



## RESILIENCE IN ISLAMIC URBAN FORM: EXPLORING DYNAMICS IN HISTORIC CENTRAL DISTRICT OF BANDA ACEH, INDONESIA

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### ABSTRACT

Islamic cities have a distinct spatial organization and architectural character deeply influenced by Islamic principles and historical context. Therefore, examining morphology provides invaluable insights into the socio-cultural dynamics and urban form components that have shaped these cities over centuries. This research aims to distinguish the distinctive features that define Banda Aceh as an Islamic city that could influence its resilience. Moves with three objectives: to delve into the history of Islam under different rulers, map the locations of historical areas as part of the urban form components, and examine the identified components' characteristics. Drawing upon the observation, latest satellite imagery, and historical archives, the study delves into the city's urban morphology and spatial organization, facilitating a comprehensive understanding of its Islamic urban form. The findings highlight historical area typologies based on governance timelines. Key finding portrays the survival of infrastructures, including mosques, commercial areas, and public spaces, which reflect cultural practices. The growth of Banda Aceh began from the western bank of the river. It also plays a role in shaping the city layout, initially with the main role of the river as a trade transportation route in the past. Studying the resilience of urban components can enrich urban planning studies and provide inputs for policymakers that there are socio-cultural elements in the city's physical structure that have endured over time, which can support efforts to enhance resilience in the future.

#### Keywords:

Urban form; Islamic city; Adaptation; Resilience; Historic centre

### 1. INTRODUCTION

The development of cities continues to progress, especially in cities of developing countries that serve as centers of economy, governance, education, and culture [1]. Urbanization, which occurs, can pose a threat to efforts to preserve socially and culturally valuable places due to the increased likelihood of adverse impacts if disasters occur [2]. In response to this possibility, the adaptability of urban form is a manifestation of resilience to disruptions [3].

Some cities have areas that remain unchanged despite various events in the past. The resilience aspect in the efforts to survive several times from a city indicates a city capable of adapting because its functions continue to operate. That function applies to various dimensions of disaster resilience, including social, physical, institutional, and ecological [4]. Disaster-prone cities also have historically significant places that need to be preserved in efforts to maintain local identity.

Cities that grow to the community's values include forming Islamic cities. The dominant local community adheres to the Islamic faith; thus, this belief factor emerges in various aspects of city design. The city's physical

arrangement and the community's socio-cultural aspects become integrated in enhancing adaptation to various disruptions.

Resilience is defined as the system's ability to withstand and recover from disturbances while simultaneously developing the capacity to adapt to a new equilibrium in the long term [5], [6], [7], [8]. As mentioned earlier, resilience to disruptions is a form of adaptation. Adaptation is the ability of a system to adjust to changes by becoming better at making those adjustments [8], [9]. It is done to reduce negative impacts and harness existing potentials to enhance positive aspects such as improving the urban system. While mitigation focuses on reducing the likelihood of an event or hazard recurring, adaptation focuses on minimizing the adverse effects of such events through adjustments [10].

The morphological approach is still being used to study the physical features of cities within the built environment scope in Islamic cities [11], [12]. The analyzes specific characteristics in determining whether a city is considered Islamic[13]. These cities changed in their time due to transformations in political views, ecology, and economic shocks, posing threats to the resilience of the social-cultural values the community seeks to preserve [14]. In old Islamic cities in Arabia, the components form one city that spatially does not merge [15]. Markets surround the main Mosque in the city center, high walls enclosing the city, narrow streets, and densely populated residential areas [16]. The main Mosque holds a sacred position in the eyes of the Muslim community; however, this place also serves multiple functions as a public open space [17]. However, the concepts of an Islamic city are generally depicted in the context of countries other than Indonesia. Other researchers emphasize that a city's local culture and geographical condition still need to be considered [18], [19]. Several researchers have explored the uniqueness of Islamic cities in Indonesia. The features found in cities in Indonesia include the presence of palaces and considerations directing buildings towards the qibla [20]. Furthermore, Islamic cities in Java show the presence of mosques as one of their main identities and public open spaces [21], [22]. More specifically, Islamic cities in the northern part of Java demonstrate the sacred value of the presence of tombs within mosque areas [23].

Some researchers conducted a study on resilience in Islamic cities. They found that factors such as a sense of belonging and local traditions significantly influence a place's ability to endure and preserve historical areas in the long term, not just in terms of infrastructure protection [24]. It is accompanied by religious factors influencing the place attachment of the community to continue choosing to reside in a certain place; thus, this is inseparable in the efforts of Islamic cities to enhance resilience besides the presence of adequate support for proper location selection and urban facilities for the population [25]. On the other hand, a downtown area lacking a good maintenance system and experiencing economic factors marked by slum areas and predominantly deteriorated environments further diminishes urban resilience [26]. Nevertheless, the relationship between the aspects of Islamic cities that endure in facing disasters and their relevance to future resilience still requires attention. There is an opportunity to research the presence of urban components in enhancing resilience against disasters supported by non-physical factors such as preserved local history.

As a majority Muslim population, Banda Aceh is known as a city that also implements Islamic law. The old city center of Banda Aceh, which also serves as the central location of historical areas and landmarks, is an area that has predominantly remained unchanged since the 2004 Indian Ocean tsunami [27]. Although the city's coastal areas were devastated by the tsunami, the center managed to survive and continue its functions despite experiencing damage. From its inception to the present day, Banda Aceh has undergone a process of adaptation, during which the old city center has remained in its original location. Therefore, this city is suitable for studying resilience against tsunamis. Adaptive cities emerge due to the aspects they possess. Therefore, this study aims to examine the components of the city that influence the resilience of Banda Aceh as an Islamic city. The novelty offered is the formulation of aspects that have made the city resilient over a long period. Based on the abovementioned aim, this study has three objectives: detecting Islamic history based on governance periods, clarifying historical locations in the study area, and analyzing its character. This study utilizes a descriptive strategy to examine the development of Banda Aceh City, particularly its downtown area, over different administrations. Data collection methods include satellite imagery, historical archives, and field observations. Data analysis involves descriptive analysis and classification. The findings of this research are beneficial academically in understanding the patterns of Islamic cities prone to disasters, allowing various parties to use them as inputs in enhancing resilience and preserving local socio-cultural values. The outline of this paper consists of an elaboration on the background of the problem and relevant studies in the introduction, followed by methods, results, discussion, and conclusion sections.

## 2. METHODS

This study employs a descriptive research strategy utilizing descriptive and classification analyses to address the three research stages, as seen in Figure 1. Using descriptive strategies in research can elucidate investigation

findings, empirical conditions, and experiences using sensory input in writing [28]. This method addresses the research objective to reveal the character and general trends of the data being compared for its development.

Data collection utilizes the literature study method, satellite image collection, and observation. Historical maps are sourced from online archives by the University of Leiden [29], and literature about Banda Aceh's history [30], [31], [32], data on cultural heritage areas come from the Banda Aceh government [33], satellite image data is from Google Earth, and documentation of the current conditions of the study area comes from direct observation. The criteria for selecting literature are those that explain the history of the development of Banda Aceh from its inception to the present day, obtained from archives of city spatial planning maps and open-source satellite maps. Then, this data serves as the basis for observing and validating current conditions through photographic data and notes regarding location, land use, orientation, and elevation.

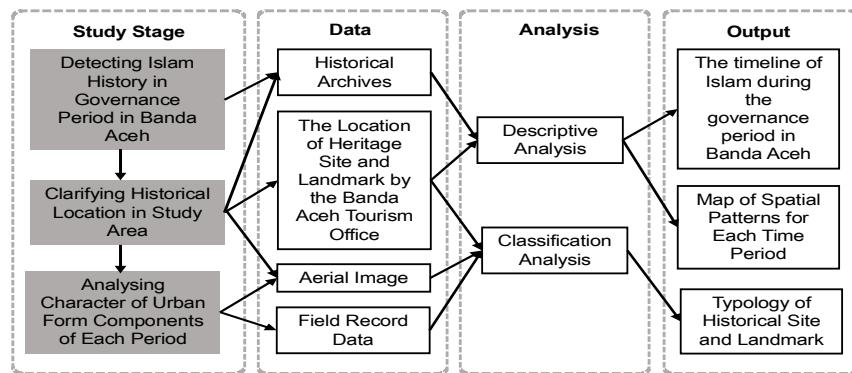


Figure 1. Research Methods

After going through the data collection and analysis process, the timeline of Islam's presence during each governance period in Banda Aceh becomes the first highlight. This clarifies when Islam initially entered Banda Aceh and since the role of Islam has been present in the city's development. Then, these results are also used as a basis for determining which map of Banda Aceh to use. We searched for a map corresponding to the governance period with available data. The map from 1873 depicts the conditions of the Aceh Sultanate before the war with the Netherlands, as seen from the land use of the palace and the Grand Mosque Baiturrahman. The 1944 map depicts the condition of Banda Aceh already dominated by areas designated for the Dutch government and military, where the palace has changed functions. The 2023 satellite image shows the current land conditions of Banda Aceh. The last two outputs are spatial patterns and city characteristics based on each typology. The classification process is carried out based on the three maps. First, spatial patterns are created, and then grouping of the characteristics based on each period of governance is done from the location data that persists from year to year and cultural heritage data. Combining these three periods is expected to answer the research objectives and generate further discussion in enhancing knowledge related to Indonesian Islamic cities and their adaptability.

### 3. RESULT AND DISCUSSION

#### A. RESULT

##### A. 1. ISLAM IN THE HISTORY OF GOVERNANCE IN BANDA ACEH

Banda Aceh was founded in the 12th century and has undergone three governance periods to date, as shown in Figure 2. Banda Aceh is a new capital from the time of the Aceh Sultanate, which has been an Islamic kingdom since the city's inception. The reign of the Aceh Sultanate lasted from the 12th to the 18th century. After going through territorial wars, the Aceh Sultanate expanded. The city of Banda Aceh not only became the center of government but also strategic trade in western Indonesia. The city's main center was located west of the Krueng Aceh River as the main entry port. This led to the emergence of new villages from traders in the north, especially in coastal areas, such as Keudah Village, Peulanggahan Village, and Pande Village.

In the subsequent governance periods (18th – 19th century), the natives of Aceh continued to adhere to Islam, where the role of mosques was highly esteemed by the community. This is evidenced by the history of the Baiturrahman Mosque, which the Dutch colonialists burned and then rebuilt in an attempt to gain sympathy from Acehnese. During this period, the center of the Aceh Sultanate's government transformed into the administrative and military center of the Dutch. They did not alter the city's function as a trading center. Instead, the city was utilized as a market area with European parties and expanded to other countries. New areas emerged besides European houses, namely Chinatown, now called Peunayong.

After Indonesia gained independence in 1945, Banda Aceh functioned as the capital and center of government, social, economic, and educational activities of Aceh Province. The former administrative areas were transformed into the administrative center of Banda Aceh, where private entities expanded the trading areas. The Krueng Aceh River is still utilized as a transportation route for fishermen. Banda Aceh was designated as a special region where Sharia Law has been enforced since 1999, with regulations outlined in Aceh's Qanun. In 2004, the Indian Ocean Tsunami occurred, resulting in adding a new city center to the south of the city as one of the adaptation efforts.

The current condition of the old city center's spatial arrangement is a long process dating back to the establishment of Banda Aceh. It began as the center of governance, worship, and trade, which then, during the colonial period and up to the present time, retained the same functions in the same area. The emergence of new settlements during the sultanate era marked the expansion of trade in Banda Aceh as a port city. The function of a city situated on the coast, connected to the main river serving as a waterway access, supported the city's growth as a trading center. Government data also indicate the presence of cultural heritage sites originating from past legacies that are still preserved. The existence of this old city center is part of the cultural identity of Banda Aceh today.

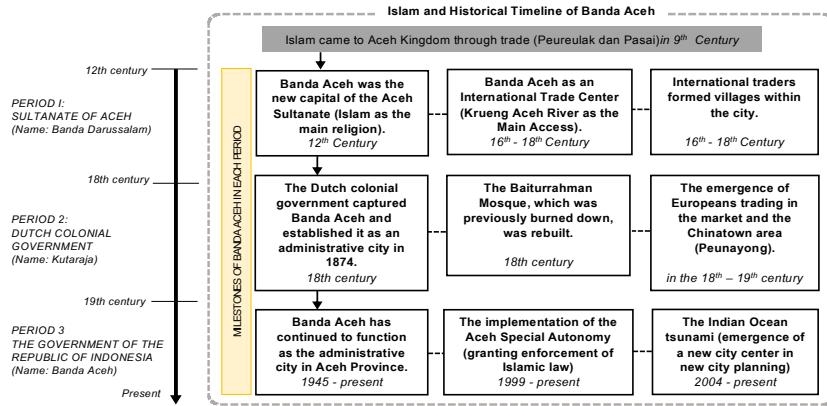


Figure 2. Islam in Different Periods of Governance in Banda Aceh

#### A. 2. SPATIAL PATTERN OF HISTORIC SITE AND LANDMARK

Based on the three different governance periods, there are spatial patterns from each period. During the Aceh Sultanate period, the city center was located west of the Krueng Aceh River, as seen in Figure 3. This kingdom was an Islamic kingdom, so from the beginning, besides the palace, there was already the Baiturrahman Mosque. The Krueng Daroy River is near the queen's garden in the palace area. To the west of the palace is the king's tomb. The city center is located right on the riverbank. This area's location is not directly accessible from the coastline, so one must pass through the main river before reaching the Mosque and market.

The city center expanded to the west and east of the river in the subsequent period as the military area functions increased. The trading area grew, such as markets, commercial facilities (post office, train station, workshop, bank), and Chinatown (Figure 3). The palace changed its function to become the governor's office and military center. The east side of the river became military barracks and a hospital. Among these places were European houses. Schools for natives were separated from schools for Europeans. In the south of the city center were military barracks and a military cemetery. The dominant open area was the military parade ground. There were already bridges on the left and west sides of the river, allowing development to occur on both sides. The trading center also had various functions as facilities.

In 2023, places from the Sultanate and Dutch colonial periods became heritage sites of the city, which, before the 2004 tsunami, were the main city centers in Banda Aceh (Figure 3). Some places and functions from previous periods remain the same. The Sultanate period left behind historical sites and the city's landmark, the Baiturrahman Grand Mosque. There are also parks from that time that have become cultural heritage sites, tourist attractions, and museums. The dominant land use from the colonial period is the trading area, especially Chinatown, whose location remains the same. There are also military areas, which, if previously owned by the Dutch military, are now owned by the Indonesian government. The military cemetery is now a cultural heritage site. The military parade ground is now an open public area for the community. There are new city landmarks that complement the city center, namely the monument at the intersection of five roads and the tsunami museum.

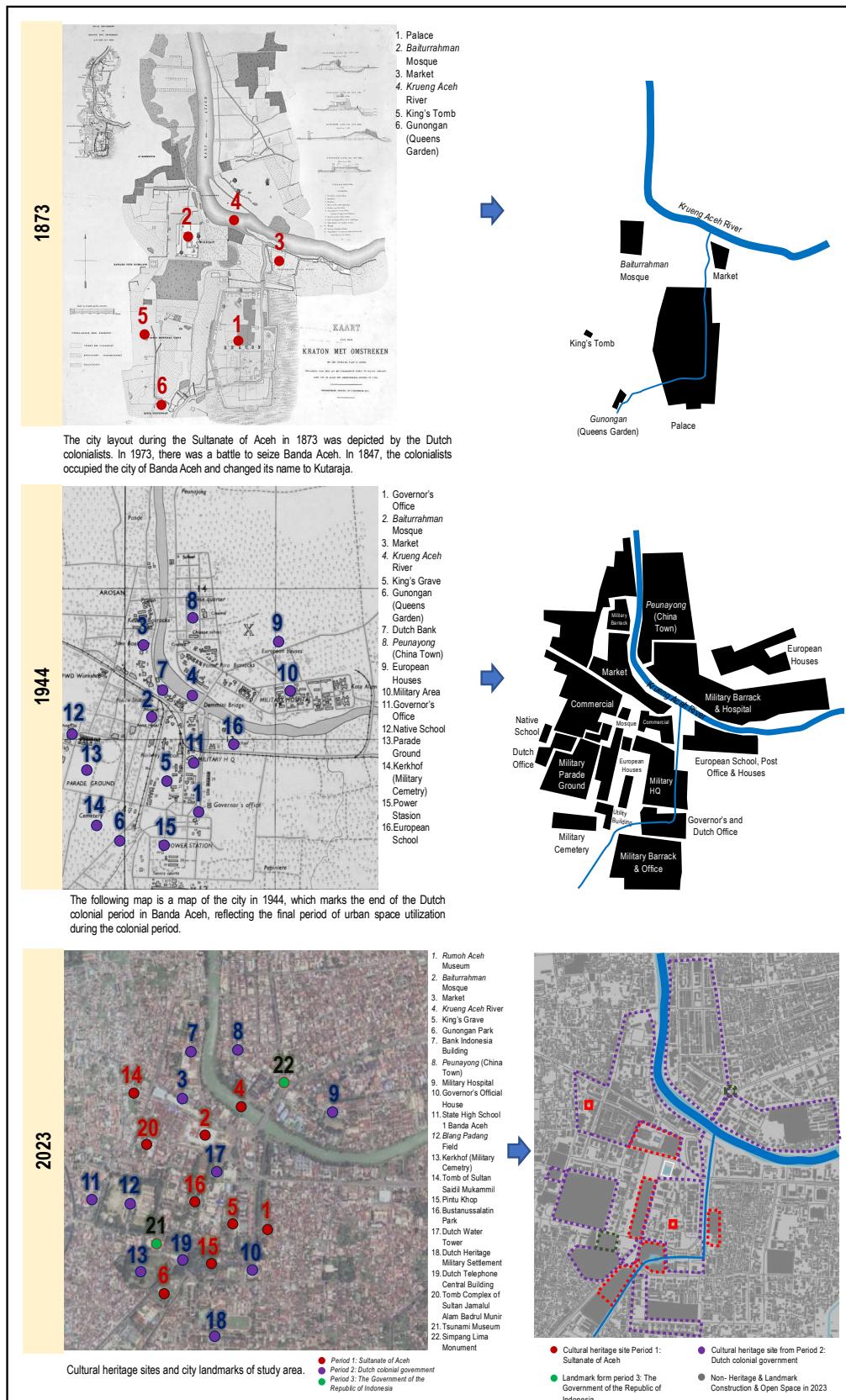


Figure 3. Spatial Pattern of Period 3

### A. 3. TYPOLOGY OF HISTORIC SITE AND LANDMARK

Based on the conditions in 2023, we found three different typologies in this city center area according to the chronology of governance periods. These typologies then serve as references for analyzing their characteristics. The character description includes the location concerning the river, as previous findings indicated that the development was situated along the riverbanks. Land use assessment is conducted to evaluate any changes from the previous period. The orientation of the buildings helps understand the direction the observed places face. Additionally, the height is considered due to current regulations in Banda Aceh city that prohibit buildings within a 100-meter radius of the Grand Mosque's fence from exceeding the Mosque's height to preserve its grandeur [34].

In typology 1, the land use has remained unchanged until now, including the Mosque, royal gardens, and the remains of the Cakra Donya Bell, which dates back to 1524. However, it has been placed in the Aceh Museum since 1915, as seen in Figure. 6. The management of these places is currently under the authority of the city government. They are all located west of the Krueng Aceh River. The orientation of the Mosque towards the qibla accommodates the needs of Muslim praying activity. At the same time, the Bustanussalatin garden, which used to be the king's recreational area, follows the orientation of the Mosque. Other places align with the direction of the river.

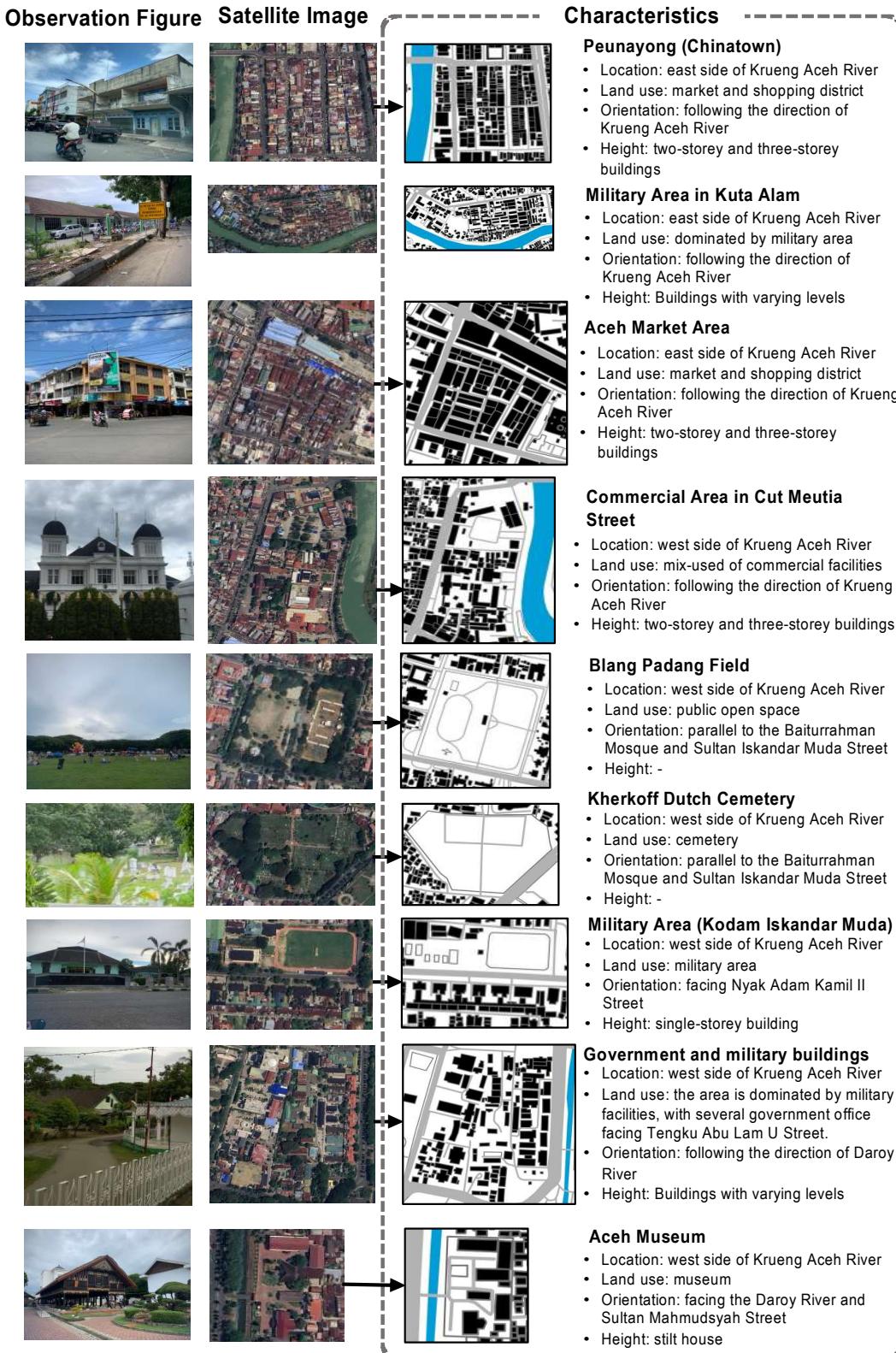
As mentioned in the previous spatial pattern findings, remnants from the colonial period are dominated by trading and military areas, as seen in Figure. 5. In the market and Chinatown, buildings consist mainly of two to three-story commercial blocks. In the military area, most buildings are single-story. These places are located on the east and west sides of the river. The Dutch Heritage Square has become the main public open space in Banda Aceh, used for exhibitions, sports, culinary events, and tourism. Generally, these places serve similar functions. The orientation follows accessibility facilities such as main roads and rivers. The rivers serve as transportation routes for fishermen to access the market area from the port.

The landmarks built during the Indonesian governance period are the monument at the five-way intersection and the tsunami museum, as seen in Figure. 6. The monument is located east of the main river, marking the connection between the five main roads, including the bridge that connects the east and west sides of the river. The tsunami museum was built in 2008 to serve as a place commemorating the 2004 tsunami event. This three-story building is situated west of the river, with its orientation following the road.

Observation Figure	Aerial Image	Characteristic
		<b>Baiturahman Mosque</b> <ul style="list-style-type: none"> <li>Location: west side of Krueng Aceh River</li> <li>Land use: mosque</li> <li>Orientation: qibla (direction of prayer)</li> <li>Height: single-storey building</li> </ul>
		<b>Gunongan Park</b> <ul style="list-style-type: none"> <li>Location: west side of Krueng Aceh River</li> <li>Land use: museum</li> <li>Orientation: following the direction of the Daroy River</li> <li>Height: stilt house</li> </ul>
		<b>Putroe Phang Park</b> <ul style="list-style-type: none"> <li>Location: west side of Krueng Aceh River</li> <li>Land use: park (open space)</li> <li>Orientation: following the direction of the Daroy River</li> <li>Height: -</li> </ul>
		<b>Bustanussalatin Central Park</b> <ul style="list-style-type: none"> <li>Location: west side of Krueng Aceh River</li> <li>Land use: park (open space)</li> <li>Orientation: following the direction of Baiturrahman Mosque</li> <li>Height: -</li> </ul>

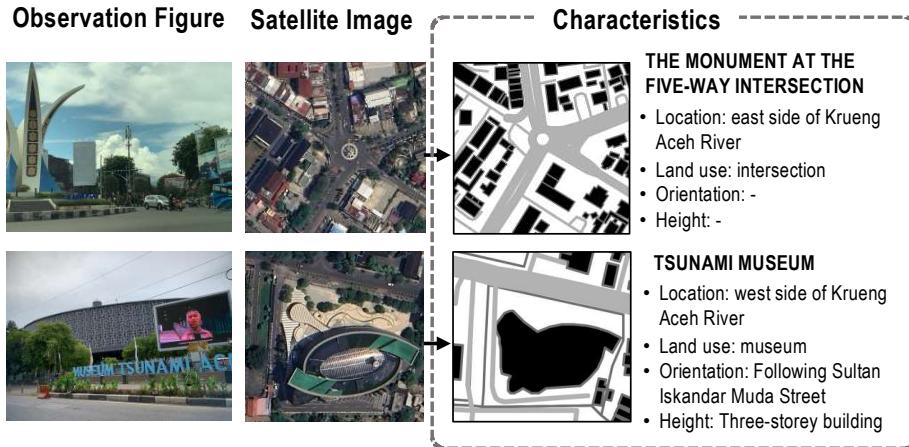
● Typology 1: Cultural Heritage Site from Sultanate Of Aceh Period

Figure 4. Characteristics of Typology 1



### ● Typology 2: Cultural Heritage Site from Dutch Colonial Government Period

Figure 5. Characteristics of Typology 2



● Landmark form period 3: The Government of the Republic of Indonesia

Figure 6. Characteristics of Typology 3

## B. DISCUSSION

### B. 1. BANDA ACEH IS AN ISLAMIC CITY IN THE CONTEXT OF THE INDONESIAN ARCHIPELAGO

Through the study of the urban form of Banda Aceh from its history of governance, we found that since the beginning, the city has exhibited characteristics of an Islamic city. Mosques have always been an integral part of the city, always coexisting with the administrative center. Even today, the grandeur of the Grand Mosque remains crucial to preserve, as evidenced by its inclusion in urban spatial planning regulations. The Mosque serves not only as a place of worship for Muslims but also as a manifestation of the social and cultural identity of the community, which serves as the city's identity. There are similarities with other countries where the position of the Mosque is crucial for Islamic cities as it serves as a central element [16]. The Mosque is situated amidst the trading area, with residential areas on the outer perimeter. The qibla serves as the primary orientation for the Mosque, as seen in Figure. 7.

There are distinctive features in Banda Aceh compared to other Islamic cities. The largest public open space in the city was developed at a different time from the Mosque and the sultan's palace. This area emerged as it was previously designated for Dutch military activities. Different governance periods influenced changes in land use despite the city's prior Islamic character. The core of the city, originally designated for administrative and commercial purposes, expanded with the addition of military facilities. Natural features such as rivers played a significant role in determining the location of the city center during the sultanate period. This area was not directly coastal and required river access to reach the port, providing security from sea routes. The river also served as the main trade route in the past.

During the Dutch colonial period, they segregated ethnicities, resulting in the separation of Chinatown, Dutch colonial-era buildings, and residential areas, which remain separate to this day. They also established a hierarchical road system, resulting in main roads being wider than neighborhood streets. Banda Aceh shares similarities with other cities in Indonesia regarding the presence of mosques [21], [22]. However, it differs in terms of the presence of tombs within the mosque area, as seen on the northern coast of Java [23]. In Banda Aceh, the tombs of the kings are separate from the main Mosque. This confirms that despite the common features of Islamic cities, considerations regarding the local geographical conditions and history also need to be taken into account. It is what makes each Islamic City distinctive.

In a broader context, within Islamic cities, the presence of mosques is crucial for the community, serving not only as places of worship but also as multifunctional areas for learning and community gatherings [17]. They can even be interconnected with market areas and government facilities [20]. In Banda Aceh, the existence of such areas aligns with the predominantly Muslim population of Aceh, making them an integral part of the identity of the Acehnese people. In the context of the 2004 tsunami, the main mosques were also utilized as shelters for the community despite not being multi-story buildings [35]. Preserving these spaces from the era of the sultanate to the present day underscores their importance to the community.

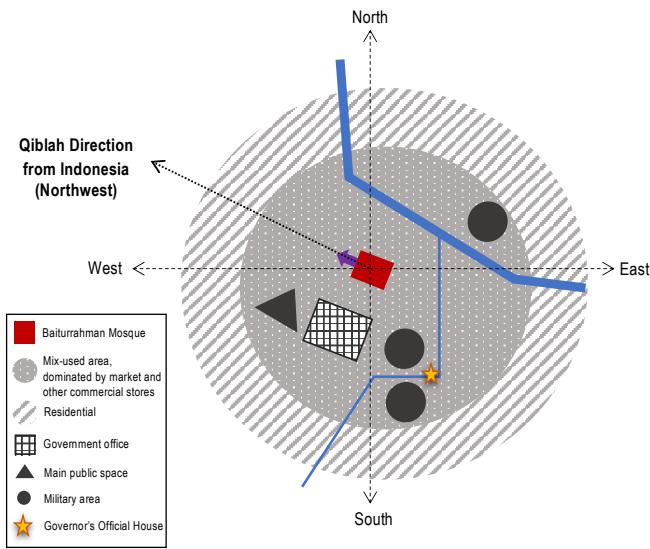


Figure 7. Islamic Urban City in Banda Aceh

## B. 2. REPRESENTATION OF RESILIENCE IN ISLAMIC URBAN FORM

The adaptation occurring in the city of Banda Aceh towards various events involves the changing land functions while retaining the Islamic city identity it already possesses. Threats such as disasters that could shift the function of a place still allow it to endure [3], preventing significant shifts in the importance of the old city center area in Banda Aceh.

In Banda Aceh, efforts to preserve cultural heritage areas up to the present have had a positive impact on the city's resilience in maintaining its historical and cultural values and strengthening its economy. On the other hand, the geographical conditions, where the presence of rivers while supporting the economy, especially in fisheries, can reduce resilience to tsunamis by providing access for tsunami waves to reach the land more quickly. Compared to resilience in other Islamic cities, the presence of this river may not be advantageous during a tsunami event. However, considering the events of 2004, the city center area did not suffer damage because it was not directly located on the coast [27].

Figure 8 illustrates the concept of Islamic city resilience proposed in our study. Resilience, embodied in the design language, stems from efforts to preserve historical areas. The uniqueness of each city arises from key historical events and geographical conditions, which may give these cities different characteristics. Islamic principles in the development of Islamic city resilience include environmental sensitivity, social integrity, and economic development. Therefore, there is a collaboration between principles aimed at avoiding environmental damage, utilizing urban land according to the needs of the community, and supporting the economic strengthening of the city.

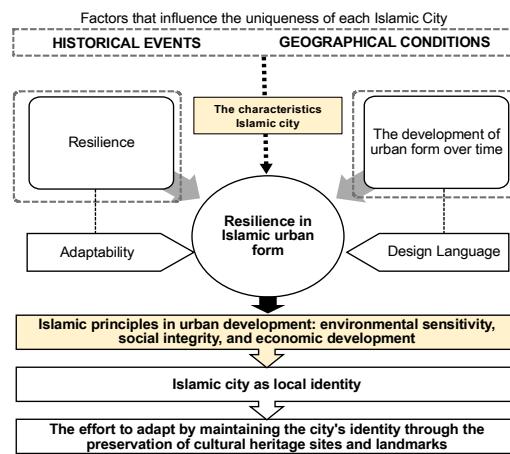


Figure 8. Concept of Resilience in Islamic Urban Form

The value of the beliefs held by the majority becomes an identity [2], [18], which then forms efforts to adapt the city system to various circumstances. With time accompanied by urban development, the city will continue to make efforts to adapt and withstand the presence of the values of the beliefs held earlier. In continuing the efforts of improving adaptation, the city requires the preservation of socio-cultural values for the future. This is in line with the concept of transformative adaptation [36], which emphasizes long-term measures that yield positive impacts for all components within the system.

By evaluating the achievements and current conditions of the city regarding the preservation of cultural heritage and spatial trends influencing its identity, valuable insights can be gained for urban planning. This input can guide policymakers in determining strategies that consider the sustainability of city components while preserving the values upheld in efforts to enhance resilience. Although Banda Aceh has demonstrated continued preservation efforts since its inception, long-term sustainability still requires strategies tailored to the city's uniqueness.

#### 4. CONCLUSION

Banda Aceh is an Islamic city whose planning, since the time of the Aceh Sultanate, has emphasized the presence of a central mosque adjacent to the palace as the seat of government and a market as the trading center. This has continued to the present day, even though Banda Aceh has had a new city center after the 2004 tsunami in the southern part of the city. This city shares characteristics of Islamic cities found in other countries, but it also has unique features that set it apart. The enduring components of the city are formed through the city's adaptation in each period of governance. This ability stems from shared values and beliefs held by the Acehnese. Local socio-cultural factors support the enhancement of resilience efforts.

The character of downtown Banda Aceh has both positive and negative effects on resilience. In terms of efforts to preserve cultural heritage and local identity, it enhances cultural heritage resilience. On the other hand, in the context of tsunami protection, the downtown's location on the riverbank can have negative impacts by accelerating floodwaters into the city. Both aspects can serve as highlights in determining suitable strategies for the future.

This study serves as an initial identification of how socio-cultural factors influence resilience efforts in urban form. Assessing resilience to disasters, especially tsunamis, in the components of urban form is necessary to understand the extent of effort required to create adaptation capabilities that have positive impacts across multiple dimensions. There are research opportunities related to disaster resilience in urban form components. Further research could elaborate more to clarify the findings of this study, such as assessing the city's resilience to natural disasters across various dimensions and exploring alternative future scenarios to gain a holistic understanding. Further depth could also be achieved by examining the perspectives of the community regarding the resilience of urban forms.

However, a limitation of this study is its focus on one aspect of urban infrastructure, namely cultural heritage preservation. This presents an opportunity for future research to explore the overall diversity of urban infrastructure components that come together to enhance resilience to disasters. Additionally, the specific time frame and location constrain the potential generalization of findings to other cities with different histories and geographical contexts.

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