

Study of Road Patterns and Space Formation in Settlement Areas on the Edge of Lake Laut Tawar, Aceh Tengah Regency

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ABSTRACT: This research aims to find developments in road patterns from 2008 to 2024 and explain the influence of road patterns on the formation of settlements on the edge of Lake Laut Tawar. This research uses a quantitative descriptive approach and diachronic reading analysis techniques. This research uses overlapping maps (superimpose), surveys, and interviews. The results of this research are to find factors that influence the formation of settlements on the edge of Lake Laut Tawar, including the flat topographic conditions. Demographics continue to increase in the population of the study location. The social culture at the study location is that the residents who live on the edges of Lake Laut Tawar are residents who have family relationships. Distribution of space designations that change function from agricultural land to residential land. Land values vary on the edges of Lake Laut Tawar according to their zones.

KEYWORDS : *Road Pattern, Lake Edge, Laut Tawar Lake*

I. INTRODUCTION

The importance of spatial planning in urban areas to support economic and socio-cultural activities. Urban life will continue to progress and develop over time following the times. The more advanced and developed the era, the more activities occur in an area. These activities include economic activities and socio-cultural activities. Increased population growth is also marked by increasingly dense settlements, so with increasingly dense settlements, urban settlements will continue to experience development and expansion from the city center to the edges. Cities with high population densities cannot accommodate the density, and this causes development in suburban areas.

Lake Laut Tawar is a tourism sector that has become an icon of Aceh Tengah Regency. To the west of Lake Laut Tawar, there have been many changes in conditions. Lake Laut Tawar, which used only to be a place for people to fish, now has many recreational areas. Tourism emerging on the edge of this lake continues to progress and develop with the times. Apart from the tourism sector, the lakeside area is also designated as a settlement; the settlement develops from the city center. The emergence of settlements on the lake's edge did not just happen; of course, some factors triggered the development of settlements on the edge of Lake Laut Tawar. With a settlement, of course, there is a road network to provide access to the settlement.

The road pattern built in the residential area on the edges of Lake Laut Tawar is neatly arranged perpendicular to the lake, thus making the residential location on the edges of this lake a beautiful and unique settlement. This differs from the roads built in other lake areas, such as Lake Matano in South Sulawesi, Lake in North Sulawesi, and Lake Poso in Sulawesi Tengah. Reindeer Lake, in Canada. The road pattern on the lake stretches along the edge of the lake. The road pattern on the edge of the lake is a factor that influences the formation of settlements on the edge of the lake.

From this background, the author feels it is necessary to research how the road patterns and spatial formation on the edges of Lake Laut Tawar influence the formation of settlements. Are there factors that influence settlements with the existence of this lake? The problem formulation in this research is (1) How will the road pattern develop from 2008 to 2024? (2) How does the road pattern influence the formation of settlements?

II. LITERATURE REVIEW

2.1 Settlement Development

Roads are an element that includes the image of a city. Road users, whether motorists or pedestrians, need access to pass and pass on roads for their daily lives. Roads provide access for movement. Movements that occur in an area will emphasize the image of the city [1]

Based on research conducted by Watopa in 2018, it was concluded that what causes settlement development is socio-cultural, environmental, distance to work locations, activity centers, and public facilities and infrastructure. The socio-cultural environment that exists at the research location influences settlement development. In a settlement where one family lives, the family's relatives also live in that area. So the settlements are clustered. From an environmental perspective, topography is a factor in the development of settlements. The topography does not support the use of residential space at that location, which is limited. Apart from that, another factor that factors into residential development is the distance to the place of work. The short travel distance increases people's interest in living in that location. Residents feel that the location of the settlement is very strategic as a place to live. Activity centers consisting of trade and services can increase economic growth. Public service facilities have a fairly high influence on the formation of settlements [2].

Based on research conducted by Damayanti et al. in 2019, they discussed the factors that influence the development of residential areas in coastal locations in Purworejo Regency. In this article, the factors that influence the development of settlements include facilities, utilities, social culture, and land value. Facilities consist of public facilities and social facilities. These facilities include facilities used for education, religion, health and the economy. From a utility perspective, Purworejo district was studied using network indicators that support the formation of settlements. These networks include clean water networks, waste water networks, drainage networks, electricity networks, and telecommunications networks. The available networks are electricity networks and telecommunications networks. However, waste water networks, clean water networks, and drainage networks are still rare in Purworejo Regency. Residents have other alternatives to overcome the lack of wastewater and clean water networks. For clean water networks, residents use well water. Meanwhile, for the waste water network, residents use septic tanks as a means of disposal. And to overcome residences that do not have sewer drainage, residents only use land as water catchment. From a socio-cultural perspective, residents who live in the outskirts of Purworejo Regency are those who are related to family, relatives and are related by blood. And another factor that influences the development of settlements is the land value factor. Land on the outskirts of Purworejo district is a location that many people are interested in living in. This causes the land in that location to be sold at a fairly high market price. So land value is a factor that influences the development of settlements [3].

According to research conducted by Nuzullia, her writing explains that the factors that influence settlement development are physical, social and economic factors, as well as land value. The aim of this research is to analyze the factors that influence residential development in Depok City. These factors include accessibility. Interrelationships between regions influence settlement development. The higher the interconnectedness that occurs, the more it triggers settlements to continue to develop on the outskirts. Apart from that, it is a public facility that can serve the population. Settlements will continue to develop in suburban locations, because good public facilities can attract residents' needs to live on the outskirts of the city. The next factor is the landowner and the criteria for the land. Good land a safe and comfortable situation will also attract people to live on the outskirts of the city. Initiatives from developers are also an influencing factor in residential development. Developers who build housing on the edge of the lake will turn land on the outskirts of the city into built-up land that is useful for residents [4].

Based on Pidora's writings, 2014 quoted Riza (2005), explaining the value of land. The value of land in a location is influenced by the function of the activities on that land. Land prices are also divided into land that has buildings and vacant land. Thus, of course the price of land that already has buildings is higher than the price of land that does not have buildings or is empty land [5].

Based on these opinions, it can be concluded that the factors that influence settlement development include topography, circulation, socio-culture, land use, land value, and land owners.

Settlement distribution patterns are divided into clustered patterns, random patterns, and uniform patterns. A cluster pattern is a settlement consisting of several houses in one location, then in another location consisting of several houses as well. However, from the location of one settlement group to another, there is a distance marked by physical elements such as roads and rivers. The form of distribution pattern is an irregular settlement pattern. The locations of houses or facilities are generally not clustered. Meanwhile, uniform settlements are settlements that often have the same shape [6].

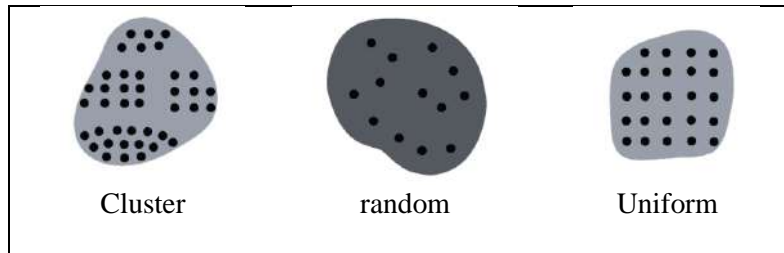


Fig 1. Settlement distribution patterns

2.2 Development Of The Road Patterns

Settlements consist of two (2) objects, namely places, locations and users (humans). However, other objects that are complementary to forming the settlement itself include nature, humans, society, protectors, and networks. These objects are factors that influence settlements [7].

Research conducted by syarif (Syarif, 2016) explains that road patterns experience changes in each period. The periods studied start with the village, coastal, city, and metro city periods. During the village period, the village was in the form of a network with an elongated pattern, but was not integrated with each other. During the coastal period, the road pattern was elongated, and the road network was integrated. During the city period, the existing road pattern was in the form of long and clustered roads, and the road network was integrated with each other. The number of road segments connecting one section to another continues to increase. Meanwhile, during the city metro period, the road pattern at the water's edge was already clustered, and there were more and more integrated roads. Researchers concluded that road patterns were greatly influenced by the layout of houses built in residential areas. With a house that has been built, the road network pattern will adapt to the direction of the house. In this study, researchers also analyzed circulation or movement patterns. The results of the research carried out are movement patterns that change over each period. During the village period, there is no route choice available. During the coastal, city, and metro periods, a choice of route directions is available. Apart from that, this research also analyzes changes in lane direction. Researchers explained that the direction of the route during the village period was a road that could only be crossed in one direction. During the coastal period, it can be entered from two directions. During the city period, the existing route can be entered from four directions. During the metro period, the route consisted of five directions [8].

Based on the writings of Giri et al in 2016 regarding the development and planning carried out in the Buyan Lake area, Bali. This article explains the factors that influence road patterns. These factors include socio-cultural, environmental, aesthetic and supporting factors. From socio-cultural factors, existing roads must pay attention to traditional characteristics and cultural values held by local residents. Then another factor that influences road patterns is environmental factors. The environmental factors in question are sustainable natural conditions. With aesthetic value, it creates a strategic, efficient, clean and beautiful road pattern to the eye. So that people who cross it can feel comfortable and enjoy its beauty. Supporting factors include those that can support activities at the Buyan Lake location, such as the edge of the lake which functions as a tourist attraction. So that from all the factors that have been mentioned, it can make the edge of the lake integrated and sustainable and become a location that can be enjoyed for its beauty. The planned road is a road whose road pattern must be able to adapt to the traditional architectural conditions of the location [9].

Road patterns according to their categories can be divided into three (3) categories including grid patterns, culdesac patterns and loop with green. Roads with a grid pattern are strategic and easy to traverse, but there is a risk of a high number of vehicles passing. With a grid pattern, the houses that will be built around the road will be regular. This is different from the culdesac pattern, which can result in a messy, undirected building layout. The loop with green pattern is a dead end road pattern where there are no intersections but the road has a way back to the main road [10]. The road pattern can be seen in Figure 2.

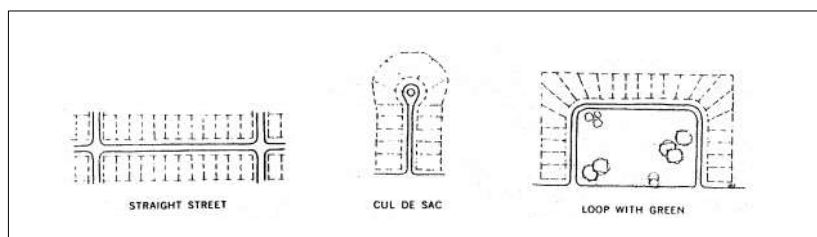


Fig 2. The road of pattern

Based on several opinions explained previously, it can be concluded that to determine the development of road patterns, you must examine the location of the road over several periods of change. There are several types of road patterns, including grid patterns, culdesac patterns, and loops with green. Road patterns are influenced by several factors, namely socio-cultural factors, environment and supporting factors.

III. METHOD

To complete research on road patterns and space formation in residential areas on the edges of Lake Laut Tawar, researcher conducted field surveys and literature studies, as well as both opinion and related planning documents. This research uses a mixed descriptive quantitative and qualitative approach. Research with a qualitative and quantitative approach is carried out by collecting data and presenting it in descriptions. Data collected in this research was collected through interviews, documentation, and maps related to the research. This research will describe how the development of road network patterns and space formation in residential areas on the outskirts of Lake Laut Tawar. Researchers took research over a period of the last fifteen years. Then regarding developments that occur in phases with a period of 5 years. The research phase will start from 2008, 2009-2014, 2014-2019, and 2019-2024. To examine the factors that influence the formation of settlements, researchers used several variables related to the problem, including topography, circulation, socio-culture, land use, land value and land owners. For more details, the research method will be described in the following table.

Table I. Method

No	Problem Formulation	Method
1	Development of Street Patterns and Space Formation	1. Phase 5 years 2. Overlapping map 3. Diachronic reading analysis
2	Factors Influencing Settlement Formation	Research Variable 1. Topography 2. Circulation/Change of lane direction 3. Social and Cultural 4. Land Use 5. Land Value 6. Land Owner

IV. RESULT AND DISCUSSION

Aceh Tengah Regency consists of 14 (Fourteen) Districts. In this research study, researcher took the research location in Bebesen District, especially Keramat Mupakat Village. The area of Keramat Mupakat Village is 1.25 km². The population of Keramat Mupakat Village is 2,704 people, with a population density of 2,163 people/km.

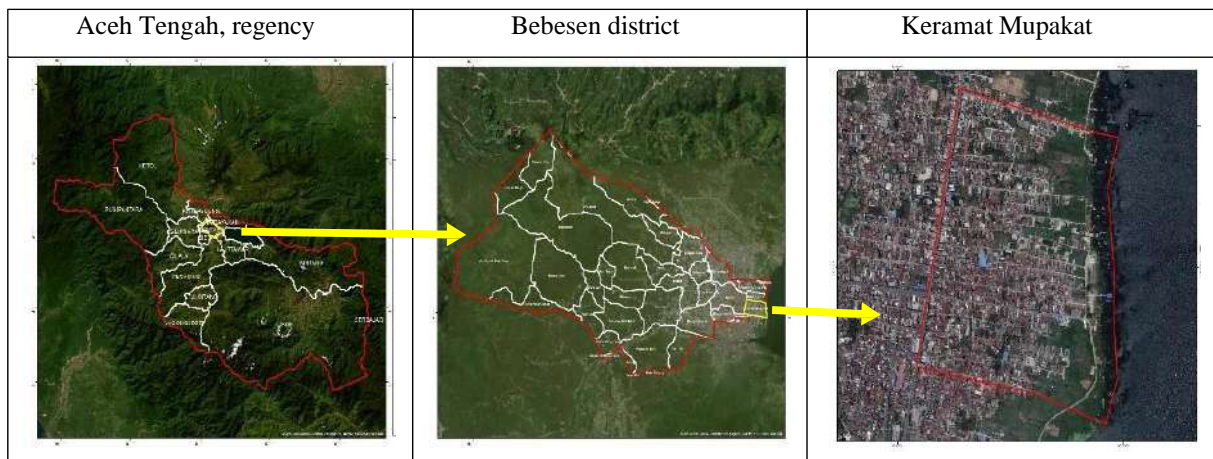


Fig 3. Research Study Location

Formerly, Aceh Tengah Regional Government built the village road at the study location. The road was built with asphalt construction. However, road construction was built only in locations where residential houses had already been built. So, the local road to Lake Laut Tawar must be built, and the only road is dirt construction in lousy condition. During the rainy season, this road is difficult to pass because of standing water in the area of the road. The road network at the research location, namely the edge of Lake Laut Tawar, is a road for village residents. This neighborhood road is crossed by vehicles at low speed. The vehicles that pass are owned by people living in that neighborhood area. The road construction is asphalt and in good condition, but only part of the road has asphalt construction.

Factors that influence road patterns in residential areas on the edges of Lake Laut Tawar are topography, road dimensions, and road class. The land surface of the road network in the residential area on the edges of Lake Laut Tawar is flat. The contour lines at the study location are the same. Types of road network according to class: The road classes at the research location are divided into three classes, namely local roads, village roads, and evacuation routes, which are explained according to their administrative function, namely sub-district roads and village roads.



Fig 4. Street Network

The value of land at the research location became relatively high after changes in land use began on Lintang street is the main road in the residential area on the edges of Lake Laut Tawar. On the left and right sides of the road corridor, buildings began to appear and function as trade and service activities. Therefore, it makes the area a lively and developed area, resulting in many requests for buying and selling land at that location.



Fig 5. Lintang Street

After analyzing research regarding the value of land in residential areas on the edge of the Laut Tawar Lake, this is in line with the researcher's opinion put forward by Hanifati 2016 which states that strategic locations will influence land values [11]. Apart from that, the value of land on the edge of Laut Tawar lake is also in line with the opinion expressed by Prasetya which states that land value will be influenced by the benefits generated from the land [12].

Likewise with the condition of land values on Lintang Street high latitude. This is influenced by the function of land use in the form of trade and services which influences the increase in land selling prices. This is in line with the opinion put forward by Sadyoutomo (2008), which explains that land is influenced by land use functions, thereby causing an increase in land sales value [13]. This is also in line with the opinion put forward by Siswanto (2007), which states that land prices are determined by the functions that can be utilized from the land [14].

After more houses were built at the study location, the Village Government opened a road with concrete construction. Roads that were once bad are now better. The village government has built and made neighborhood roads longer so that they can be integrated with each other and make it easier for residents to pass through.

2008	2009-2014	2014-2019	2019-2024
 <p data-bbox="220 495 480 696">Several roads that start from the main road do not reach the ring road on the edge of Lake Laut Tawar. The ring road is marked with a blue line.</p>	 <p data-bbox="499 495 759 943">Addition of alley roads to connect one road section with another road and increase in road length from neighborhood roads to the Lake Laut Tawar ring road. The increase in road length in this phase occurred on seven road sections, and construction of a small alley road consisting of five road sections. The progress of the road is marked with a red line.</p>	 <p data-bbox="788 495 1048 994">Addition of alley roads to connect one road section with another road and increase in road length from neighborhood roads to the Lake Laut Tawar ring road. The addition of roads in this phase is less than the previous phase. The increase in road length in this phase occurred on two road sections, and construction of a small alley road consisting of one road section. The progress of the road is marked with a red line.</p>	 <p data-bbox="1098 495 1358 943">Addition of alley roads to connect one road section with another road and increase in road length from neighborhood roads to the Lake Laut Tawar ring road. The increase in road length in this phase occurred on two road sections, and construction of a small alley road consisting of three road section. The progress of the road is marked with a red line.</p>

Fig 5. Development of the Road Network

Road users who pass on this road are residents who live in the research study location village and who live to settle. The circulation of movement patterns on the existing road network in the research study area, namely the residential area on the edge of the Freshwater Lake, is a neighborhood road that is traversed from the west to the east, and also vice versa from the east to the west. The circulation at the research location never changed. Detailed according to the name of the road, environmental roads start from the main road, namely the latitude road to the ring road or lakeside evacuation route. The neighborhood road or village road route is a two-way road, but to exit the village road to the main road there is an alternative road other than the neighborhood road where they entered. The alternative road in question is to pass through the ring road and continue with other environmental roads, which can lead to the main road or latitude road. Likewise, the condition of the roads in the study area if residents hold parties that eat up the road. Residents go to their homes by passing through the neighborhood road next to their road to the ring road and turning onto the road where they live. As an illustration, residents who want to go to their residence on Alfitrah Street, to return to the main road can take the lakeside ring road and go to Jalan MJM until they return to the main road. Likewise with other village roads. The ring road is an alternative that can connect village roads to the main road. An illustration of circulation or movement patterns at the study location can be seen in Figure 6.



Fig. 6. Circulation

After analyzing the development of road patterns and identifying the circulation that occurs at the research location, namely the outskirts of Lake Laut Tawar. The road pattern in the 2019-2024 phase depicts environmental roads in residential areas that do not have many intersections. If you cross one road, there is no way to get to the other road. However, to get to the main road there is an alternative road that can be used, namely the ring road which is right on the edge of Lake Taut Tawar. Reviewing the opinion expressed by Kwanda in 2000 which stated that there are three road patterns including the grid pattern, cul desac and loop pattern. Of the three patterns written, the road network at the study location is closer to the loop with green road pattern.

Most homeowners own private homes, and several people, namely migrant residents, still rent homes. In several places, the majority live in rental homes. Regarding ownership, much of the land has been certified at the study location.

From a socio-cultural perspective, the residents in the residential area on the edges of Lake Laut Tawar are residents who have family ties. The road in the study location was initially planned and opened by residents. The majority of residents' livelihoods are farmers and fishermen. Residents opened paths leading to rice fields for farming and for residents active on the lake as fishermen to catch fish.

After analyzing the development of road patterns, it can be seen that the presence of freshwater lakes is a factor that influences the shape of road patterns in residential areas. The road pattern, which is perpendicular to the lake, is influenced by the function of the lake which is used by fishermen to the job location.

Initially, landowners built settlements one by one at each location. Each house was built near rice fields and lakes, which are locations for residents to earn a living. The buildings were neatly built facing north, some facing south. So, with the construction of these houses, road construction will continue.





2008	2009-2014	2014-2019	2019-2024
 <p data-bbox="236 1144 469 1173">House building in 2008</p>	 <p data-bbox="507 1144 770 1279">The construction of houses began to increase one by one and a pier appeared on the edge of the laut Tawar lake</p>	 <p data-bbox="802 1144 1066 1223">House construction taking place at the research location continues to increase</p>	 <p data-bbox="1102 1144 1366 1301">The construction of houses taking place at the research location continues to increase and a National Basarnas has begun to be built on the shores of the Laut Tawar Lake</p>

Fig 7. Development of the Settlements

Residents build houses in the area on the edges of Lake Laut Tawar to serve as private residences, but some build houses to rent to other people. The construction of houses built in the area on the edge of the Tawar Sea Lake is concrete, and some are board construction. The number of floors of houses in the residential area of the study location consists of first and second-floor houses. Apart from building houses, developments in the residential area on the edges of Lake Laut Tawar include the construction of a pier and the National Search and Rescue Agency (Basarnas) office. The Basarnas office is located right on the shore of Lake Laut Tawar. The Basarnas office is next to the pier.

After identifying settlements at the research location, the settlements were initially built one by one by the landowners at that location. Each house was built near rice fields and lakes which are locations for residents to earn a living and make ends meet. The building was neatly built facing north, some facing south. So with the construction of these houses, road construction continues.

In contrast to the settlements on the outskirts of the Lake Tempe area, the initial settlements were spread out. Houses are built to suit existing natural conditions. With this house building, the government began to build service facilities. So that the settlement pattern in the Lake Tempe area becomes a centralized pattern towards public service facilities.

In 2024, the construction of houses in the area on the outskirts of Lake Laut Tawar will follow the existing road. Likewise, the position of the house being built is on the right and left sides of the road. The construction of the house faces north and south. Each house is built facing the road. So we found differences with Lake Tempe, where the settlement pattern was spread out, while the settlement pattern on the outskirts of Lake Laut Tawar was formed in a uniform pattern that followed the road. Each house follows an existing road.

V. CONCLUSION

The road network pattern continues to develop at each phase. In phase 2, namely in 2014, there were the addition of five alley roads. In phase 3, namely in 2019, there was an increase in the length of local roads and one section of alley road. In phase 4 of 2024, there will be the addition of three alley roads.

The existing road network pattern at the study location is closer to the loop with green road pattern. The road pattern at the study location does not have a dead-end road pattern with no intersections, but this road has a way back to the main road.

The location of Laut Tawar Lake is in the east, causing the road to be built according to the location of Lake Laut Tawar. So, the direction of village road construction is the road starting from the collector road to the lakeside ring road. If seen from the cardinal directions, the road is a road from west to east.

The existence of freshwater lakes is a factor that influences the shape of road patterns in residential areas. The road pattern is perpendicular to facing the lake, influenced by the function of the lake which is used by fishermen to locate their job.

The land surface on the edges of Lake Laut Tawar is flat and has no contours, so the flat topography influences residential development. Land with a flat contour can make it easier to build roads and residential areas. So, with this topography, roads are easier to build in the form of perpendicular roads.

Demographics. Population and livelihoods influence the formation of settlements. As the population in Central Aceh Regency increases, residents continue to look for settlements on the outskirts, namely the outskirts of Lake Laut Tawar. The occupations of the people who first lived in the research location were farmers and fishermen. So access is needed for them to carry out activities. To facilitate their access to the location, a neighborhood road was opened perpendicular to the lake.

Land value is a factor in the formation of settlements. The location of Jalan Lintang on the edges of Lake Laut Tawar is a strategic road location for trade and service areas, and the location of the land on the ring road on the edge of Lake Laut Tawar can become a tourist attraction, causing high demand and selling value. With tourism potential, land on the shores of the lake experiences high buying and selling demand. This causes the selling value to automatically increase.

Land use distribution is also an influential factor. The distribution of land uses in the study location includes houses, vacant land, docks and national basarnas offices. At the study location, houses are the cause of the road network. The large number of houses being built means that road network construction continues. The pattern of the road network will follow the houses built in the residential area on the edges of Lake Laut Tawar.

The development of settlement patterns is oriented towards pre-existing settlements. The settlement pattern from 2008 to 2024 forms a uniform pattern following the road.

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