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Spatial Configuration and Circulation Effectiveness in Mall @Alam Sutera, Tangerang

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Abstract

Modern shopping malls have become big, multi-story places where people go for more than just shopping, which makes it really important to design good movement between the different floors. While space syntax is widely used to analyze spatial layouts, there is limited empirical understanding of how linear spatial configurations specifically impact uneven visitor distribution across vertically stacked levels in Indonesian urban malls. This study investigates how spatial configuration impacts visitor circulation patterns using Mall @Alam Sutera as a case study. The research addresses a gap in understanding the relationship between spatial integration and circulation efficiency within a commercial environment. The method used in this research is simulation approach with DepthmapX software validated by field observations. The research analyzes spatial connectivity, integration, and intelligibility across four levels (LG, GF, 1F, and 2F). The results reveal a significant disparity: The Ground Floor (GF) serves as the most effective distribution hub due to superior integration and central visibility, whereas the Second Floor (2F) suffers from critical isolation with the lowest intelligibility ($R2 < 0.50$), directly correlating with observed low visitor traffic. These findings demonstrate that linear layouts require strong vertical integration mechanisms to activate upper levels. The study concludes by offering data-driven design strategies to resolve spatial segregation and enhance overall circulation efficiency in multi-level commercial environments. These findings contribute to the development of a more efficient and data-driven mall design, with a focus on improving circulation and visitor experience in commercial space.

INTRODUCTION

The development of shopping mall has seen significant growth in recent decades. Along with urbanization and lifestyle changes in urban communities, shopping malls have evolved beyond their traditional role as commercial spaces to become multifunctional centers' for recreation, social interaction, and entertainment. Malls are developing rapidly especially in urban centers such as Jakarta, Surabaya, and Tangerang in Indonesia. In recent years, the demand for malls that offer convenience, comfort, and diverse amenities has significantly increased. These modern malls not only fulfil shopping needs, but also offers a more comprehensive shopping experience by integrating various functions, from shopping and dining to entertainment in one integrated location. This has attracted people to stay longer in shopping centers, which has made the shopping center become an important part of urban life.

Shopping malls have evolved significantly beyond their traditional role as commercial centers to become multifaceted hubs for recreation, social interaction, and urban entertainment. In the modern "experience economy", malls are transforming into lifestyle destinations where physical environment and spatial design play a critical role in determining customer satisfaction and retention (Bang, 2025). Malls have evolved into multi-functional social spaces where people gather not only for retail activities but also for leisure, entertainment, and social interaction (Douglas et.al., 2025). In rapidly urbanizing contexts like Indonesia, shopping malls serve as "third places" that cater to diverse lifestyle needs, integrating retail, dining, and leisure under one roof (Andi et al., 2020; Nirmayanti, 2023). Consequently, the spatial configuration of these environments is pivotal. As established in architectural theory, the spatial layout directly influences movement patterns, determining how visitors navigate, interact, and distribute themselves within a building (Hillier & Hanson, 1984; Pranata & Astuti, 2025).

In Tangerang, several areas have experienced significant development, including Alam Sutera. There are several areas in Tangerang that have been developed by the private sector, including Alam Sutera, which integrates a shopping center as part of the residential and commercial development (Badan Perencanaan dan Pembangunan Daerah Kota Tangerang, 2023). It has made Alam Sutera as one of the rapidly developing areas, which is dominated by commercial and residential properties. This area has several large shopping centers that are becoming their main attraction, such as Living World Alam Sutera, Mall @ Alam Sutera, Flavor Bliss, and IKEA Alam Sutera. Each shopping center has its own characteristics and uniqueness in offering shopping and recreational experiences for the community.

The object of this study is Mall @Alam Sutera. This mall is located in the private area of Alam Sutera, Tangerang, Banten, Indonesia. This mall was established in 2012 and it consists of five floors with a total area of approximately 7.8 acres (Kusumaputra, 2013). It is strategically located, near the Jakarta-Merak toll road, which makes this mall easily accessible. This mall is targeted at the upper-middle class segment of society, with various well-known tenants such as supermarkets, restaurants, and other entertainment areas. Although it has potential as a large shopping center, this case study has had challenges in attracting visitors compared to other shopping centers in the area.

However, achieving effective circulation in multi-storey malls presents significant challenges. A critical issue in vertical commercial complexes is the "vertical segregation" effect, where upper floors often suffer from reduced visibility and accessibility compared to ground levels, leading to uneven tenant profitability (Hosseini et al., 2024). Mall @ Alam Sutera, located in Tangerang, Indonesia, exemplifies this spatial challenge. Designed with a predominant linear configuration, the mall occupies a strategic location with a premium tenant mix. Despite these advantages, preliminary field observations reveal a critical disparity in visitor distribution. Activity is heavily concentrated on the Lower Ground (LG) and Ground Floor (GF), creating vibrant zones, whereas the First Floor (1F) and particularly the Second Floor (2F) experience significantly lower footfall, resulting in "dead zones" in peripheral areas.

This discrepancy raises fundamental questions about the effectiveness of the mall's linear spatial configuration in facilitating vertical movement. While previous studies have utilized Space Syntax to analyze general urban movement or horizontal mall layouts (Andi et al., 2021; Wijaya et al., 2024), there is a limited empirical understanding of how linear layouts specifically impact vertical integration in Indonesian shopping centers. The specific problem addressed in this study is the disconnect between the mall's physical linearity and the lack of upward visitor flow.

Therefore, this research aims to evaluate the impact of spatial configuration on circulation effectiveness at case study using a combined simulation and observational approach. Specifically, this study addresses the question: how do the spatial metrics of connectivity, integration, and intelligibility vary across the four levels of this case study? By using space syntax analysis through DepthMapX software, validated by empirical field observations, this study provides actionable insights for optimizing commercial layouts. The findings contribute to the broader architectural discourse on designing integrated vertical public spaces that maximize usability and visitor flow.

LITERATURE REVIEW

Shopping Malls as Evolving Public Spaces

Shopping malls have transcended their original function as mere retail aggregators to become “third places” regarding urban social life (Oldenburg, 1999). Pacione (2005) originally defined malls as enclosed centers designed for shopping convenience. However, recent literature argues that in the modern "experience economy," the physical environment is a primary driver of visitor satisfaction and retention (Bang, 2025). In Indonesia, this evolution is marked by the integration of lifestyle, entertainment, and commercial functions, where the mall acts as a substitute for traditional civic spaces (Douglas et.al., 2025). Consequently, the success of a mall is no longer solely defined by tenant mix but by the quality of its spatial configuration in facilitating social interaction and exploration (Andi et al., 2020). Furthermore, optimizing visitor flow is crucial to ensure that isolated areas or 'cold spots' are minimized, thereby sustaining the economic viability of tenants across all zones (Astarini & Utomo, 2025).

Shopping malls have evolved beyond traditional retail functions into multifunctional spaces that integrate shopping, recreation, and social interaction. The typical configuration of a shopping center is a closed building or an open market (International Council of Shopping Center, 1999). In general, the functions and activities that can be accommodate in a shopping center are not only limited to shopping, but also recreation, gathering, and socializing. Such activities impact the form and configuration of the shopping center itself.

Shopping malls as enclosed spaces comprising multiple retail units interconnected by circulation paths to ensure ease of navigation for visitors (Pacione, 2005). With their increasing prevalence in urban environments, especially in Indonesia, malls have become essential for urban lifestyles, replacing traditional markets due to enhance comfort, convenience, and comprehensive service offerings (Nirmayanti, 2023).

Spatial Configuration and Circulation

Spatial configuration refers to the interconnected relationships between spaces in a structural layout, which determines accessibility and circulation patterns (Hillier, et.al., 2007). A well-designed configuration enables seamless movement, enhancing both user experience and space utilization. According to (Hillier & Hanson, 1984), the connectivity and integration of spaces significantly impact how people navigate and interact within built environments. In shopping center, circulation is a critical factor in ensuring accessibility and distributing visitors across different areas. Circulation is categorized into horizontal and vertical components in shopping center.

According to Coleman (2006), horizontal circulation patterns can be categorized into five types there are linear arrangements, circuits, journeys, keyholes, and networks (can be seen in Figure 1). Each pattern serves distinct spatial and functional objectives, optimizing movement efficiency and tenant visibility. Vertical circulation elements, such as stairs, escalators, ramps, travellators and lifts, complement horizontal circulation, facilitating seamless access between levels. Recent studies highlighted that poor visibility of vertical connectors leads to "vertical segregation," where upper floors become dead zones due to psychological separation from the main activity hub (Hosseini et al., 2024). This case study implemented a linear circulation pattern in horizontal circulation. This circulation pattern has connected the anchor tenants on both ends of the mall. For the vertical circulation in the case study, the five elements of vertical circulation were applied to facilitate efficient and convenient movement between levels.

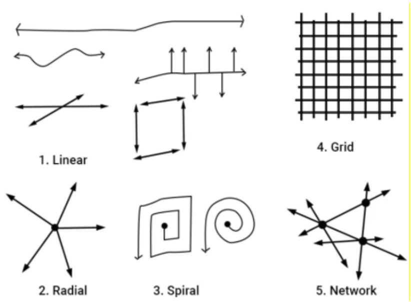


Figure 1. Typologies of Mall Circulation Patterns
(Source: Coleman, 2006)

High connectivity contributes to sense of space, which helps visitors recognize and understand spatial patterns in shopping center. Effective connectivity increases the engagement between areas, which makes it possible for visitors to navigate from one area to another more efficiently and intuitively. A well-designed spatial configuration will result in organized circulation, where the main circulation is clearly defined and connected to important functions such as anchor tenants and key facilities. Secondary circulation provides access to retail units and other supporting facilities. With clearly marked and efficient circulation routes, visitors can easily reach their destinations without being lost or obstructed, which also has the effect of improving the visiting experience.

Space Syntax as an Analytical Tool

Space syntax, introduced by (Hillier, et.al., 1993) offers a mathematical approach to analyze spatial configurations and their impact on human behavior. In the context of shopping centers, this method can be used to understand how spatial configuration has an impact on visitor circulation as well as the areas that have greater potential to attract visitors. Space syntax is a graphical analysis of spatial layouts that can be translated into elements such as connectivity, integration, and intelligibility to predict movement patterns and spatial interactions.

Space syntax also enables identifying the level of spatial accessibility from visibility through a method that is known as visual graphic analysis (VGA). This method can be used to analyze and compare visual fields of generated from spatial arrangements, and it can provide information about the user's location based on the spatial visibility. When it comes to a spatial design simulation, the analysis is usually done using simple regression, which can be done with DepthMapX software. This simulation software aims to analyze the spatial layout by considering the relationship patterns between the spatial elements visualized through the VGA. The results of the analysis are displayed in the form of a color gradient map, which reflects the values of the analysis results for a specific area (Pinelo & Turner, 2010).

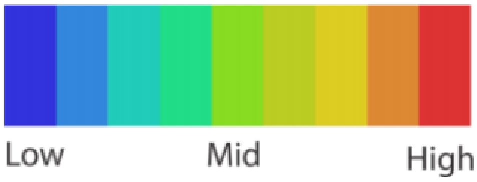


Figure 2. Value parameters in DepthMapX software
(Source: Pinelo & Turner, 2010)

It can be seen in Figure 2 that low values are illustrated in a blue color, while higher values are illustrated gradually in green, yellow, and red color as the highest value (Pinelo & Turner, 2010). The important aspects such as connectivity, integration, and intelligibility are key factors that determine the quality of a spatial system's room configuration. The connectivity refers to the amount of accessible space from a given space (Pinelo & Turner, 2010). The measurement of connectivity is made to define the interaction level of each space with the surrounding spaces. Connectivity measures the number of immediate spaces directly connected to a specific location. In a mall, high connectivity usually occurs in atriums or main intersections where choices of movement are highest (Hillier, 2007).

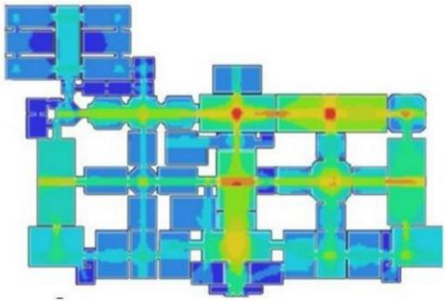


Figure 3. Example of evaluation result for the connectivity aspect in VGA map
(Source: Pinelo & Turner, 2010)

It can be seen in Figure 3 that the interaction values between spaces are converted into a color map, where each color represents the connectivity level of the analyzed spaces. The highest connectivity values are marked in orange to red color, while lower connectivity values are represented by green to blue color.

The integration value describes how accessible the spaces area within a configuration. Integration describes how accessible a space is from all other spaces in the system. It shows that high integration of spaces can play a significant role in enhancing circulation and the overall user experience (Hillier, et.al., 1993). The more directly connected spaces there are, its integration value will be higher. In contrast, the more spaces that must be navigated, the integration value will decrease.

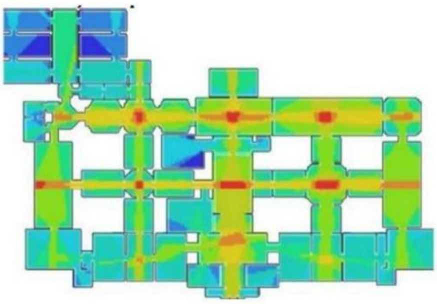


Figure 4. The position of integration in VGA map
(Source: Pinelo & Turner, 2010)

The integration values of each space are converted into a color map, where the colors indicate the level of integration of the analyzed spaces (seen in Figure 4). As noted by Pranata & Astuti (2025), spaces with high integration values (indicated by warm colors in VGA maps) naturally attract high pedestrian flow without the need for signage, acting as the “movement core”. The highest integration spaces are marked in orange to red color, which indicates more activity than the green to blue areas, which indicates lower integration values.

Intelligibility measures on how easy an individual can understand the spatial layout based on their visual experience. Intelligibility defined as the correlation between local connectivity and global integration. In shopping centers, the spatial intelligence will help visitors feel more comfortable about navigating the various areas without getting lost (Hillier & Hanson, 1984).

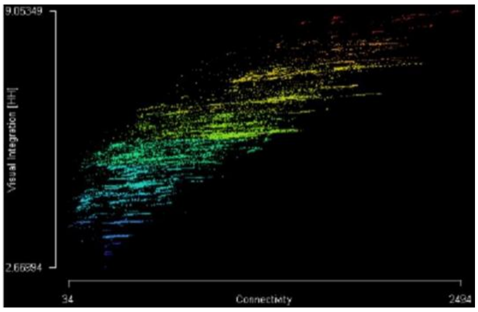


Figure 5. Intelligibility in VGA map
(Source: Pinelo & Turner, 2010)

Figure 5 shows the results of the space syntax evaluation of intelligibility. This resulted from the correlation between connectivity and integration, which was displayed in a graph that illustrated the relationship between the two aspects. A high intelligibility value implies that a visitor can understand the entire building's structure based on their local view. Low intelligibility often correlates with visitor disorientation and "lost" spaces (Andi et al., 2021).

Previous Studies and Research Gap

Several studies have applied space syntax to Indonesian commercial contexts. Andi et.al. (2020) compared the spatial configurations of Ayani Megamall and Matahari Mall in Pontianak, finding the loop configurations tended to distribute visitors more evenly than complex, fragmented layouts. Similarly, Pranata & Astuti (2025) analyzed The Park Mall Solo Baru, discovering that blind spots near vertical transportation resulted in significantly lower interaction rates on upper floors.

However, a specific gap exists regarding linear multi-level configurations. Most existing studies focus on the efficiency of loop or centralized atrium designs. There is limited empirical research detailing how a strict linear typology, often assumed to be the simplest for navigation, can paradoxically lead to severe vertical segregation when applied to multi-storey malls. This study addresses this gap by investigating Mall @ Alam Sutera, analyzing why its linear layout succeeds in horizontal connectivity (GF) but fails to sustain vertical integration to the second floor.

METHODS

This study used a simulation-based approach validated by empirical field observations. This approach was selected to have deep understanding on evaluating whether the spatial configuration and circulation can influence the distribution of visitors and their movement patterns within the mall (Hillier et.al., 1993). The primary methodology utilizes space syntax quantitative analysis (Pratama et.al., 2025) to evaluate the spatial configuration, while qualitative field observations serve as a verification tool to compare simulated potential movement with actual visitor behavior (Hillier, et.al., 1993). This dual approach allows for a comprehensive assessment of how physical layout influences circulation effectiveness in a multi-storey commercial environment.

This simulation was done using DepthMapX software to visualize and evaluate circulation patterns based on existing spatial data. By simulating this, we were able to directly observe the impact of various spatial configurations on visitor movement. This method was used for exploring the mall spatial layout and evaluating the effectiveness of circulation. This approach emphasized visual interpretation and spatial simulation to understand the spatial relationships.

The data collection and analysis processes involved four key stages. The first stage was direct observation, conducted to understand visitor movement patterns across all floors of case study. This observation mas made to understand the movement patterns of visitors on each floor of the mall, especially in areas with high and low activity levels. The observations documented areas of high and low activity through visual records, including photographs and field notes. These observations served as reference points for subsequent spatial simulations by DepthMapX software.

The second phase involved collecting spatial layout data. This floor plan includes the entire layout of the mall, which will be used as the main input in the simulation. Spatial data must be in a digital format that can be processed with DepthMapX software, such as AutoCAD files (Pinelo & Turner, 2010). These files served as the primary input for simulations.

The third phase is the simulation process by using DepthMapX software. Spatial data were imported into the software, followed by simulations using convex maps, axial maps, and visibility graph analysis (VGA maps). These simulations evaluated three primary metrics; there are connectivity, integration, and intelligibility. The simulation outputs provided visual maps highlighting areas with varying connectivity and integration levels, offering insights into visitor movement patterns and identifying suboptimal areas.

The final phase of space syntax analysis was used to interpret the simulation results. Connectivity, integration, and intelligibility values were calculated and visualized by using color gradients. Connectivity scores were displayed in red to indicate a high value and in blue to indicate a low value. integration was similarly visualized, while intelligibility was analyzed through scatter diagrams that correlate connectivity and integration. In this study, intelligibility values are interpreted using the following criteria: values between 0.0-0.4 indicate poor spatial clarity, 0.5-0.7 indicate moderate clarity, and 0.8-1.0 indicate good spatial clarity. Higher intelligibility values suggest that users can more easily understand and navigate the spatial configuration based on local cues. The result was interpreted to align the simulation patterns with real-world observations, identifying areas that require spatial rearrangement.

After the simulation was completed, the results were analyzed qualitatively. The connectivity and integration maps that are generated from the DepthMapX software will be compared with the field observation results. This aims to understand the compatibility between the simulated movement patterns with the real conditions in the field. The areas that were less integrated or difficult for visitors to access would be identified as an area which needed to be reorganized. In addition, the simulation results will also be interpreted with a focus on how the spatial configuration can be optimized to improve visitor distribution around the mall. By using a qualitative approach, this study is expected to provide deeper insights into the relationship between spatial layout and visitor circulation. The spatial simulation of DepthMapX software will provide a concrete visual representation of visitor movement patterns and areas that need improvement for the mall to work more efficiently and attract more visitors.

RESULTS AND DISCUSSION

Spatial Configuration Analysis

The circulation spatial configuration in the case study adopts a linear pattern that extends longitudinally, connecting two anchor tenants on both sides with a central atrium serving as the primary node. This configuration aligns with Coleman's (2006) description of a linear circulation pattern, which typically aims to maximize visual clarity and simplicity. Theoretically, this design serves as a connector between commercial spaces and an orientation guide, where the placement of anchor tenants is intended to generate a "dumbbell effect," pulling visitors through the central corridor (Douglas et.al., 2025). However, while this configuration facilitates strong horizontal movement along the main axis, the Space Syntax analysis reveals significant disparities in how this linearity functions across different vertical levels, as detailed in the subsequent floor-by-floor analysis.

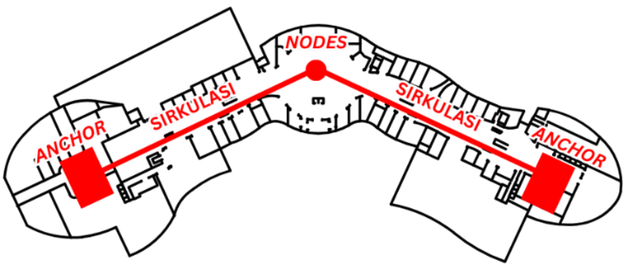


Figure 6. The spatial configuration of a typical floor

In Figure 6, it is highlighting how key distribution points around the anchors generate activity hubs, strengthening movement across the mall's floors. This configuration not only supports horizontal movement but also maximizes the strategic placement of commercial spaces. The design emphasizes ease of navigation and visibility, with tenant placements along the corridor strategically curated to draw visitor interaction and exploration. Visual connections between the pathways and adjacent tenants allow for direct visual access, enhancing the seamless flow of movement and improving the overall spatial experience. The circulation path was designed with navigation and visibility as consideration. The placement of tenants along this route made sure every area had an appeal that invited interaction and exploration. The visual connection between the pathway and surrounding tenants was also strengthened with the design which allows direct views of various shop and facilities along the corridor, create a visual connection that encourages visitors to keep moving and exploring the area.

Based on our observations in a one-week period, on a daily basis from November 11, 2024 to November 18,2024, between 11:00 a.m. and 2:00 p.m. local time, it can be concluded that visitor distribution in this mall is found to be uneven. The visitors are mostly on the Lower Ground and Ground Floor, where there are tenants like supermarkets and popular restaurants. Meanwhile, other floors, including the levels that accommodate anchor tenants such as cinemas, were unable to attract sufficient visitor numbers (seen in Figure 7).

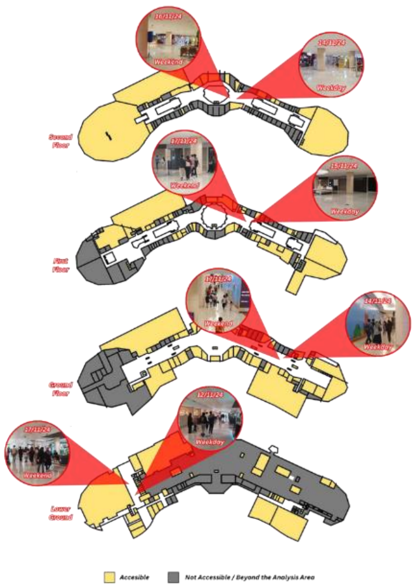


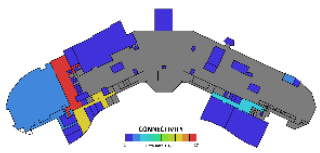
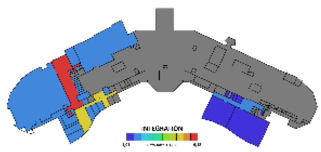
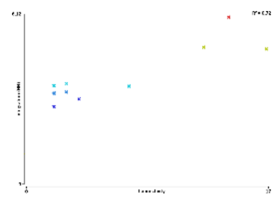
Figure 7. The comparison of visitors on each floor in the case study

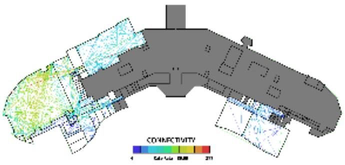
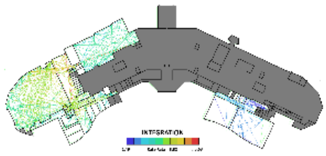
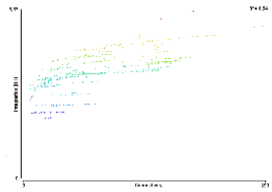
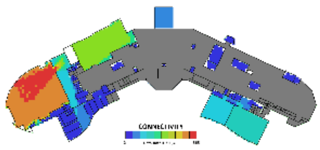
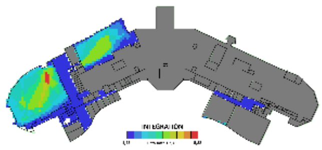
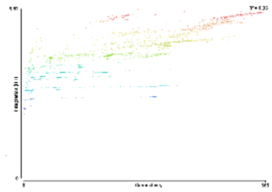
Spatial Syntax Analysis of Individual Floors

Lower Ground Floor Analysis

The lower ground floor functions as the primary entry point for visitors arriving from the basement parking area. The quantitative analysis presents a paradox: while the connectivity values are relatively high along the main corridor (Mean=146.2), the global integration is only moderate (Mean=2.6). The Convex Map analysis indicates that connectivity is concentrated heavily along the central axis linking the parking entrance to the supermarket. However, peripheral zones show a sharp drop in integration values, creating "blind spots" similar to those identified by Pranata & Astuti (2025) in other Indonesian malls. This suggests that while the linear corridor effectively channels visitors through the space, it fails to distribute them laterally to tenant units located away from the main axis. The moderate intelligibility ($R^2 = 0.54$) further confirms that while the main path is clear, the overall spatial logic of the LG floor is less coherent than the floor above it.

Table 1. Spatial analysis of the Lower Ground Floor

Method	Connectivity	Integration	Intelligibility
Convex	 The main corridor has high connectivity, especially leading to the supermarket and major tenants. Corner areas show low connectivity.	 The main corridor demonstrates high integration, facilitating access between spaces. The east wing has low integration.	 R² = 0.72 ('quite good'), indicating a fairly clear spatial structure.

Axial	 The main pathway serves as the primary connectivity axis, while secondary paths are less connected.	 The main pathway is well integrated; areas far from the main axis are less integrated.	 R^2 = 0.54 ('adequate'), with challenges in secondary pathways that are less connected.
VGA	 Main intersections have high visibility, supporting visual navigation.	 Areas with high visibility have good integration, supporting visual movement.	 VGA Map: R^2 = 0.36 ('poor'), reflecting inadequate visual guidance in some areas.

Source: author, processed by DepthMapX software

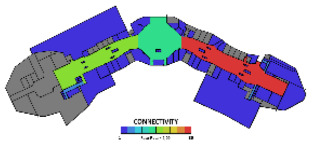
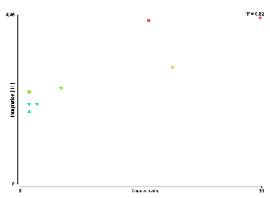
Convex map analysis demonstrated strong connectivity along the main corridor, especially in those areas where parking entrances connected to anchor tenants. However, connectivity decreased at edge areas, which reflects their lower integration with the main circulation. Axial map analysis supported this point by identifying the main corridor as the dominant axis, while secondary corridor indicated lower accessibility. Visibility analysis (VGA) highlighted well-integrated areas around those intersections, but there were some isolated zones that could face challenges due to limited visual connections.

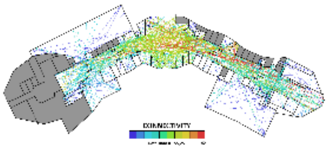
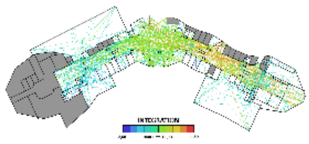
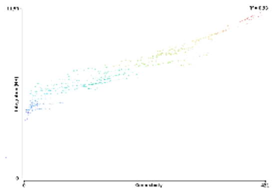
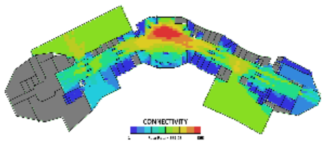
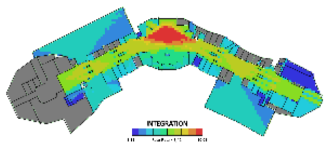
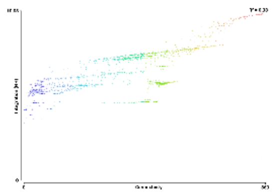
The result of the space syntax analysis has shown that the lower ground floor (LG floor) had sufficient connectivity, integration, and intelligibility in the main corridor area and large tenants. From among the three methods, the convex map provided the best intelligibility results, while the VGA map presented challenges for visual navigation. The average overall score indicated that connectivity and integration on the LG floor were quite well developed, but some areas required more attention to improve orientation and accessibility in general.

Ground Floor Analysis

The ground floor emerges as the most spatially optimized level in the entire building, acting as the central distribution hub. The analysis reveals the highest values across all metrics, with mean connectivity peaking at 174.8 and mean integration at 4.4. Unlike the LG floor, the high integration on the GF is evenly distributed across the eastern and western wings, facilitated by the central atrium which acts as a powerful integration core (Hillier, 2007). The Visual Graph Analysis (VGA) shows expansive isovist fields, meaning visual connectivity is uninterrupted along the linear spine. Isovists are view-shed polygons that capture spatial properties by describing the visible area from a single observation point (Franz & Wiener, 2008). This result explains why the GF is the liveliest area; the spatial configuration naturally privileges this floor as the "destination" rather than just a transit zone. The high intelligibility score (R^2 = 0.71) indicates that visitors on this floor can intuitively grasp the mall's layout, reducing navigation stress and encouraging exploration (Andi et al., 2021).

Table 2. Spatial analysis of the Ground Floor

Method	Connectivity	Integration	Intelligibility
Convex	 High connectivity in the atrium area and main corridors, especially in the east wing, allowing smooth movement between tenants.	 The atrium area and main entrances have high integration values, indicating optimal accessibility for visitor distribution.	 R^2 = 0.82 ('good'), indicating that the ground floor layout is relatively easy for visitors to understand.

Axial	 Main pathways serve as the backbone of circulation, connecting strategic spaces with generally high connectivity values.	 Paths with high integration support main visitor flows, especially toward major tenants.	 R^2 = 0.93 ('very good'), reflecting a clear relationship between primary pathways and supporting spaces.
VGA	 Visibility in the atrium and main corridors is excellent, facilitating visitor orientation and navigation.	 High visual integration in the atrium area allows easy navigation and guides visitor movement.	 R^2 = 0.38 ('poor'), indicating visibility challenges in some areas blocked by large tenants or corners.

Source: author, processed by DepthMapX software

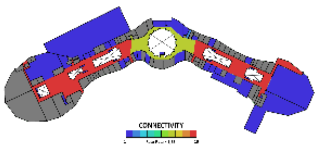
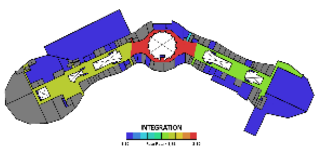
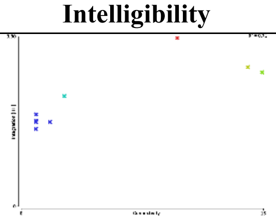
Convex map analysis demonstrated high connectivity values in main areas such as the atrium and main corridors, especially in the east wing, which provided fluent circulation of spaces. Axial map analysis supported this point by having the corridor functionally as the backbone of visitor movement, and connecting major points with an impressive level of efficiency. Visibility analysis (VGA) supported these findings by showing high visual connectivity especially in the atrium and main corridors, which served as directional references for visitors.

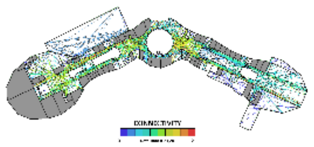
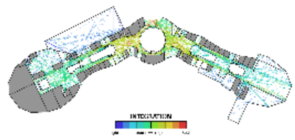
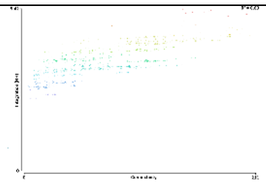
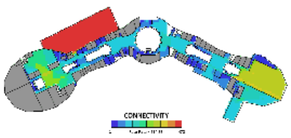
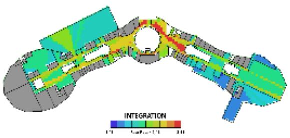
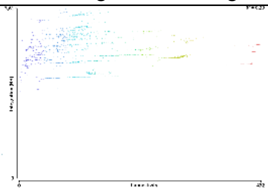
The result of the space syntax analysis has shown that the ground floor had good connectivity and integration around the atrium and main corridor, especially in the east wing, which effectively supported visitor circulation. However, the intelligibility still required some improvement, especially in visibility and circulation in several areas. Having a more accessible design and adding wayfinding elements could improve their navigation and improve the whole visitor experience.

First Floor Analysis

Moving vertically to the First Floor, a noticeable decline in spatial efficiency is observed. While the central atrium area retains high connectivity, the peripheral corridors exhibit significantly lower integration values compared to the GF. The Axial Map results highlight that the "movement potential" is strictly confined to the primary linear route, with little spillover into secondary corridors. This creates a funneling effect where visitors are less likely to deviate from the main path to explore side tenants. The intelligibility score drops to R^2 = 0.50, suggesting that as visitors move away from the atrium void, their understanding of the spatial layout diminishes. This finding aligns with Hosseini et al. (2024), who argue that without strong vertical visual connections, upper floors in linear malls risk becoming spatially segregated from the main activity hub.

Table 3. Spatial analysis of the First Floor

Method	Connectivity	Integration	Intelligibility
Convex	 High connectivity is located in the east and west wings, enabling smooth visitor movement between spaces.	 The atrium serves as the area with the highest integration, facilitating access to various areas.	 R^2 = 0.71 indicates that the layout is relatively easy for visitors to understand.

Axial	 The main pathways, especially in the west wing, function as the backbone of circulation distribution.	 Highlights the importance of main pathways as key routes for circulation distribution.	 $R^2 = 0.60$ indicates a fairly clear spatial relationship, although some areas might be confusing.
VGA	 Visibility on this floor is quite good in anchor tenant areas, but the main corridors tend to lack visual orientation support.	 The atrium area has the best visual integration, helping visitors navigate the space.	 $R^2 = 0.20$ indicates poor visibility, making it difficult for visitors to navigate.

Source: author, processed by DepthMapX software

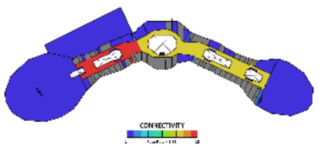
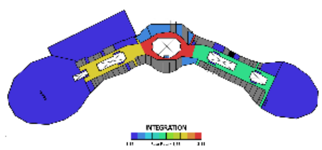
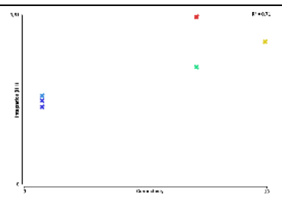
Convex map analysis demonstrated the presence of even connectivity along the main corridor, especially in the area close to the atrium and escalators. However, the secondary corridors demonstrated lower connectivity, which showed irregular circulation of movements. Axial map analysis highlighted the main route as the most integrative element, while those less distinct indicated a decreased accessibility. Visibility analysis (VGA) highlighted difficulties in secondary areas where visual connections could be weaker, which affected both orientation and navigation.

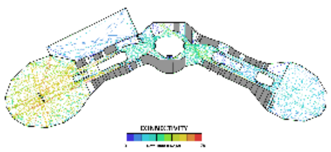
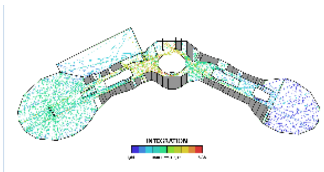
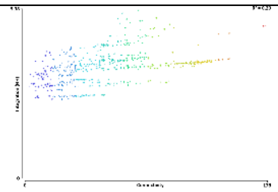
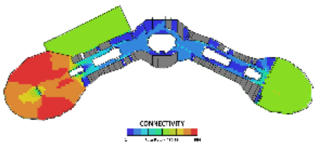
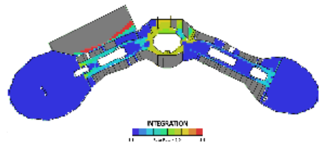
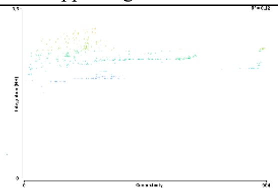
The result of the space syntax analysis has shown that both the east and west wings, as well as the atrium, were well balanced for connectivity, integration, and intelligibility. The east and west wings offered more connectivity, while the atrium offered more integration. All of these things came together to create a level of intelligibility that was easily understood by visitors. This showed that the first floor was quite efficient when it came to the circulation of visitors. However, despite all that, the low intelligibility value for the VGA map indicated the need for appropriate wayfinding elements to help visitors navigate the level.

Second Floor Analysis

The second floor (2F) demonstrated the most critical spatial failure within the mall's configuration. The analysis reveals the lowest performance metrics, with intelligibility plummeting to $R^2 = 0.33$ (Convex) and as low as $R^2 = 0.12$ (VGA). These scores indicate a "broken" spatial logic where the relationship between local paths and the global layout is unclear. The VGA maps show fragmented visual fields, particularly in areas distant from the escalators. The linear configuration, which worked well on the GF, becomes a liability here; without the high footfall generated by main entrances or major anchors, the long linear corridors become desolate "dead ends." This lack of integration explains the field observations of sparse visitor activity. The layout fails to generate the necessary "natural movement" described by Hillier (1984), resulting in a zone that is economically disadvantaged for tenants due to poor visibility and accessibility.

Table 4. Spatial analysis of the Second Floor

Method	Connectivity	Integration	Intelligibilty
Convex	 The west wing has better access and connecting paths compared to other areas.	 The atrium has the highest integration value, indicating its role as a strategic center that facilitates visitor distribution.	 An intelligibility value of $R^2 = 0.71$ shows that the relationship between spaces is relatively easy for visitors to understand.

Axial	 The main path in the west wing plays a significant role in supporting visitor distribution.	 The main path connecting key tenants acts as a major route for supporting mobility.	 An intelligibility value of $R^2 = 0.20$ indicates unclear paths, creating challenges for supporting circulation.
VGA	 High visibility is concentrated in the west wing, facilitating visitor access to specific tenants.	 The atrium is an area with good visibility, but the values indicate there is still room for improvement.	 With an $R^2 = 0.12$ value, visibility on this floor is considered poor, making navigation challenging for visitors.

Source: author, processed by DepthMapX software

Convex map analysis demonstrated low connectivity values, especially in those areas away from the atrium and escalators. Axial map analysis revealed limited integration, with only several corridors that served as main routes, while other areas were still underutilized. Visibility analysis (VGA) also highlighted poor visual connection, which made it difficult to navigate and reduced visitor interaction with tenants in remote areas. Intelligibility was the lowest of all levels, which indicated that the layout was difficult for visitors to understand.

Space syntax analysis on the second floor has shown a continuous pattern with the previous levels, where the west wing was the area with high connectivity and the atrium with good integration. However, the overall intelligibility value was quite low. This demonstrated that the second floor had poor accessibility and low visibility. It could be difficult for visitors to navigate and understand the spatial layout on this floor, which could make it hard for them to explore this level.

Comparative Analysis

This analysis has revealed significant findings in the entire four floors of Mall @Alam Sutera. The lower ground floor served as the main entrance for visitors from the basement parking area. The connectivity value was comparatively high, especially along the main corridor that connected the entrance to the parking lot with major tenants such as supermarket. However, the integration throughout the floor area was comparatively moderate, as these peripheral areas demonstrated limited accessibility and uneven visitor distribution. While the software analysis underrepresents LG's role as the mall's main gateway, its strategic position highlights the need for enhanced integration measures.

Figure 8. (left) Observational Snapshot of the Lower Ground Floor on Weekdays. (right) Observational Snapshot of the Lower Ground Floor on Weekends.

The GF emerged as the most optimized level, acting as the central distribution hub for visitor circulation. It demonstrated the highest connectivity, integration, and intelligibility values, particularly around the atrium and main corridors. Observations showed dense visitor activity in key areas, supported by an intuitive layout that facilitated seamless navigation and enhanced the overall shopping experience.

Figure 9. (left) Observational Snapshot of the Ground Floor on Weekdays.
(right) Observational Snapshot of the Ground Floor on Weekends.

The 1F performed reasonably well but showed uneven visitor distribution. High connectivity was concentrated near the atrium and escalators, while peripheral wings appeared less frequented. Improving integration across these less active areas was essential to enhance the floor's overall functionality and attractiveness.

Figure 10. (left) Observational Snapshot of the First Floor on Weekdays.
(right) Observational Snapshot of the First Floor on Weekends.

The 2F had the most challenges, exhibiting the lowest scores in connectivity, integration, and intelligibility. Observations revealed sparse visitor activity, particularly in areas distant from escalators and the atrium. These findings underscored the need for design interventions to improve accessibility and visual connections across the floor.

Figure 11. (left) Observational Snapshot of the Second Floor on Weekdays.
(right) Observational Snapshot of the Second Floor on Weekends.

The Impact of Linear Configuration on Vertical Segregation

A comparative analysis across all four levels reveals a phenomenon of "vertical segregation". Reviewing the data holistically, the Ground Floor acts as a "super-integrated" layer that monopolizes movement potential, while the effectiveness of the linear topology degrades significantly as one moves upwards. The critique often leveled at linear malls is that they rely too heavily on anchor tenants to drive circulation (Coleman, 2006). In this case study, the analysis suggests that the linear configuration is highly effective for horizontal circulation on the ground level but lacks the necessary vertical integration mechanisms to pull visitors to the 2F.

A holistic analysis revealed that the ground floor would be the most optimal floor for connectivity, integration, and intelligibility than the other levels. The ground floor has shown the highest value, as indicated by the warm colors on the convex map, which reflected a high level of integration. This is caused by its strategic position as a central point in the vertical circulation system, as well as the high concentration of tenants that engage visitors. The first floor was ranked second with a pretty good performance, although it was not as optimal as the ground floor. In contrast, the lower ground floor and second floor had lower performance with a dominant cool color in the mapping. This would reflect more limited connectivity and integration.

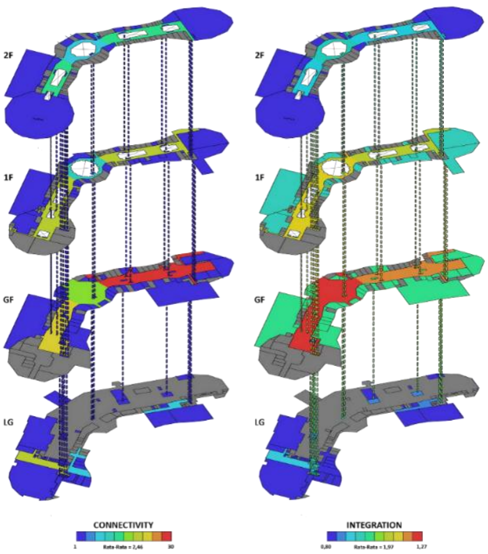


Figure 12. Holistic connectivity and integration analysis

As we can see in Figure 12 that the ground floor was considered the most optimal for integration. This was explained by the fact that the ground floor was located in the middle vertically, which made access to other floors more efficient. This position has made the ground floor to be the nearest circulation center to all other rooms and floors. In addition, the elevators and escalators were dominated by warm colors throughout the whole level. This showed that this vertical circulation played an important role as the only access between the levels.

Table 5. The Arrangement of Table

Floor	Connectivity			Integration			Intelligibility
	Min	Avg.	Max	Min	Avg.	Max	
LG	2,3	146,2	291,6	1,2	2,6	5,1	0,54
GF	1	174,8	438	1,7	4,4	8,6	0,71
1F	1,6	96,5	232,6	1,4	2,4	4,3	0,50
2F	1,6	181,6	365	1,3	2,2	4,2	0,33

This answers the research question regarding the impact of configuration on circulation effectiveness. The linear pattern is not universally effective; it creates a hierarchy that heavily favors the ground floor. The low R2 values on the top floor (0.12 - 0.20) provide empirical evidence that the layout is unintelligible to visitors, likely causing disorientation and reducing the desire to explore. Consequently, the "quietness" of the upper floors is not merely a result of tenant mix, but a direct consequence of a spatial configuration that fails to visually and physically integrate the upper strata with the vibrant ground floor hub. To rectify this, spatial interventions such as introducing new vertical attractors or breaking the linearity with intermediate nodes are required to boost the integration values of the higher levels.

CONCLUSION

This study evaluated impact of linear spatial configuration on visitor circulation effectiveness across four levels of Mall @ Alam Sutera. Through the application of Space Syntax methodology validated by empirical observations, the research yields three critical conclusions that address the vertical distribution disparity in commercial environments. This finding challenges the assumption that the "entry level" is automatically the most integrated. The Space Syntax analysis reveals that the GF's superior performance is driven by its central position in the vertical hierarchy and the presence of the atrium, which creates a high-integration core connecting the east and west wings. In contrast, the LG floor functions primarily as a transit corridor; while it has high local connectivity along the main axis, it lacks the global integration required to distribute visitors to peripheral tenants effectively.

To resolve these structural inefficiencies, specific spatial interventions are re recommended. Design strategies should focus on enhancing vertical intelligibility. This can be achieved by: 1) Introducing "intermediate nodes" or breakout spaces along the long linear corridors of the 2F to break the monotony; 2) Strategically placing high-attraction tenants (anchors) at the ends of the upper-floor corridors to generate the "dumbbell effect" simulated on the ground floor; and 3) Improving visual permeability around vertical transportation points (escalators) to visually link the quiet upper zones with the vibrant atrium below.

This study confirmed that a linear spatial configuration has a dual impact: it is highly effective for horizontal movement on the ground level but contributes to vertical segregation on the upper floors. A linear typology offered clarity. It requires robust vertical integration mechanisms to function effectively in a multi-storey context. This study contributes to the architectural discourse by demonstrating that connectivity alone is insufficient; successful mall design relies on a coherent spatial logic where every floor is visually and physically integrated into the global system. Future research should expand this analysis by incorporating agent-based modeling (ABM) to simulate the potential impact of the proposed design interventions before implementation.

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