

## Geometric Typology of an Organically Developed Commercial Corridor: A Case Study of Anggrek Street, Maumere

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### ABSTRACT

Organically developed commercial areas commonly exhibit diverse building geometries that influence the spatial character and visual quality of the urban environment. This study aims to identify and analyze the geometric typology of buildings along the Anggrek Street commercial corridor in Sikka Regency based on five geometric attributes: building position, orientation, basic form, form transformation, and visual inertia. A descriptive qualitative approach was employed through field observations of five representative buildings selected using purposive sampling to capture the diversity of geometric characteristics within the study area. The analysis adopted an architectural typology approach to examine the relationships among these geometric attributes in shaping the spatial character of the commercial corridor. The results indicate that the corridor is predominantly composed of semi-attached and attached building typologies, reflecting increasing land-use intensity. Building orientation facing the street corridor enhances urban legibility and the visibility of commercial activities. The basic forms are primarily rectangular and cuboid, which have evolved through additive and subtractive transformations in response to spatial requirements. Differences in visual inertia are influenced by mass composition, color, façade articulation, and signage. The findings demonstrate that the spatial character of the corridor is shaped primarily by geometric transformation rather than variations in basic building form. Unlike previous typological studies that primarily focus on planned commercial districts, this study develops an integrated framework consisting of five geometric attributes to interpret organically developed commercial corridors. This study contributes to the advancement of geometric typology research by providing empirical insights into organically developed commercial corridors in small emerging cities, offering a conceptual basis for future urban design and corridor planning.

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## 1. INTRODUCTION

Commercial corridors constitute an essential component of the urban spatial structure, functioning not only as centers of economic activity but also as elements that shape the visual identity of a city. Beyond facilitating commercial transactions, these areas reflect the interaction between social dynamics, cultural values, and the continuous adaptation of the built environment to changing spatial demands [1,2]. As urban areas evolve, commercial districts often undergo physical transformations that influence the geometric characteristics of buildings and, consequently, the overall spatial quality of the urban corridor.

Anggrek Street is one of the organically developed commercial corridors in Maumere City, Sikka Regency, East Nusa Tenggara Province, Indonesia. Located in Kota Uneng Village, Alok District, the corridor forms part of the Perumnas Maumere area and has gradually developed into a local commercial and service center. The corridor extends approximately 916.5 m and functions as an important connection between the city center and surrounding residential neighborhoods. All buildings fronting both the northern and southern sides of the corridor of the street were included in the field observation.

The selection of Anggrek Street as the study area was motivated by its distinctive pattern of urban development. Unlike formally planned commercial districts, the corridor has evolved incrementally without comprehensive urban design guidelines. As a result, the area exhibits considerable variation in building geometry, spatial configuration, and visual composition within a relatively short street corridor [3,4]. The corridor is predominantly occupied by mixed-use buildings that combine residential spaces with commercial functions, creating a complex urban environment characterized by continuous physical adaptation.

The evolution of Anggrek Street is closely associated with the post-disaster urban development of Maumere following the 1992 Flores earthquake and tsunami. The disaster triggered extensive urban restructuring, including the relocation of settlements from vulnerable coastal areas and the expansion of the city toward safer inland locations. Within this context, Anggrek Street gradually transformed into a strategic residential, commercial, and institutional corridor as part of Maumere's urban expansion [5]. This long-term adaptive development has generated various morphological phenomena, including building mass transformation, changes in spatial configuration, increasing building density, and visual fragmentation, making the corridor an appropriate case study for geometric typology analysis.

Previous studies on commercial area typology have predominantly focused on planned commercial districts in large metropolitan cities. In contrast, investigations of organically developed commercial corridors in small cities, particularly in Eastern Indonesia, remain limited. Small emerging cities often exhibit distinctive spatial dynamics, where building forms evolve incrementally in response to changing economic activities, land constraints, and individual development decisions. Consequently, the geometric characteristics of commercial buildings differ substantially from those found in planned urban environments.

Although numerous studies have examined commercial corridors from functional, architectural, and urban design perspectives, few have investigated geometric typology by integrating building position, orientation, basic form, transformation, and visual inertia within a single analytical framework, particularly in organically developed commercial corridors in small emerging cities.

Unlike previous studies that primarily classify commercial buildings according to function or architectural style, this study focuses on building geometric typology by integrating five geometric attributes: building position, orientation, basic form, form transformation, and visual inertia. This integrated approach provides a more comprehensive understanding of how geometric characteristics collectively shape the spatial identity of organically developed commercial corridors. Therefore, this research contributes to the advancement of architectural typology studies by extending the application of geometric typology to commercial corridors in small emerging cities.

Based on this background, the study aims to identify and analyze the geometric typology of buildings along the Anggrek Street commercial corridor through five principal geometric attributes: building position, orientation, basic form, form transformation, and visual inertia. The findings are expected to improve the understanding of the spatial characteristics of organically developed commercial corridors and provide a conceptual basis for future urban design and corridor planning.

Architectural typology provides an appropriate analytical framework for understanding the physical characteristics of the built environment. It classifies buildings according to recurring morphological attributes, enabling researchers to identify similarities, differences, and patterns of spatial development [6,7]. Rather than serving merely as a classification system, typology also functions as an analytical tool for interpreting the relationship between physical form and spatial organization [8].

Within the context of geometric typology, building characteristics can be examined through several interrelated geometric attributes, including building position, orientation, basic form, mass transformation, and visual inertia [9]. Building geometry is influenced by plot configuration, urban density, structural systems, and spatial requirements [10–12]. Building orientation determines accessibility, visibility, environmental responsiveness, and the relationship between buildings and the street corridor [13]. Meanwhile, additive and

subtractive transformations reflect the continuous adaptation of building forms to functional requirements and spatial constraints [14]. Visual inertia complements these geometric attributes by describing the degree of visual dominance generated by building mass composition, proportion, façade articulation, color, and signage. Together, these five attributes provide a comprehensive framework for interpreting the geometric characteristics and spatial evolution of organically developed commercial corridors.

## 2. METHOD

This study employed a descriptive qualitative approach to identify and analyze the geometric typology of buildings along the Anggrek Street commercial corridor, Maumere City, Sikka Regency. The qualitative approach was selected because it enables an in-depth interpretation of spatial and visual phenomena based on the existing physical characteristics of the built environment.

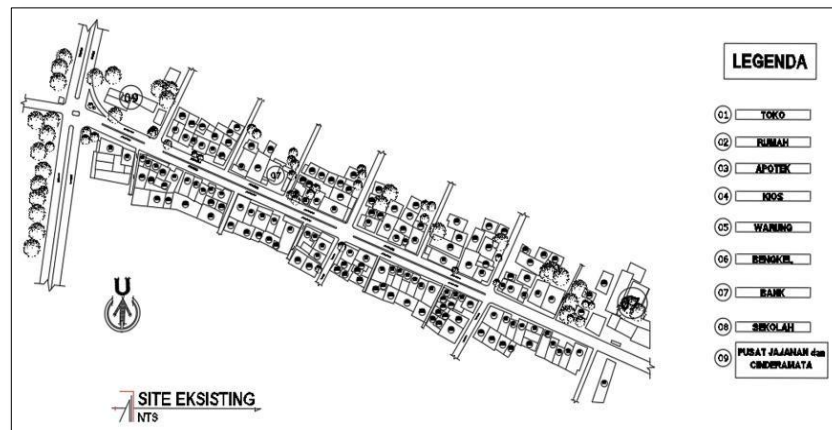


Figure 1. Location Map of the Anggrek Street Commercial Area

The study was conducted along the 916.5 m Anggrek Street commercial corridor, located in Kota Uneng Village, Alok District, Maumere City, Indonesia. The observation covered buildings facing both the northern and southern sides of the corridor. Field data were collected through direct observation, photographic documentation, field sketches, and visual recording of the physical characteristics of the buildings. The observations focused on five geometric attributes: building position, building orientation, basic building form, form transformation, and visual inertia.

Because not all buildings along the corridor represented different geometric characteristics, this study employed purposive sampling to select representative cases. Five buildings were chosen based on their ability to represent the range of geometric typologies identified during the preliminary field survey. The selection criteria included variations in building position, orientation, basic form, form transformation, and visual inertia. Following the preliminary field survey, field observations continued until no additional geometric typologies were identified, indicating that *typological saturation* had been achieved. Consequently, five representative buildings were selected through purposive sampling for detailed analysis. These representative buildings are presented in Table 1.

Table 1. Representative Buildings Selected for Geometric Typology Analysis

Building Code	Building Function	Representative Geometry	Geometric Characteristics
Red–Yellow Building (B1)	Commercial	Detached building	Simple rectangular geometry
Indomaret ( B2)	Commercial	Semi-attached building	Additive mass transformation
Dunia Motor ( B3)	Commercial	Attached building	Strong visual inertia
Green Building ( B4)	Mixed-use	Vertical mass development	Attached with façade articulation
White House ( B5)	Residential	Detached building	Symmetrical basic form

The five selected buildings adequately represented all geometric typologies identified within the study corridor. During the field investigation, no additional geometric characteristics were observed beyond those represented by the selected samples. Therefore, the selected buildings were considered sufficient to achieve the objectives of the study while allowing a more detailed comparative typological analysis.

The collected data were analyzed using an architectural typology approach through descriptive-comparative analysis. Each building was examined according to the five geometric attributes, after which similarities and differences among the samples were compared to identify recurring geometric patterns. The

synthesis of these attributes was then used to interpret the spatial characteristics and geometric identity of the Anggrek Street commercial corridor.

The overall research procedure is summarized in **Figure 2**, which illustrates the sequence of research activities from problem identification, literature review, field observation, purposive sampling, geometric typology analysis, comparative analysis, and synthesis of the geometric characteristics of the study area.

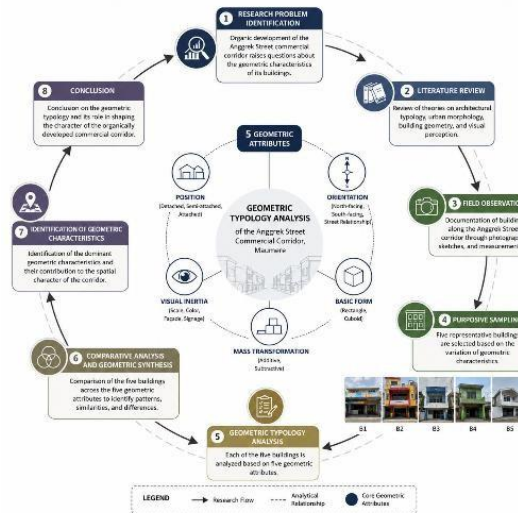


Figure 2. Research Flow Diagram

### 3. RESULTS AND DISCUSSION

The geometric typology of buildings along the Anggrek Street commercial corridor reflects the interaction between building form, land-use intensity, commercial activities, and the organic evolution of the urban corridor. Based on field observations, the geometric characteristics of the selected buildings were examined through five key attributes: building position, building orientation, visual inertia, basic building form, and building mass transformation.

#### a. Building Position

Field observations revealed three spatial relationships among buildings along the Anggrek Street commercial corridor: detached, semi-attached, and attached building configurations.



Figure 3. Example of a Detached Building (Two-Storey Residential House)

The detached building typology is represented by a two-storey white residential building that maintains open space on one or more sides of the structure. These open spaces enhance visual openness while allowing better access to natural daylight and cross-ventilation. According to Ching [17], detached buildings exhibit a higher degree of spatial independence because they maintain a more autonomous relationship with their surrounding environment.



Figure 4. Semi-Attached Buildings (Left: Dunia Motor; Right: Green Commercial Building)

The semi-attached typology is represented by buildings such as *Dunia Motor* and several mixed-use buildings that are connected to adjacent structures on one side while retaining limited open space on the other. This spatial configuration reflects a transitional stage in the evolution of the commercial corridor, where increasing land-use intensity encourages more efficient utilization of individual plots without completely eliminating open spaces around the buildings. Such a configuration demonstrates an adaptive response to growing commercial space demands while preserving access to natural lighting and ventilation. From the perspective of urban morphology, changes in spatial relationships between buildings represent an evolutionary process in urban form, in which increasing land-use intensity gradually produces a more compact urban fabric in response to economic growth and changes in land use [15].



Figure 5. Examples of Attached Buildings (Left: Indomaret; Right: Red-and-Yellow Shophouse)

The attached building typology is represented by the Indomaret building and several adjoining shophouses constructed with little or no spacing between adjacent structures. This arrangement creates a continuous street wall, resulting in a more compact urban form and a stronger spatial definition of the street corridor. Marshall [16] argues that commercial corridors with high land-use intensity commonly develop through continuous building frontages, reinforcing the enclosure and spatial definition of the street environment.

The predominance of semi-attached and attached buildings along the Anggrek Street corridor indicates that land-use intensity is one of the primary factors influencing the formation of the corridor's geometric typology. As commercial activities intensify, buildings tend to maximize plot utilization, reducing the distance between adjacent structures and creating increasingly compact spatial relationships. This pattern is characteristic of organically developed commercial areas, where building forms continuously evolve in response to increasing spatial demands and land development pressures [17,18].

These findings are consistent with previous studies on urban morphology, which indicate that organically developed commercial areas tend to evolve toward more compact building configurations as commercial intensity increases [15]. However, unlike planned commercial districts, the transformation observed along Anggrek Street occurred incrementally through individual building development rather than comprehensive urban planning.

### b. Building Orientation

The buildings along the Anggrek Street commercial corridor exhibit a consistent orientation pattern, with their main façades facing the primary street corridor along the north and south directions. This configuration demonstrates the strong spatial relationship between buildings and the street, where the road functions as the principal organizing element of the corridor.

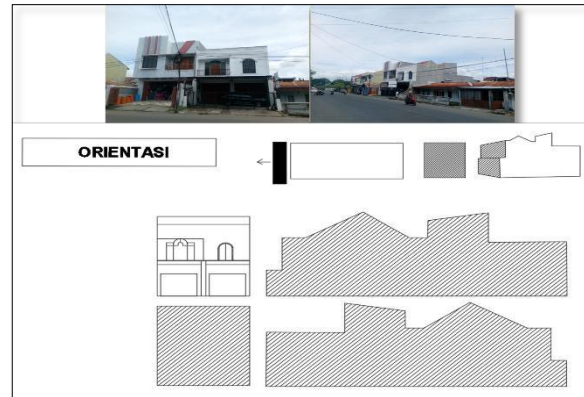


Figure 6. Geometric Analysis Based on Building Orientation

Field observations indicate that most buildings are consistently oriented toward the Anggrek Street corridor, with their primary façades directly facing the street. This uniform orientation highlights the role of the street as the dominant spatial element guiding building layout and supporting commercial activities. Consequently, commercial buildings locate their main entrances, display areas, and signage on the street-facing façade to maximize visibility, accessibility, and interaction with pedestrians and motorists.

According to Lynch [19], paths are fundamental components of urban structure that shape orientation, imageability, and movement patterns within a city. Along the Anggrek Street commercial corridor, the consistent street-facing orientation reinforces the dual function of the street as both a public space and an economic corridor connecting various commercial activities. Moreover, the alignment of building façades creates a continuous street wall, strengthening visual continuity and improving the legibility of the corridor. This finding is consistent with Carmona et al. [17], who argue that buildings with a coherent orientation toward the street contribute significantly to urban spatial quality, visual continuity, and the formation of corridor identity.

Beyond its role in defining urban space, building orientation also reflects adaptation to the tropical climate. With the primary façades oriented toward the north and south, the buildings are exposed to solar radiation from the east and west, increasing the potential for heat gain. To mitigate these effects, most buildings incorporate passive shading elements such as canopies, balconies, overhangs, secondary skins, and articulated façades. These elements not only enhance the architectural appearance of the buildings but also function as passive environmental strategies that reduce direct solar radiation and improve indoor thermal comfort. Koenigsberger et al. [20] emphasize that building orientation in tropical climates should be accompanied by appropriate shading devices to minimize solar heat gain and enhance thermal performance.

Although the buildings share a similar orientation, field observations reveal different geometric responses to climatic and functional requirements. The Indomaret building employs a wide-span canopy to protect the main entrance and commercial space from direct sunlight and rainfall. The red-and-yellow commercial building incorporates projecting balconies and articulated façade elements that simultaneously function as shading devices and reinforce the building's visual identity. In contrast, several residential and mixed-use buildings utilize open balconies, overhangs, and larger window openings to maximize daylight penetration and natural cross-ventilation. These variations demonstrate that, despite having a common orientation, each building adopts distinct design strategies in response to functional needs, local climatic conditions, and owner preferences. Such strategies are consistent with passive design principles that emphasize the integration of building orientation, shading devices, natural ventilation, and daylighting to improve thermal comfort while reducing cooling loads [21].

Overall, the orientation of buildings along the Anggrek Street commercial corridor is influenced not only by the street network as the primary organizing element of the urban fabric but also by the need to maximize commercial visibility and respond to local climatic conditions. The consistent orientation contributes to a highly legible street corridor, while variations in façade treatment demonstrate the adaptive capacity of individual buildings to satisfy both functional and environmental requirements. These findings suggest that

building orientation plays a significant role in shaping the spatial character and geometric identity of the organically developed commercial corridor.

The findings of this study are consistent with previous research on commercial corridors, which emphasizes that buildings tend to orient their primary façades toward the street to maximize accessibility, visibility, and commercial exposure. Lynch [19] argues that streets (*paths*) function as the principal organizing elements of urban structure, influencing orientation patterns and users' perception of the urban environment. Similarly, Carmona et al. [17] reported that a consistent building orientation contributes to stronger street enclosure, improved urban legibility, and greater continuity of public space. The relatively uniform orientation observed along the Anggrek Street corridor therefore reflects a common morphological characteristic of commercial areas where economic activities are concentrated along the primary transportation network.

However, unlike many planned commercial districts where building orientation is controlled through urban design regulations, the Anggrek Street corridor demonstrates a more adaptive pattern. Although the buildings generally share the same orientation toward the street, individual owners have adopted different façade configurations, shading devices, and entrance arrangements according to functional needs and climatic considerations. This finding suggests that the spatial coherence of the corridor is achieved primarily through a common street orientation, whereas architectural expression remains largely determined by individual development decisions rather than coordinated planning.

### c. Visual Inertia

Visual inertia refers to the ability of a building to maintain visual dominance when perceived from different viewpoints along an urban corridor. This dominance is determined by the interaction of geometric form, mass composition, building scale, color, materials, façade articulation, and the presence of signage that attracts the attention of street users. According to Ching [22], a building achieves visual emphasis when it exhibits greater contrast, scale, proportion, or spatial prominence than the surrounding elements. Similarly, Cullen [23] explains that the visual experience of an urban environment (serial vision) is created through variations in form, color, and visual hierarchy encountered along a street corridor.

Field observations indicate that buildings along the Anggrek Street commercial corridor exhibit varying degrees of visual inertia. Commercial buildings characterized by dominant red, yellow, and black color schemes demonstrate the highest level of visual inertia. Their strong color contrast, bold mass composition, extensive façade surfaces, and vertical emphasis establish these buildings as prominent visual landmarks within the corridor. Beyond reinforcing the architectural identity of the buildings, these visual attributes also enhance their attractiveness to road users, thereby strengthening their commercial function.

Table 1. Comparison of Visual Inertia among Buildings along Anggrek Street

Building	Dominant Color	Scale	Signage	Visual Inertia
Red–Yellow Building (B1)	Very High	High	Medium	Very High
Indomaret (B2)	High	Medium	Very High	High
Dunia Motor (B3)	Medium	High	High	Medium–High
Green Building (B4)	Medium	Medium	Low	Medium
White House (B5)	Low	Medium	None	Low

Buildings B1 and B2 exhibit the highest degree of visual inertia because they combine strong color contrast, dominant building mass, and highly visible signage. In contrast, B5 demonstrates the lowest level of visual inertia due to its neutral color palette, simple geometric form, and the absence of commercial visual elements.

Although the Indomaret building has a relatively simple geometric form, it achieves a high level of visual inertia through the application of a recognizable corporate identity, including standardized color schemes, large-scale signage, and a distinctive façade composition. Carmona et al. [17] argue that façade articulation, color, and signage are essential components in enhancing urban legibility and reinforcing users' visual orientation within commercial environments.

Unlike B1 and B2, the Dunia Motor building demonstrates a moderate to high level of visual inertia. Its visual prominence is primarily derived from the scale of the building mass, the large commercial signboard, and the broad façade openings. However, its more restrained color palette produces a lower degree of visual contrast than the Red–Yellow Building and the Indomaret building.

The green commercial building (B4) exhibits a moderate level of visual inertia. Although its façade color is visually distinctive, the relatively simple mass composition and smaller signage reduce its overall visual dominance within the street corridor.

Conversely, the two-storey white residential building (B5) displays the lowest level of visual inertia. Its neutral colors, simple geometric composition, limited façade articulation, and absence of commercial signage prevent it from becoming a dominant visual element within the corridor. This observation suggests that visual dominance is determined not only by building size but also by the combination of color, façade articulation, visual identity, and architectural expression.

The comparison among the five representative buildings demonstrates that visual inertia is strongly associated with the architectural expression of commercial activities. Commercial buildings generally exhibit higher visual inertia because they employ contrasting colors, prominent signage, and expressive façades designed to attract public attention. In contrast, residential buildings prioritize geometric simplicity and functional efficiency, resulting in lower visual prominence. These findings indicate that visual inertia should be understood not merely as a geometric characteristic but also as an adaptive architectural response to commercial requirements and marketing strategies within the corridor.

Nevertheless, the individually developed visual expressions observed along the Anggrek Street corridor have produced an uncoordinated visual hierarchy. As each building emphasizes its own architectural identity, the corridor lacks a coherent visual character at the urban scale. This finding is consistent with Carmona et al. [3], who emphasize that the visual quality of urban environments depends on the consistency of building relationships, façade harmony, and the coordinated management of visual elements throughout the streetscape.

The variation in visual inertia observed among the five representative buildings supports previous studies emphasizing that visual dominance within commercial corridors is determined not only by building size but also by the combined effects of façade articulation, color contrast, signage, and mass composition. Ching [22] explains that visual emphasis emerges from differences in proportion, scale, and contrast, whereas Cullen [23] argues that the sequence of visually dominant elements contributes significantly to the serial visual experience of urban streets. The present findings reinforce these theoretical perspectives by demonstrating that commercial buildings achieve greater visual prominence through the deliberate integration of architectural and graphic elements.

Nevertheless, the Anggrek Street corridor differs from many contemporary commercial environments where visual identity is regulated through façade guidelines or streetscape design controls. The observed variations in color, signage, and façade treatment indicate that visual inertia develops independently at the individual building scale. Consequently, while several buildings function as strong visual landmarks, their cumulative effect is a fragmented visual hierarchy rather than a coherent streetscape. This finding highlights the importance of integrating individual building identity with broader urban design objectives to improve the visual quality of organically developed commercial corridors. Therefore, visual inertia should be understood not only as an individual architectural property but also as a component of collective streetscape identity.

#### **d. Basic Building Form**

Based on field observations of the five representative buildings, the basic building forms along the Anggrek Street commercial corridor are predominantly characterized by simple geometric shapes, particularly rectangular and cuboid forms. Although the buildings differ in function and façade expression, they share a relatively consistent basic geometry that has evolved through various forms of mass transformation in response to functional requirements.

Buildings B1 (Indomaret) and B5 (the two-storey residential house) exhibit simple cuboid forms with symmetrical mass compositions and minimal geometric transformation. These characteristics contribute to a high degree of visual legibility, as the buildings retain their original proportions and geometric clarity. According to Ching [22], rectangular and cuboid forms represent the most stable geometric configurations because they provide order, balance, and efficiency in spatial organization. Their geometric simplicity also facilitates construction while allowing flexibility in the arrangement of interior spaces.

In contrast, Buildings B2 and B3 demonstrate additive transformations of the basic form through the incorporation of projecting façades, balconies, canopies, and additional vertical volumes. These modifications create more dynamic mass compositions without altering the primary geometric identity of the buildings. Ching [22] explains that additive transformation enables buildings to accommodate new functional requirements while preserving their fundamental geometric characteristics. Within commercial buildings, such transformations generally serve to expand usable space and enhance visual attractiveness to street users. Building B4 exhibits a more complex basic form generated through the composition of multiple rectangular volumes arranged both horizontally and vertically. Although its mass composition is more articulated than the other case studies, the building still maintains a clear underlying geometric order. This finding indicates that

the geometric complexity observed along the Anggrek Street corridor results primarily from the composition and transformation of simple forms rather than from the use of fundamentally different geometric shapes.

From the perspective of urban morphology, the predominance of rectangular forms reflects the strong relationship between building geometry and plot configuration along the corridor. Most buildings occupy relatively narrow and elongated plots, making rectangular forms the most efficient solution for maximizing land utilization. Oliveira [18] argues that basic building forms evolve as an adaptation to plot configuration, cadastral subdivision, and the functional development of urban areas. Consequently, the consistent use of rectangular geometry observed in this study suggests that the physical characteristics of the plots have exerted a greater influence on building form than individual architectural preferences.

In addition to plot configuration, the basic building form also reflects adaptation to commercial activities. Retail buildings require flexible interior layouts for merchandise display, customer circulation, and storage, making rectangular plans particularly suitable for efficient spatial organization. This observation supports the argument of Rapoport [24], who states that building form is the outcome of interactions among human activities, functional requirements, environmental conditions, and socio-economic development.

Overall, the findings demonstrate that the Anggrek Street commercial corridor exhibits a high degree of consistency in basic building form. The visual diversity of the corridor is generated primarily through mass transformation and façade articulation rather than through variations in basic geometry. These findings indicate that the geometric identity of the corridor is shaped not by differences in fundamental building forms but by the ways in which individual buildings transform their basic geometry in response to spatial demands, commercial activities, and the gradual organic evolution of the corridor.

#### **e. Building Form Transformation**

Field observations reveal that all five representative buildings along the Anggrek Street commercial corridor have undergone varying degrees of building form transformation. Rather than altering their fundamental geometric forms, these changes occur primarily through additive and subtractive transformations, allowing the buildings to respond to functional requirements, land constraints, and the continuous evolution of commercial activities.

Additive transformation is the most dominant form of geometric modification observed within the study area. Buildings B2 and B3 demonstrate volumetric expansion through the addition of balconies, canopies, secondary skins, Aluminium Composite Panel (ACP) cladding, and upper-level building masses. These interventions generate more dynamic mass compositions while increasing the amount of usable commercial space. In addition to accommodating functional requirements, these architectural elements strengthen the buildings' visual identity and improve their recognition within the commercial corridor.

Conversely, subtractive transformation is evident in nearly all observed buildings through recessed entrances, façade setbacks, terraces, open balconies, enlarged window openings, and carved façade elements. These modifications reduce portions of the original building volume to improve daylight penetration, natural cross-ventilation, and the transition between public and private spaces. In commercial buildings, subtractive transformations also enhance accessibility by creating more open and inviting interfaces between indoor activities and the street corridor.

According to Ching [22], form transformation is a process of modifying basic geometric configurations while preserving their primary identity. Buildings may evolve through addition, subtraction, or dimensional modification, enabling them to accommodate changing functional requirements without losing their underlying geometric characteristics. This concept is clearly reflected along the Anggrek Street corridor, where relatively uniform basic forms have gradually evolved into diverse architectural compositions through continuous geometric transformation.

From the perspective of urban morphology, these transformations represent an incremental process of spatial adaptation driven by changing commercial demands and urban growth. Oliveira [18] argues that building form evolves through the interaction between plot configuration, functional change, and the broader dynamics of urban development. This evolutionary process is evident along Anggrek Street, where commercial buildings have expanded vertically and horizontally while retaining the original configuration of their plots.

Building form transformation is also strongly influenced by the economic objectives of property owners. The addition of balconies, canopies, façade panels, and other architectural features not only increases building capacity but also enhances commercial visibility and strengthens business identity along the corridor. Rapoport [24] argues that changes in building form reflect the continuous interaction between human activities, socio-economic conditions, and the physical environment. Consequently, building transformation should be understood as an adaptive response to both functional and economic pressures rather than merely an architectural modification.

The findings indicate that building transformation along the Anggrek Street commercial corridor is highly adaptive but largely occurs through individual development decisions. Each building has evolved

according to the specific needs of its owner without the guidance of an integrated urban design framework. As a result, although the buildings originate from relatively similar basic forms, successive transformations have produced considerable variation in mass composition, proportion, and façade articulation. These observations suggest that the visual character of the corridor is influenced more by the cumulative effects of building transformation than by differences in the original geometric forms.

Overall, building form transformation constitutes the principal mechanism underlying the geometric typology of the Anggrek Street commercial corridor. Beyond accommodating spatial and commercial requirements, the transformation process shapes the visual identity, spatial character, and morphological evolution of an organically developed commercial corridor. These findings demonstrate that the geometric character of the corridor is defined not by static building forms but by their continuous adaptation to changing urban and economic conditions.

The building transformations documented in this study are consistent with previous urban morphology research, which describes building evolution as a gradual adaptation to changing functional demands and urban development processes. Oliveira [18] explains that building forms evolve incrementally through interactions among plot configuration, land-use change, and socio-economic development. Similarly, Rapoport [24] argues that architectural transformation reflects the continuous adaptation of the built environment to human activities and changing cultural and economic conditions. The additive and subtractive transformations observed along Anggrek Street therefore represent a typical evolutionary process within organically developed commercial environments.

However, the transformation pattern identified in this study differs from that commonly observed in planned commercial districts. Rather than following coordinated design regulations, modifications along the Anggrek Street corridor occur independently according to the preferences and economic capacities of individual property owners. This process has produced considerable diversity in mass composition, façade articulation, and building proportions despite the relatively uniform basic building forms. Consequently, the corridor's geometric identity is shaped not by standardized architectural forms but by the cumulative effects of incremental transformations that have occurred over time.

These findings demonstrate that building transformation functions as the primary mechanism driving the morphological evolution of the corridor. While this adaptive process enhances spatial flexibility and supports commercial growth, it also generates increasing visual diversity that may reduce overall streetscape coherence in the absence of integrated urban design guidelines. Consequently, future corridor development should balance architectural adaptability with urban design consistency to preserve both commercial vitality and visual coherence.

#### 4. CONCLUSION

The geometric typology of buildings along the Anggrek Street commercial corridor demonstrates that the spatial character of the area has evolved through the interaction of five principal geometric attributes: building position, orientation, basic form, building form transformation, and visual inertia. The predominance of semi-attached and attached buildings reflects increasing land-use intensity, while the consistent orientation of building façades toward the street reinforces the role of the corridor as the primary organizing element of commercial activities and urban movement.

Although the buildings share similar rectangular and cuboid basic forms, their architectural character is primarily differentiated through continuous building form transformation. Additive and subtractive modifications, including balconies, canopies, façade articulation, and recessed spaces, represent adaptive responses to commercial expansion, functional requirements, climatic conditions, and spatial constraints. Consequently, the geometric identity of the corridor is shaped more by the transformation of basic forms than by differences in the original building geometry.

The analysis also reveals that variations in visual inertia are influenced by mass composition, façade articulation, color, scale, and signage. Commercial buildings generally exhibit stronger visual dominance than residential buildings, contributing to the corridor's commercial identity while simultaneously producing a fragmented visual environment due to the absence of integrated urban design control.

Overall, this study demonstrates that the geometric typology of the Anggrek Street commercial corridor is the product of continuous spatial adaptation associated with the organic growth of a small emerging city. By integrating five geometric attributes into a single analytical framework, this research extends the application of geometric typology in the study of organically developed commercial corridors. The findings provide a conceptual reference for future urban design strategies aimed at improving visual coherence, spatial quality, and the sustainable development of commercial corridors.

This study is limited to five representative buildings located within a single commercial corridor. Consequently, the findings cannot be generalized to all commercial areas in small cities. Future studies are

recommended to investigate a larger number of buildings and compare multiple commercial corridors to obtain a broader understanding of geometric typology in organically developed urban environments.

From an urban design perspective, the findings suggest that future development of organically evolved commercial corridors should prioritize geometric coherence while maintaining the adaptive characteristics that support local commercial activities. Such an approach may improve both spatial quality and corridor identity without limiting the flexibility of individual building development.

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