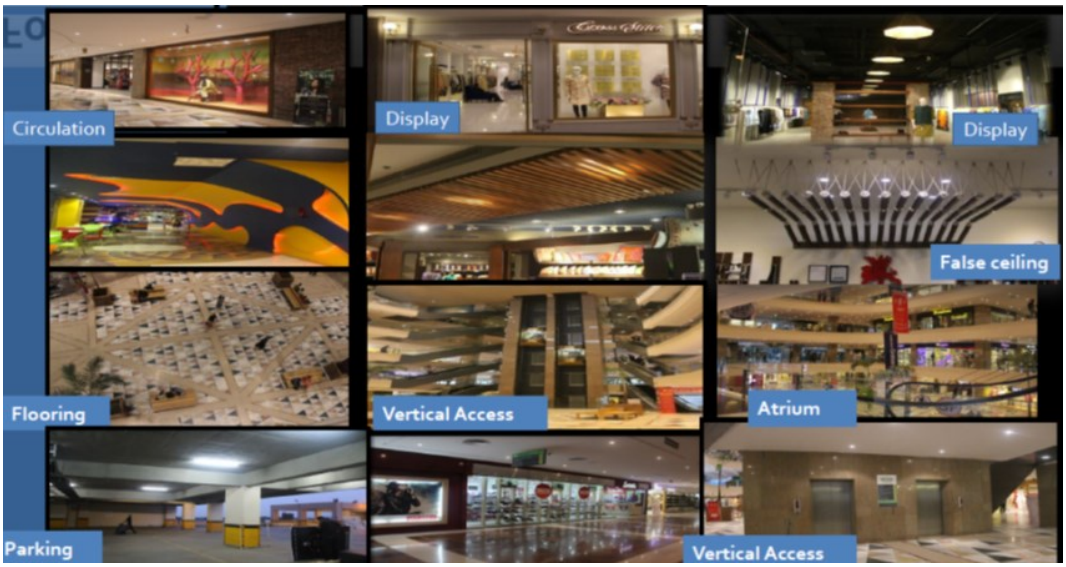


Figure 8. Architectural views of Fortress Square Mall

Vogue Towers is a compound, with over forty retail showrooms, underground parking levels, and a terrace food court. It also contains Lahore's first chain multiplex cinemas. The overall gross area is double the circulation of the building, with its spatial planning again strictly following the structure. The other services and vertical transport rise to international levels, as indicated in Figure 9.

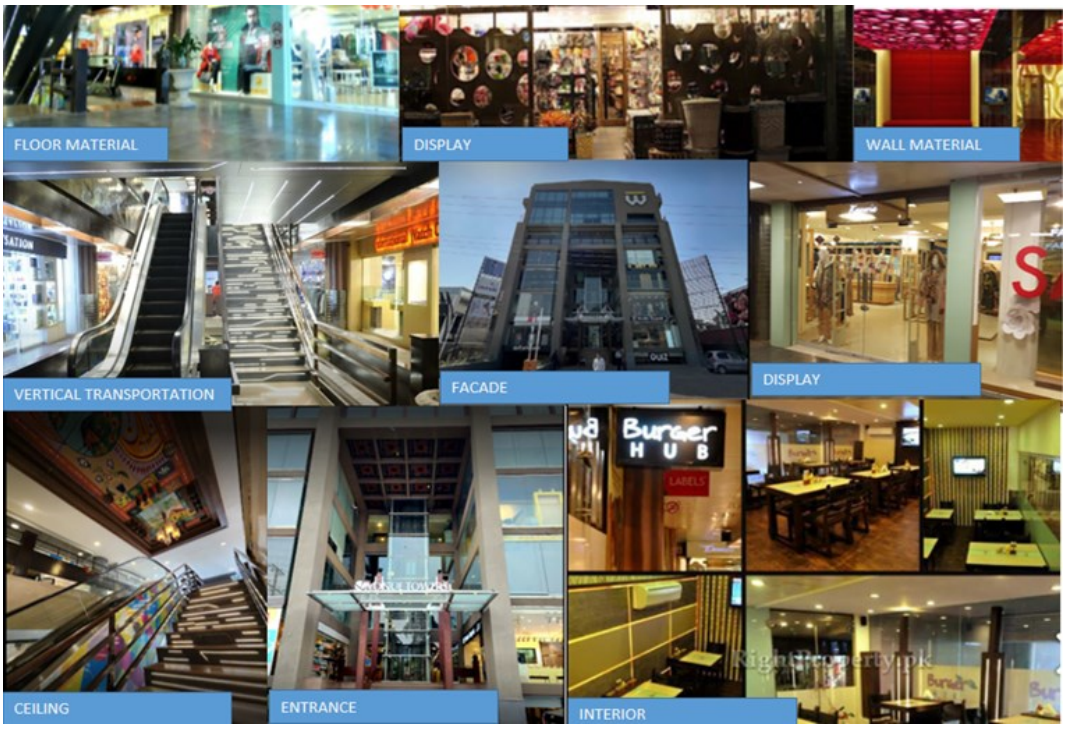


Figure 9. Architectural views of Vogue Towers Mall

As displayed in Figure 10, the Gulberg Galleria is a midrise colonial-style mall with a unique impact. The building plan utilises an l-shape, with all of the working areas accommodated in this shape. Vast space should be given for shopping purposes.

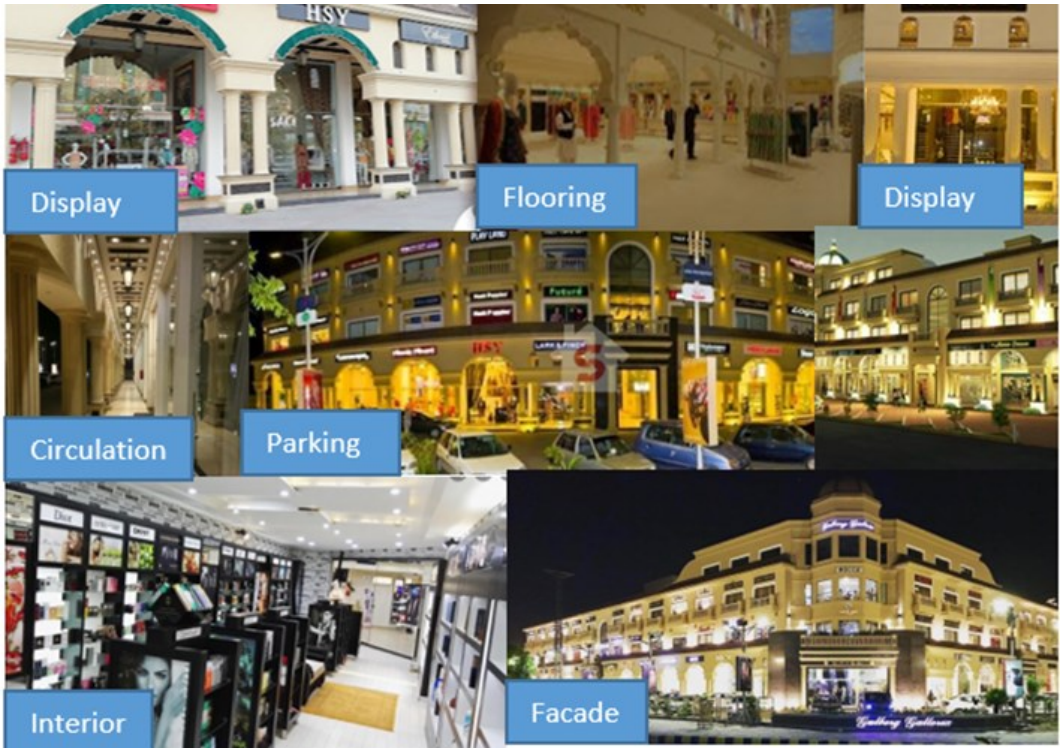


Figure 10. Architectural views of Gulberg Galleria

5 Results and discussion

The literature and collected data showed that the gross area, circulation area, parking space, vertical transportation, and other services, along with sustainability techniques and the building façade, play key roles in the success of any mall. In this regard, some average minimum and maximum values were determined and suggested as guidelines for existing prevailing trends. The collected data, like the data on the structural components, depict practical trends in the case studies, but these could not be generalised for other malls because of the complicated technical details and design constraints. Similarly, factors that are not basic components of any mall but play roles in entertainment and better facilitation for users could be considered in future studies such as those on food courts and hyper malls and play key roles in enhancing the foot traffic of any mall.

5.1 Gross/shop area

With the multiplication of global brands inside the city, plazas have suddenly turned out to be aesthetically unpleasent, with constrained floor areas and limited variety. For example, worldwide department store chains like Debenhams, Imprints, and Spencer, along with fashion giants like Zara and H&M, would require no less than 278,71-1.858,10 m^2 of floor space for display before they would proceed with doing business in Pakistan. The overall trend for the gross or sales area of shopping malls under discussion is 33,83 % on average, with a minimum of 16 % and maximum of 50 %, as shown in Figure 11.

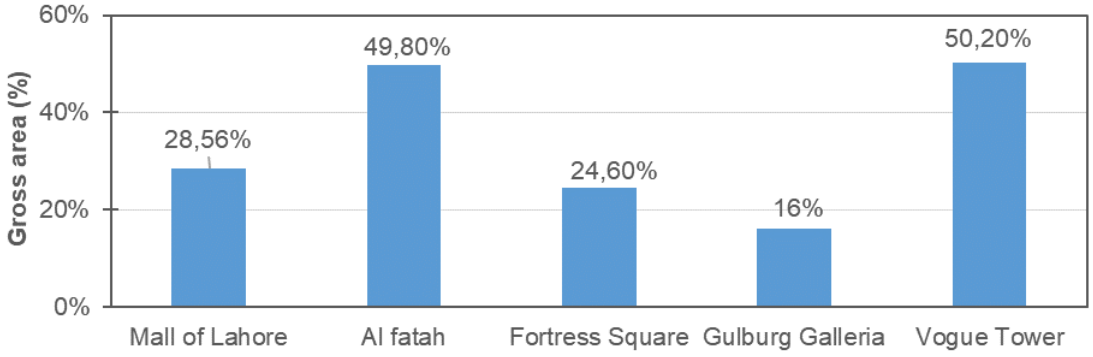


Figure 11. Gross areas of selected malls

5.2 Circulation area

Navigation is one of the key recall values of a mall and has a large impact on the visitor experience. It is advised to keep away from multiple aisles and confusing pathways, and have instead a unified floor plate across all the levels. The placements of escalators and elevators need to be focused on convenience and safety, rather than forcing visitors to cover more of the floor plate circulation area. This is a significant factor in attracting users. Gloomy congested corridors are no longer a trend. Corridors provide not only a mode of movement but also accommodate subsidised amenities, kiosks, and stalls to attract users, with minimum, average, and maximum percentages of 16 %, 22 %, and 32 %, respectively. In some malls, their net space is even equal to the gross circulation area, as shown in Figure 12. Factors such as window shopping inside a mall make it necessary to accommodate such window shoppers without blocking the paths of those using the circulation spaces as connections from one point of the mall to another. If this is not done, window shoppers will not be comfortable doing his/her window shopping in a constrained space, while at the same time, other shoppers will feel that the path is too narrow.

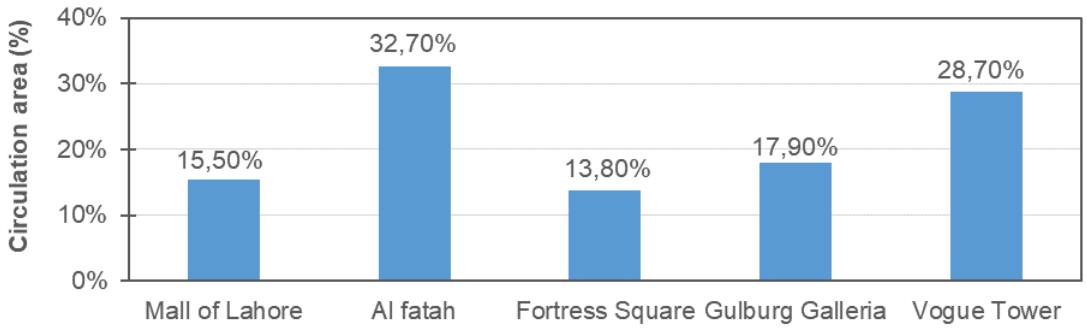


Figure 12. Circulation areas of selected malls

5.3 Parking area

Although there is a lack to a certain extent of huge shopping complexes with facilities like elevators, escalators, walking spaces, wide corridors, clean toilets, and plentiful covered parking, the demand for these is in the process of being fully accommodated. Covered, convenient, and secure parking is needed by the users of malls, and will increase their number. Figure 13 shows that an average of 24,3 % of their area is dedicated to parking in the malls included in this study.

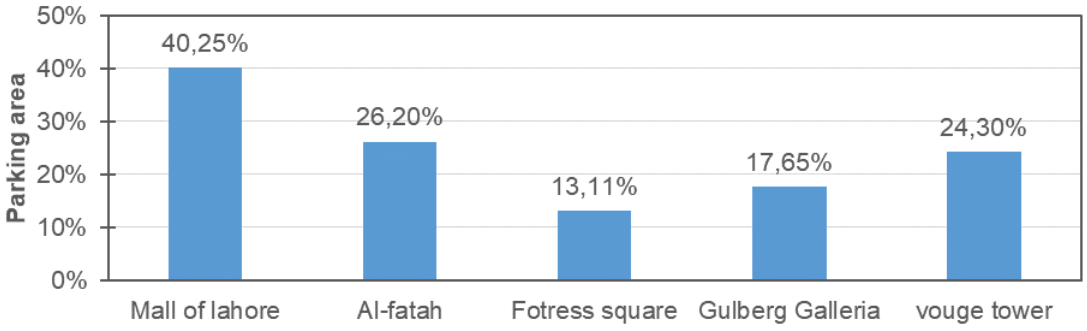


Figure 13. Parking areas of selected malls

5.4 Public facilities

The public facilities should be neat and clean to avoid unhygienic conditions and should be provided in clearly marked locations to accommodate users. An average of 1,1 % of the area is dedicated to toilets in the malls considered in this study, as seen in Figure 14. However, the minimum area is 0,51 % and maximum 2,30 %.

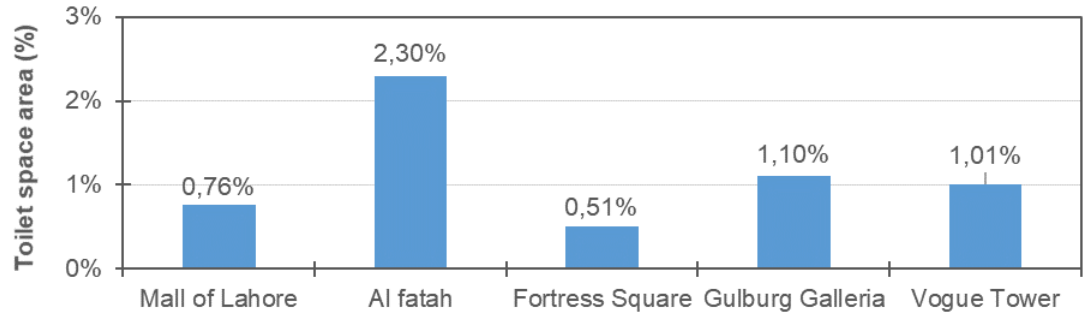


Figure 14. Toilet space areas of selected malls

The service areas serve as the backbone of a mall. If these are not well integrated, the overall appeal and glamour of the mall will be ruined. The un-obstructed supply of electricity and central air-conditioning systems are extremely important. Even the lighting creates an overall ambience in a mall that makes it more attractive and improves the visibility. Other services include security and emergency systems, which are extremely important in view of the current prevalence of security threats. The minimum, maximum, and average areas reserved for these services are 0,73 %, 7,50 %, and 3,00 %, respectively, as depicted in Figure 15.

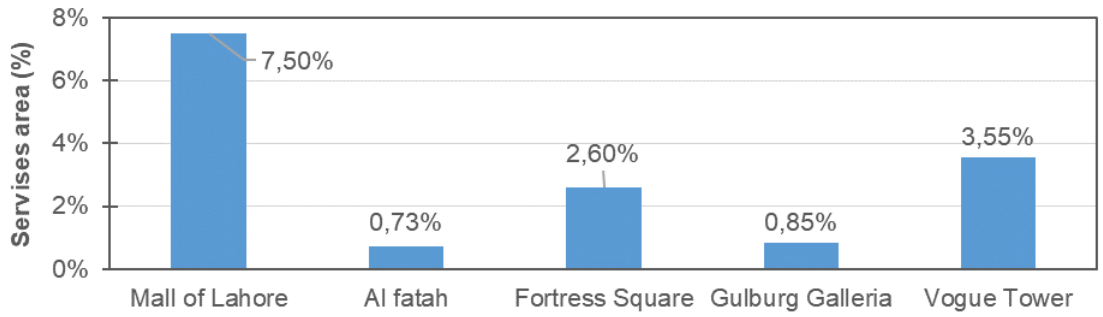


Figure 15. Service Areas of Selected Malls

5.5 Vertical transportation

All of the malls considered have staircases, escalators, passenger elevators, and cargo lifts for the convenience of users, allowing them to travel efficiently through the multi-story building in the minimum time and spend more time in shopping and entertainment. The minimum, maximum, and average areas dedicated to vertical transportation are 3,30 %, 7,15 %, and 4,60 %, respectively, as shown in Figure 16.

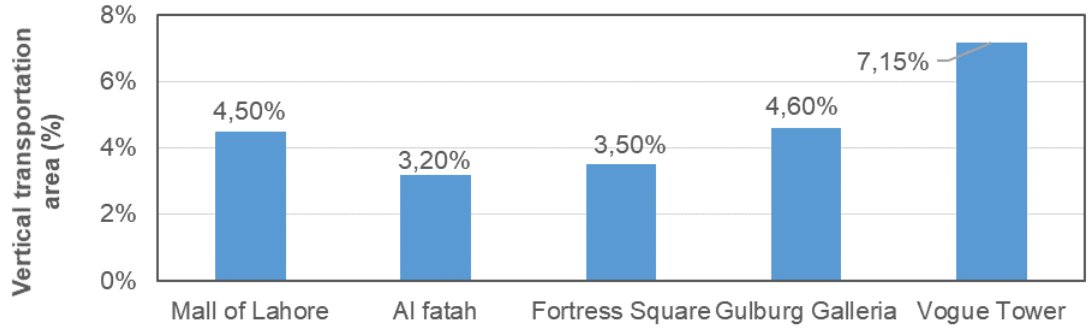


Figure 16. Vertical transportation areas for selected malls

5.6 Structural details

The general standards for reinforced-concrete frame structures were practically and successfully implemented in all the selected shopping malls. In addition, the buildings were designed to perform multiple functions, with various dead loads and the capacity to handle live loads, even under catastrophic conditions. The square columns used have an average size of 0,762 × 0,762 m, while the circular columns have a diameter of 0,91 m. The minimum centre-to-centre distance between columns is 4,12 m, while the maximum is 8,54 m.

The average grid size is 6,70 × 7,62 m. Although the planning grids varied between projects, the values presented in Table 3 are generalised with respect to the case studies and future projects, which should be designed per their design and structural constraints.

Table 3. Structural details of selected malls

Structural details	Mall of Lahore	Al-Fatah Mall	Gulberg Galleria	Fortress Square	Vogue Tower
Column size (m)	0,61 × 0,61 0,69 × 0,69	1,52 × 0,61 0,61 × 0,61	0,914 × 0,610 0,914 × 0,914 0,610 × 0,914	0,69 × 0,69 0,46 × 1,23	0,610 × 0,914
	0,76 × 0,76	0,381 × 0,420 1,1 diameter 0,762 diameter	1,1 diameter 0,61 diameter	0,762 x 0,460 0,914 diameter	1,520 × 0,610
Column shapes	rectangular circular	rectangular, circular, elliptical	rectangular, circular	rectangular, circular	rectangular circular
Grid size (m)	4,20 × 7,00	8,32 × 9,80	4,97 × 4,72	5,31 × 4,60	7,77 × 6,63
Vertical Axis (m)	7,00	9,75; 7,32; 1,95	4,84; 4,69; 4,67; 3,51; 4,42; 4,76; 8,92	3,79; 4,60; 6,1; 6,70; 7,62	6,63
Horizontal axis (m)	4,20	4,10; 8,34; 5,43; 5,64	4,94; 4,99; 3,51; 5,45	3,20; 5,3; 6,10; 7,62	7,77
Ramp gradient	7,78	8,00	7,34	6,70	7,50
No of lifts	10	4	7	2	4
No of escalators	4	5	2	2	1
No of stair cases	6	4	3	2	3
Vertical transport	20	13	12	6	8
Expansion joint (m)	50,30 × 18,90	-	50,40 × 45,7	19,10 × 22,44	-

5.7 Green initiatives

Vogue Towers is committed to sustainable and responsible practices, with several green initiatives to minimise the mall's environmental footprint. The mall has implemented several measures to reduce its energy consumption, such as energy-efficient lighting and HVAC systems. The mall also has a waste management system, with separate bins for recyclable and non-recyclable waste. The mall's commitment to sustainability sets it apart from other shopping destinations in the city. The parking area is also equipped with modern technology such as automated ticketing and guidance systems, ensuring a hassle-free parking experience.

The Al Fatah Mall has also introduced many green features, including intelligent centralised lighting control, an integrated building management system, and a parking guidance system, which guides a vehicle to the nearest vacant parking space using digital sensors, indicators, and a control panel designed with a four-wire system. A low-cost central battery system has also been installed for emergency lighting, which uses intelligent lighting control logic.

Its high visibility, central location, impactful brand exposure, high foot traffic, and provision of designer fashion make the mall of Lahore sustainable. There is ample parking space available on the premises, with a capacity of 400 cars.
The Gulberg Galleria also offers facilities and services to its customers that are top notch, with high end Pakistani brands and designers, with women and men alike enjoying the great ambiance and social sustainability (entertainment). The wide foreground provides ample parking space and a full view of the building. The site is easily accessible because the mall was constructed on a corner plot at the entrance of Gulberg.
Green techniques were introduced by implementing vertical and horizontal projected elements. A spacious foreground is available for parking and external views.

5.8 Building façade treatment

These buildings have a modern style, with the wide use of glass and modern materials, as illustrated in Table 4. Special attention was given to the construction of the corners because they have to make connections with the other sides of the building and play significant roles in attracting the viewer's eye. Today, aluminium sheets are used, along with glass. The tall and long facades of the buildings are managed in a very attractive way. For example, the height has becomes an aesthetic element. Because of the history of Lahore, traditional architecture with a modern touch is used to give a contemporary look.
To play with shade and shadows, a new method was introduced to make the main entrance and other parts of the building more prominent in the form of false elements. In addition, Pakistan is facing an energy crisis. Therefore, designers are trying to use natural light and central air conditioning systems to enhance the workability of buildings, but large glass facades increase the energy consumption and are not well suited to the local climate of Lahore, which is harsh and extreme not only in terms of high temperatures in summer, but also extremes during the cold season.

Table 4. Building façade treatment

Mall	Façade treatment
Mall of Lahore	Use of gutka on exterior windows has given some traditional modified form of jahroka. Less use of glass can be seen. Symmetrical structure. Building architecture is traditional style with modern touch make it unique attractive.
Al-Fateh	The exterior of the building is divided into four parts with respect to the elevation of the building. In the north side of the building which is the front side of the building the architect used a lot of glass in order to attain the maximum daylight to the building. In the exterior the designers used the following materials; Curtain glaze glass aluminum and composite panel.
Fortress Square	Use of Perforated glass panels on the walls. Granite on projected elements. Use of false elements. Contemporary architectural is used to make façade interesting.
Gulberg Galleria	Architectural elements like glass windows on main entrance and Columns and colonial elements are used repeatedly. Colonial style architecture. Corner treatment is done to emphasize building entrance and make it more appealing.
Vogue tower	Glass is the main element, columns and beams are exposed at exterior, steel structure is also used also the use of dark colors make it more eye catching. Overall symmetrical in façade treatment.

6 Conclusions

Initially, the central business district of Lahore shifted from old Lahore and Mall road to Gulberg and the Defence Housing Authority (DHA), but now retailing is gaining immense popularity in Lahore's Central Business District (CBD), which is spreading to defence housing society and other planned societies as well. The very first point that can be concluded is that the retail sector has a bright future in Pakistan. In particular, the literature shows the scope for improvement in Lahore as the provincial capital of Punjab. The construction of mega projects

will soon begin in Lahore because of the ample space for the retail sector. This will attract international brands, and some bylaws are being relaxed. The Emporium Mall and Packages Mall are some examples of these projects. The dark, gloomy, and congested environment of the typical plaza with its low aesthetic and service levels is no longer the choice of the people and has become unsuccessful in all respects. On the other hand, malls, and especially those constructed after 2005, are comparatively spacious and well lighted, providing services like emergency exits, HVAC, and firefighting systems, which make malls function more effectively. Spatial efficiency plays an important role not only in terms of the functioning of a mall but also in terms of its level of success, which can be achieved by placing shops and other attractions in the view of users, providing convenience without tiring shoppers. There should also be ample circulation or way finding in a mall to allow for window shopping, along with subsidised corners and kiosk placement that will attract users. Way finding is not only significant for the process of navigation but should provide users with opportunities to enjoy the facilities within a mall with greater ease.

Vertical transport systems like lifts, escalators, and stairs are also provided for the convenience of users. The vertical growth trend shows that malls with more than 10 stories are commonly built. In addition, the goods in a mall should be placed so that everything is visible to users at once and be inviting to its visitors. Public amenities like public toilets and play areas should be provided for the convenience of users. Appropriate well-organised, and clearly marked parking or valet parking plays a significant role in attracting visitors.

A vital contribution to the success of any mall is made by allied facilities like food courts and cinemas, which are not only sources of entertainment but also increase the likelihood that people will visit the mall. The significance and role of food courts and hyper malls are key elements to increase foot traffic, which could also be a game-changer. This is similar to how entertainment facilities enhance the value of any mall. Although they are not a compulsory factor for design, they are now trending.

Similarly, mixed-use multi-story buildings, like office, apartment, and shopping combinations, can also increase the efficiency of a mall in terms of the sales and attraction levels. The inviting areas of the enormous shopping complexes considered provided services like escalators, extensive corridors/walking spaces, clean toilet areas, and adequate included parking. The parameters considered in the case studies included the gross area, circulation, parking area, toilet area, services area, and vertical transportation, which had average values of 33,83 %, 22,00 %, 24,30 %,1,10 %, 3,05 %, and 4,60 %, respectively. These will be helpful in future studies as minimum thresholds for successful mall planning with greater ease and accuracy. This means that these guidelines are standards that are used in practice and will definitely act as minimum thresholds. High-quality malls have higher occupancy rates mainly because they offer better quality facilities and amenities that support the overall development, along with shop sizes that suit international brands. The average ramp gradient is 1:7,9; which is close to the standard value of 1:8. The total number of vertical transport facilities, including passenger lifts, cargo lifts, escalators, staircases, and fire exits, is 14 on average. However, for a new project, values should be calculated based on the occupancy rate and time. The above-mentioned values could act as thresholds in practice, with the understanding that smaller values will not be functionally efficient. The distances for expansion joint provided are more than 15,24 m along the longer axis and 18,29 m along the shorter axis. With reference to building facade treatment, the Mall of Lahore and Gulberg Galleria were designed as architectural style amalgamations of traditional and modern architecture, while a colonial architectural style facade is evident in the latter example. The rest of the malls considered have modern and contemporary looks, with the use of excess glass on the facade, along with cladding and false elements. Sustainability is an important emerging trend, which is implemented in newly constructed buildings, and is drawing much attention globally. Energy consumption minimisation, sustainable site selection, waste reduction, and the inclusion of open spaces and greenery are green initiatives being implemented in the studied building.

The majority of the upcoming commercial towers in Lahore will be comprised of 4-7 floors and will give consideration to adequate parking bays, as well as wider corridors, maintenance

contracts, and facilities. In addition, the upcoming malls will give greater regard to the space requirements of anchor and sub-anchor tenants.
The high-quality design of public spaces is also a key consideration for sustainable communities. The significance of a user-friendly public space, which provides many opportunities for contact, will add to the aesthetic and functional quality. For the elderly and disabled, a well-conceived and inclusive design approach should be implemented.
Based on the identification of existing trends in architectural planning, structural systems, and services, this research defined the emerging trends and provided guidelines for the future architectural planning of shopping malls in Lahore for architects, architectural engineers, structural engineers, services designers, builders, real estate developers, urban planners, and shopping mall managers. These should consider the design features of urban forms to meet sustainable development goals and attract more shoppers.
However, this research had some limitations. This study was based on one city in Pakistan, which was Lahore. No specific age group or gender were selected while collecting the data.,

Acknowledgments

The authors are grateful to the architectural engineering and design department and the building and maintenance department of UET Lahore for their cooperation.

References

[1] Finn, A.; Louviere, J. J. Shopping center image, consideration, and choice: Anchor store contribution. *Journal of Business Research*, 1996, 35 (3), pp. 241-251. https://doi.org/10.1016/0148-2963(95)00129-8
[2] Altekar, D.; Keskar, A.; Vidyapeeth, D. Y. A Study of the Factors Impacting the Buying Decision Process vis-à-vis Specified Consumer Durables in NOIDA. *Journal of General Management Research*, 2014.
[3] Hoyer, W. D.; Brown, S.P. Effects of brand awareness on choice for a common, repeat-purchase product. *Journal of Consumer Research*, 1990, 17 (2), pp. 141-148. https://doi.org/10.1086/208544
[4] Keller, K. L. Conceptualizing, measuring, and managing customer-based brand equity. *Journal of Marketing*, 1993, 57 (1), pp. 1-22. https://doi.org/10.1177/002224299305700101
[5] Nygaard, A.; Utgård, J. En kunnskapsbasert varehandel. Handelshøyskolen BI, Accessed: March 20, 2024. Avalable at: https://biopen.bi.no/bi-xmlui/handle/11250/94226 [In Norwegian]
[6] Jhamb, D.; Kiran, R. Emerging Trends of Organized Retailing in India: A Shared Vision of Consumers and Retailers Perspective. *Middle-East Journal of Scientific Research*, 2012, 11 (4), pp. 481-490.
[7] Bloch, P. H.; Ridgway, N. M.; Dawson, S. A. The shopping mall as consumer habitat. *Journal of Retailing*, 1994, 70 (1), pp. 23-42. https://doi.org/10.1016/0022-4359(94)90026-4
[8] Geuens, M.; Brengman, M.; s'Jegers, R. An exploratory study of grocery shopping motivations. In: *European advances in consumer research*, Gröppel-Klein, A. (ed.). Valdosta: Association for Consumer Research; 2002, pp. 135-140.
[9] Anuradha, D.; Manohar, H. L. Customer shopping experience in malls with entertainment centres in Chennai. *African Journal of Business Management*, 2011, 5 (31), pp. 12319-12324.
[10] Wong, G. K. M.; Lu, Y.; Yuan, L. L. SCATTR: an instrument for measuring shopping centre attractiveness. *International Journal of Retail & Distribution Management*, 2001, 29 (2), pp. 76-86. https://doi.org/10.1108/09590550110381535
[11] Brösamle, M.; Hölscher, C. Architects seeing through the eyes of building users. In: *Spatial Cognition in Architectural Design*, Barkowsky, T.; Bilda, Z.; Hölscher, C.; Vrachliotis, G. (eds.). Melbourne, Australia: SFB/TR 8 Spatial Cognition; 2007.

[12] Vilar, E. et al. Using environmental affordances to direct people natural movement indoors. *Work*, 2012, 41 (Supplement 1), pp. 1149-1156. https://doi.org/10.3233/WOR-2012-0295-1149
[13] O'Neill, M. J. Effects of Signage and Floor Plan Configuration on Wayfinding Accuracy. *Environment and Behavior*, 1991, 23 (5), pp. 553-574. https://doi.org/10.1177/0013916591235002
[14] Vilar, E.; Rebelo, F.; Noriega, P. Indoor human wayfinding performance using vertical and horizontal signage in virtual reality. *Human Factors and Ergonomics in Manufacturing & Service Industries*, 2014, 24 (6), pp. 601-615. https://doi.org/10.1002/hfm.20503
[15] Slone, E. et al. Floor plan connectivity influences wayfinding performance in virtual environments. *Environment and Behavior*, 2015, 47 (9), pp. 1024-1053. https://doi.org/10.1177/0013916514533189
[16] Cliburn, D. C.; Rilea, S. L. Showing users the way: Signs in virtual worlds. In: *2008 IEEE Virtual Reality Conference*, Lin, M.; Steed, A.; Cruz-Neira, C. (eds.). March 8-12, 2008, Nevada, USA, Institute of Electrical and Electronics Engineers, Inc.; 2008.
[17] Gärling, T.; Lindberg, E.; Mäntylä, T. Orientation in buildings: Effects of familiarity, visual access, and orientation aids. *Journal of Applied Psychology*, 1983, 68 (1), pp. 177-186. https://psycnet.apa.org/doi/10.1037/0021-9010.68.1.177
[18] Zhou, Y.; Herr, C. M. A Review of Advanced Façade System Technologies to Support Net-Zero Carbon High-Rise Building Design in Subtropical China. *Sustainability*, 2023, 15 (4), 2913. https://doi.org/10.3390/su15042913
[19] Lew, A. A.; Ng, P. T.; Ni, C.-C.; Wu, T.-C. Community sustainability and resilience: similarities, differences and indicators. *Tourism Geographies*, 2016, 18 (1), pp. 18-27. https://doi.org/10.1080/14616688.2015.1122664
[20] Zabek, M.; Hildebrand, L.; Wirth, M.; Brell-Cokcan, S. Used building materials as secondary resources - Identification of valuable building material and automized deconstruction. *Journal of Facade Design and Engineering*, 2017, 5 (2), pp. 25-33. https://doi.org/10.7480/jfde.2017.2.1684
[21] Han, H. et al. Exploring the Features of Sustainable Urban Form and the Factors that Provoke Shoppers towards Shopping Malls. *Sustainability*, 2019, 11 (17), 4798. https://doi.org/10.3390/su11174798
[22] Khan, F. M.; Pafka, E.; Dovey, K. Extremes of mixed-use architecture: a spatial analysis of vertical functional mix in Dhaka. *City Territory and Architecture*, 2022, 9 (31). https://doi.org/10.1186/s40410-022-00177-y