

The Dutch colonial architecture of buildings in Manado's Old City: A response to the coastal tropical climate

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Abstract. The late 19th and early 20th centuries was an era when the phenomenon of global warming began, as did the development of cities in Indonesia. In that era, cities in Indonesia functioned as colonial cities. The city of Manado is one of the coastal cities, written in the Dutch Royal Act of 1814 as the territory of Dutch sovereignty, was amended in 1848, 1872 and 1922. Dutch colonial art and architecture in Indonesia are not only influenced by culture but also the climate. For the purpose of physical comfort in the tropical environments, architects began to use local building materials, since the early 19th century, and the building began to be replaced by a customizing architecture. Descriptive analysis was employed as the method in this study. The result found that the Dutch Colonial Architecture emphasized the physical aspects, the royal style adapted to local conditions, and the local building emphasis on function. The tropical climate of Manado City influences the shape of the building with Dutch colonial architectural style in this area. As climate change is shown by rising temperatures, further observations on the design of colonial architecture will be important.

1. Introduction

The last ten years has become the hottest decade of the earth since the last 100 years. It is possibly the hottest year in the last millennium century [1]. The city is well researched and illustrated that since there is a city, there is also development, either in whole or in part, to both positive and negative directions. Since there are a close relationship between a city and people living in different times, the city likely tends to be dynamic. As one of the discoveries in the history, the city is a point of maximum concentration showing the strength and culture of a society [2]. Many Dutch city managers and architects applied the concept of local or traditional values in planning and developing the city, settlements, and buildings [3]. According to Ardiyanto *et al* [4], Dutch colonial architecture in the tropical area in the early 20th century adapted to the tropical climate. In addition to wind, the climate depends on the amount of total solar radiation received at a site. It is also influenced by the length of the daytime. The duration of the daytime will be longer than a night in the cities located in the north of the equator [5]. Climate and environmental aspects are factors affecting the architectural products [6]. Humans have a large enough capacity to adapt to a variety of climates and environments [1], including on the design of the building. Roaf *et al* [1] said that vernacular or traditional building designs are climate-sensitive, using a number of climate-friendly building techniques, and providing appropriate passive or isolation cooling techniques. Tropical climates of coastal cities on the island of Sulawesi, such as Makasar and Manado, have buildings with facades that have adapted to the tropical climate.



Those buildings have the characteristic of the art deco style of European architecture that has been adapted into an Indonesian neo-vernacular style of tropical architecture [7]. According to Purwanto, a building that has a hall as a building protector tends to be cooler than the buildings that directly receive the heat of the sun on the walls of its facade. Other researchers prove that the roof is the most important building element in the process of forming the passive cooling in humid tropics [8]. The building style of Dutch colonial architecture in Indonesia has adapted to local traditional architecture [3], as well as the colonial buildings in Manado.

Manado is one of the coastal cities in Eastern Indonesia that was established by the Dutch in the 1700-1900 period [9]. Meanwhile, the Residency of Manado was one of the cities built in 1824 [10]. The city of Manado has 18.7 km of coastline and coordinates 1.4748°LU, 124.8421°BT (tropical cancer). Here is the map of the old city of Manado.

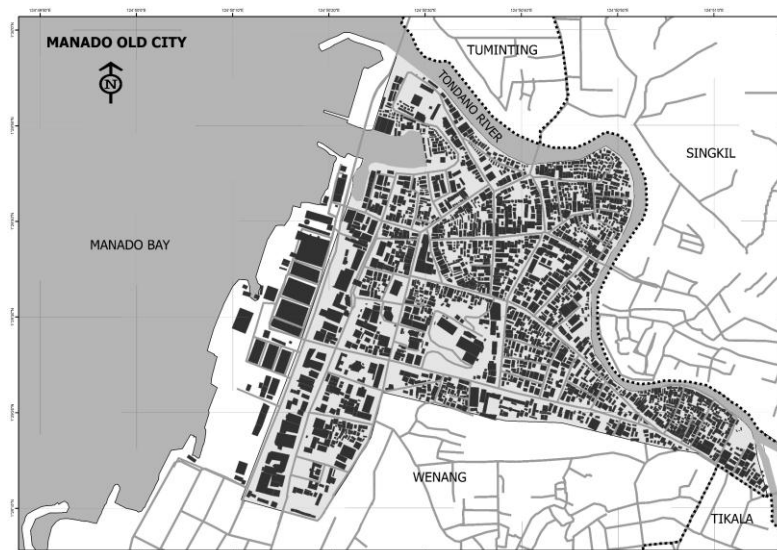


Figure 1. Map of the Old City of Manado (Personal Process 2016)

Old buildings in the old city of Manado are identified as having Dutch colonial architectural style [10]. Dutch colonial architecture in Indonesia is a unique cultural phenomenon. It is a mixture of Dutch colonial and Indonesian culture. It does not exist elsewhere, even in the other former colonized countries [11]. The uniqueness of these buildings can be seen in their colonial relics. According to the results of identification and analysis of Handinoto [12], the architectural style in that the period is divided into three, namely Indische Empire Style (18th-19th century); Transitional Architecture Style (1890-1915); and Indo-Europe Style (1920-1930). In the mid-20th century, global warming resulted in climate change and increased the frequency and intensity of extreme weather events. The IPCC states that global warming can cause significant changes in physical and biological systems (KLH) [13]. The purpose of this study is to analyze the colonial architectural style of Dutch architecture in the old city of Manado that is influenced by a local culture and climate change. This study accommodates the perspective of architects, environmentalists, and urban planners. Their collaboration is important in this study to get multidisciplinary perspectives rather than a monodisciplinary viewpoint. This study will be useful in understanding the relationship between the dynamic climate change that occurs in Indonesia and the architectural style of buildings in this country.

2. Materials and Method

2.1. Materials

Based on the results of identification, there are three architectural styles of Dutch colonial architecture in the old city of Manado, namely Minahasa Raad (1930), St. Ignatius Church (1953), and Benteng Cinema (1953). Three colonial architectural styles that influenced colonial buildings in the city of Manado are the style of Indische Empire, intermediate, and modern colonial architecture [10].

Indische Empire architecture is a style that developed in the 19th century in the Dutch East Indies. This style was popularized by the Governor-General HW Daendles (1808-1811) [12], while the Transitional Architecture Style was a Romanic plagiarism of European architectural style [12]. Transitional architecture style buildings are mostly designed by building inspectors who work in the Dutch government development department [12]. The Indo-European Architecture style is the combination between the buildings that have the shape of a mixture of the archipelago and modern architectures adapted to the climate, building materials, and technologies developed at that time [12].

The elements of architectural style can be divided into these four aspects, including building plan, building view, building materials and construction system [12]. According to Ardyanto et.al [4], the style of Dutch colonial architecture in Indonesia have anticipated the condition of humid-tropical climate. Therefore, the buildings in Indonesia must adjust to the conditions of tropical climate and the dynamics of the changes. The following building elements can be used in the concept of colonial architectural style presented in the table.

Table 1. Elements of Building Materials

Indische empire (18th-19th Century)	Transitional architecture (1890-1915)	Modern colonial architecture (1915-1940)
Bricks on columns and walls	Bricks on columns and walls	Concrete building materials
The main material of wood on truss, sills, and doors	The main material of wood on the truss. Frames and doors	The use of glass material is wide enough (especially on windows)
Not much use of glass	The use of glass on windows is still very limited	

According to Handinoto in Wulur [14], the architectural style of the Indische Empire (Ages 18-19) is determined by the main building construction materials such as bricks (both columns and walls), wooden building materials (mainly for the truss), board and doors. It also does not use a lot of glass. In the style of Transitional Architectural building (1890-1915), the building materials are bricks on columns and walls, the main material of wood on truss, board, and doors, and the limited use of glass on windows. Then, the materials in Modern Colonial Architecture style (1915-1940) are mainly consisting of concrete building materials and quite wide glass materials (especially on windows).

The element of a construction system in an Indische Empire-style building (1819) is on the bearwalls, with rows of columns on the front and back porch. Then, the use of columns and beams construction system, and a roof shield construction with roof tile coverings. The Transitional Architectural Buildings (1890-1915) used a bearish wall construction system with prominent front levels, using a saddle shape and a shield using roof tiles. There was also an attempt to use the additional construction as a vent on the roof. For the style of Modern Colonial architecture (1915-1940), the frame construction system is used, so the wall only serves as a cover. It is still dominated by a saddle roof with roof tile or shingle roof, and there is a section of the building using concrete construction, using a flat roof of concrete (Table 2).

Table 2. Elements of Construction Systems

Indische empire (18th-19th Century)	Transitional architecture (1890-1915)	Modern colonial architecture (1915-1940)
Bearing wall, with column rows on the front and back porch	Bearing wall with prominent front gevels	The frame construction system, so the wall only serves as a cover
Using a column and beam construction system	Roof: the shape of the saddle roof and the shield by using roof tile coverings	Roof: still dominated by gable roof with roof tile or shingle roof material
Construction of roof shield with roof tile coverings.	There is an effort to use additional construction as a vent on the roof	There are parts of the building using concrete construction, using a flat roof of concrete material, which has never existed

2.2. Method

In this study, the data were collected through field observation, photo documentation, identification of buildings that become the object of research, and analysis between the findings and the concept of colonial-style buildings in the tropical areas. The data were then analyzed using descriptive analysis. It is used to analyze the colonial architectural building style elements in Manado in response to the tropical climate of this region.

3. Results and Discussions

The characteristics of European architecture are still clearly seen in the building. Nonetheless, the existence of surrounding corridors whose the rooms have many doors depicts an enormous adaptation to the tropical climate [4]. Hadinoto stated that the colonial architecture in Malang during the years of 1990-1915 has adapted the design to the local climate. Having a good ventilation, it is especially designed to adjust to the heat of the sun and rain [4].

Minahasa Raad is one of the buildings representing the government buildings during the Dutch colonial period. Minahasa Raad has a symmetrical floor plan with a central space surrounded by the main hall. It uses the light beam elements on the back porch and windows but not on the entire window. Some windows do not use light-resistant elements, especially on windows in the western part of the building (Figure 2). From the floor plan, the analysis shows that 50% is influenced by the transitional architecture style (1890-1915). The buildings look symmetrical and do not use columns, appeared as simple buildings that do not use many complicated ornaments. The Minahasa Raad building was built in 1930 (entered in the 19th century). According to Soekiman in Kumurur (2015) [10], the 19th century is known as the eclectic period. It was a period when practical perspectives lifestyles were applied. At that time, people were more concerned with function and work. Instead of presenting the beauty, they were more aware of the usefulness of the work. Similar to Minahasa Raad building, the building is very simple but there is still an ornament attached to the facade (gevel). The building envelope can lose the heat by infiltration and transmission through thermal conduction, convection, and radiation.

It is visible that the design of Minahasa Raad building is clean, without using many ornaments. From the analysis of building-looking elements, it shows that 67% is influenced by the transitional architecture style (1890-1915). Bricks are the important materials in building Minahasa Raad, especially for constructing the walls. While wood materials are used to make roof and door frames. The use of glass is still very limited, used only on the windows. From the analysis of elements of building materials, it is found that Minahasa Raad building is influenced by two colonial architectural styles with the same percentage. They are Indische Empire style (33%) and transitional architecture style (33%).



Figure 2. Minahasa Raad Building (Personal Processed, 2017)

According to Goulding and Lewis [16], solar energy can make a major contribution to the heating requirements of a building. Minahasa Raad building is dominated by a shingle roof and combined with a Tuitgevel gevel type. The analysis of construction system elements shows that 22% of it is a transition architectural style. Overall, Minahasa Raad building appears as a clean design. It has a sun-shading (overhang) on every window, high main door (3.20 m), and a canopy (overhang) on the roof with the width of 1.127m. Meanwhile, the sun-shading width is 0.50-0.8 m. It is made of wood materials and brick wall fillers.

Next is the St. Ignatius Catholic Church Building (Fig. 3). The Catholic Church of St. Ignatius represents a religious building built in Dutch colonial times. This church is located in the Don Bosco Manado school complex. The St. Ignatius Church plan consists of altars, the sitting room of the congregation, the confessional space, and its full symmetrical form. Although there is no terrace surrounding it, the entrance uses a light beam element or canopy.

The materials of the building consist of bricks (as the main construction material in both column and wall), wood (especially on truss), boards and doors. It uses natural stone materials on the outer walls, which serves to protect the walls from the effects of sunlight and rain. The use of glass is still very limited. It is only used on doors and windows with a narrow size. Serving as a natural lighting, glass is used only in the windows. According to Goulding and Lewis [15], the optimal use of natural daylight (especially in buildings used mainly in a daytime) can, by replacing the artificial light, make a significant contribution to energy efficiency, visual comfort, and the well-being of occupants.

Wood materials are used in window frames, as well as indoors. Meanwhile, a truss uses a concrete construction with a frame system, in which the building wall serves as a wall cover. The roof is dominated by a saddle roof with a shingle roof cover.

There is a section of the building that uses a concrete construction. It is a flat roof of concrete material, which has never existed, where the flat roof becomes an additional decoration on the building. The roof serves as a balcony on the church of St. Ignatius. There are windows to enter the light and natural air to the church room, using lightweight building materials; bricks as the main construction materials for both the column and the wall. It uses wood materials, especially on truss and doors and also natural stone materials on the outer wall that serve to protect the walls from the sunlight and rain. These buildings were not

designed for an air-conditioner and electricity fan usage. All of the physical environment aspects have been considered and applied in the building design.

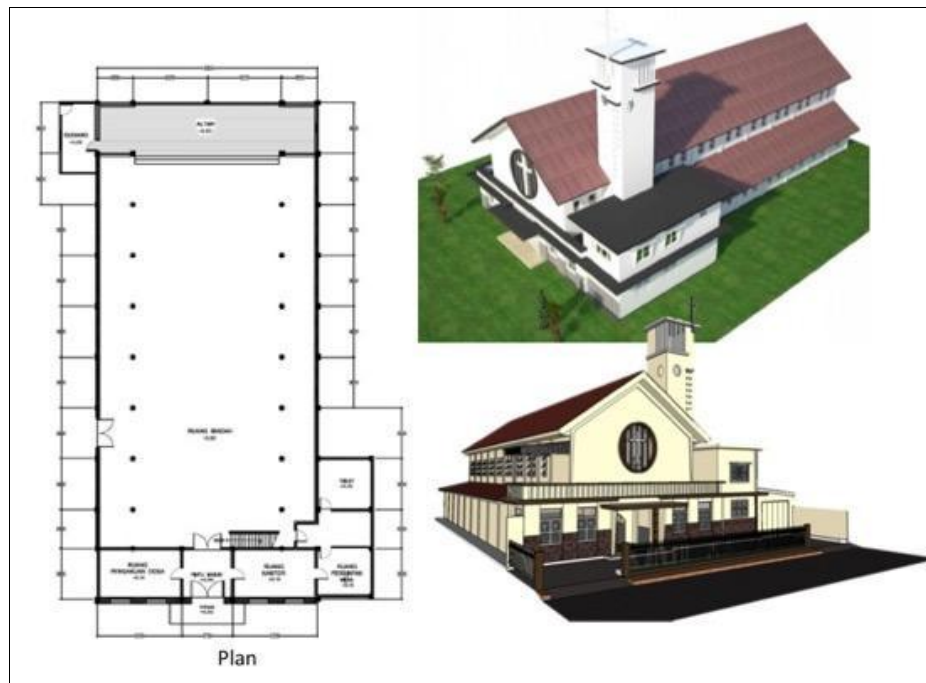


Figure 3. St. Ignatius Church Building (Personal Process, 2015)

The next building, which becomes the focus of the author's study, is the former Benteng Cinema. The current cinema building plan is not symmetrical but more varied (Figure 4). However, when viewed in the initial form, the balance point of the former Benteng Cinema building is located on the left and right side of the building. Since about 1952-1954, the building had been rebuilt and changed its shape by putting a balance point in the center of the building. A two-story building with no terrace surrounds the building and uses sunbathers, though not on all windows. From the analysis of floor plan elements of the building, it can be known that the former "Benteng" Cinema is 67% influenced by a modern colonial architectural style.

The use of openings on the walls in the form of windows indicates that this building uses natural exposure and lighting, although it does not use the roof as a passive coolant. In addition to the amount of contrast and the lighting window, the penetration of natural light can be controlled by reducing the flow of events [15]. Thus, the possibility of building without a saddle roof or shield is to store heat, so it is necessary to add the electrical energy to cool the room.

Among several buildings in the old city of Manado, the castle theater is one of the buildings that has a unique architectural style. This is one of the Dutch heritage buildings that has an art deco style. Now the Benteng Cinema is converted into small shops, restaurants, and salons. In this building, bricks are used as wall fillers whereas wood materials are used only on its windows and doors. There is not much use of glass on windows.



Figure 4. The former building of Benteng Cinema in 1990 and 2000 (Personal Process, 2015)

4. Conclusions

Dutch colonial building style was designed by utilizing elements that were adapted to the tropical climate. The buildings were designed to reduce heat through large overhangs and cross ventilation. As the author's recommendation, there are some things that could be a concern and follow-up later on in the future. First, the government should review the policy on the development of the city, especially in the old city of Manado. It must be done by rejuvenating old buildings in the old city. The government is willing to discuss with development actors, academics, industry, and society as well as the concept of "fourth helix". For academicians and researchers, there is a need for further studies to explore the other issues on the Dutch Colonial architecture style buildings in the city of Manado. Finally, this study was conducted for the purpose of reducing the impact of climate change in the city.

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