

# TRANSFORMATION OF CANALS IN COLONIAL BATAVIA

**EUIS PUSPITA DEWI, KEMAS RIDWAN KURNIAWAN, EVAWANI ELLISA**

## **Abstract**

This study aims to explore the changes in form and function of canals as important elements in the colonial city of Batavia. Historically, in the 17th Century, Batavia was built as the trading and colonial administrative centre for the Verenigde Oost-Indische Compagnie (VOC). The VOC was a trading company backed by the Dutch East Indies colonial government, as part of the Dutch empire. The presence of the canals in Batavia made a significant contribution to the development of the colonial and indigenous civilization in Batavia. However, the canals in colonial Batavia underwent a process of transformation, from the beginning of the 17th Century to the end of colonialization in 1949. Through investigating maps, photos, and historical texts, a morphological analysis is used within a historical research method to review the form and function of the canals and their transformation. This paper maps out and identifies the differences occurring between three periods of 1) 'The Heyday of Canals' Period, 2) 'The Deterioration of Canals' Period during the VOC colonial, in the 17th century until the 18th century, and the last, 3) 'The Function Changes of Canals' Period during the Dutch Colonial State in the 19th century. During the early VOC period, Batavia had many canals that formed an urban grid and these canals were used effectively in an urban context as the entrance or the 'front yard.' The canals formed a compact city and had many roles, such as for defense, as a medium of segregation, as a means of transportation and as a representation of a preferred colonial lifestyle. However, in the 18th century, the canals physically deteriorated due to lack of maintenance and natural sedimentation. Socially, life along the canals was compromised with poor health conditions attributed to mosquitoes and pollution from surrounding plantations. Meanwhile, in the 19th Century, the canals of the Dutch Colonial State period were reduced in number and no longer formed a transportation grid. The role of the canals as a means of transportation was fulfilled instead by roads with various vehicles. The canals' role was then relegated in people's perception to the 'back yard.' During this time, the canals served as service areas for waste and to contain flood waters. The canals also had many functions related to the livelihood of indigenous people in Batavia, including transportation, washing, bathing, drinking water and sanitation.

**Keywords:** Batavia, canal, colonial, morphology, transformation

## 1. Introduction

A canal is a man-made element that physically connects the city with waterbodies and is an essential part of a city (Moore, 1994). Besides being a container and carrier of water or other fluids, a canal is also a life-giving source for humans, just as the veins and arteries of the body (Moore, 1994). Historically, Batavia was a city of canals. As a pioneer, VOC Governor-General J.P. Coen built the first canals in the Dutch East Indies. The Jayakarta Kingdom was selected as the location for the city of Batavia as a colonial city because it was located in a strategic region for the port as a trade center. In 1617, the VOC conquered the Jayakarta kingdom. The existence of the Ciliwung River in Batavia was a great incentive to build the city in that area and it was the forerunner to the construction of canals. The presence of the canals in Batavia made a significant contribution to the development of western and indigenous civilization in Batavia. However, in colonial Batavia, the canals underwent many changes, both in terms of physical form and cultural attributes. In the early colonial period, the canal was used as an element of defense, transportation, water supply and symbol of glory for the European colonizers. Subsequently, the canals were damaged by environmental factors. The canal functions changed at the end of the colonial period into a 'back yard' that was used only by indigenous communities. The research discusses the morphological transformation of the canals in Batavia, both physically and in relation to cultural aspects. Some research studies about the canals in Batavia have been undertaken, but all sources have highlighted the systemic use of the canal city in order to control flooding in Jakarta (Caljouw and Nas, 2005) and most researchers regard flooding problem in terms of a structural approach, which concerns historical urban and geographic aspects (Gunawan, 2010).

## 2. Method

This study employed a diachronic approach to reconstruct events over time and a synchronic approach to study historical events and relevant attributes over a particular time in greater depth. A morphological analysis was used as a method to collect and analyze data related to the form and the function of canals, based on spatial quality, figure, form, and context-forming space. This method was also used to review the changes in the physical attributes or the form and function of canals and to explore the underlying economic and social processes. Data was collected through the investigation of 1) maps from Atlas Maior, (Breuning, 1954), The National Archive of the Republic of Indonesia (Arsip Nasional Republic Indonesia, ANRI), which are collected in the Grote Atlas van de VOC (Comprehensive Atlas of the Dutch United East India Company); 2) photos from many different sources, i.e., ANRI, KIT Library, KITLV, COLLECTIE\_TROPEN MUSEUM, etc.; and 3) the text of travel records, newspapers, affidavits, decrees, and other related items. etc.; and 3) the text of travel records, newspapers, an affidavit, decrees, and other related items.

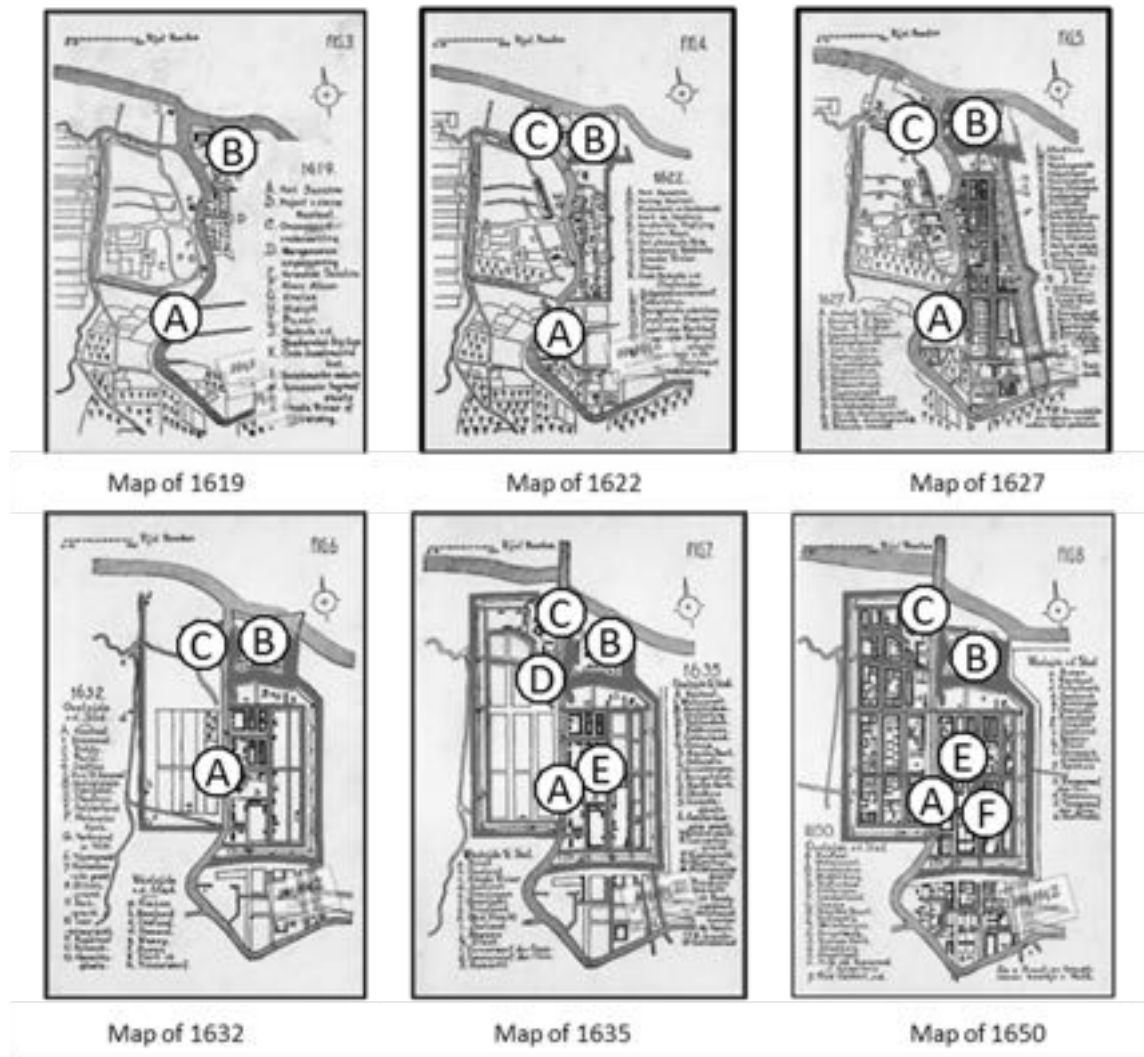
## 3. Periodization Of Canals In Colonial Batavia

Generally, as Grijns and Nas (2000) state, during the colonial era, Batavia underwent two major phases in its development. The first phase was the development of the city as an ideal canal city, while the second phase involved the expansion of the suburbs, due to the movement of Batavia, instigated for health reasons, away from the city and the construction of Weltevreden to the south (2000). However, this study resulted in the classification of three chapters of canal transformation, consisting of: 1) the 'Heyday of the Canals' Period, in which Batavia was built in order to realize the ideal canal city; 2) the 'Deterioration of Canals' Period and 3) the Period of function changes on Canals. During the 'Heydays of the Canals' Period, the canals were designed through careful planning and with development principles that were adopted from the city of Amsterdam. In fact, the 'ideal city' period lasted for no more than 100 years, until the 'The 'Deterioration of Canals' Period. This was the period of excessive pollution and burial of the canals. The final period was the 'Period of function changes on Canals, which was the time of new construction of the canals in some areas of the city, the recovery of damaged canals, and the utilization of the canals with new functions.

### 3.1. 'The Heyday of Canals' Period (The Early 17<sup>th</sup> Century – The Middle of 18<sup>th</sup> Century)

This period represents the VOC's most powerful phase, marked by the construction and the utilization of the canals as an important trading area. Morphologically, during this period, Batavia was built from the edge of the river into the surrounding territories with straight canals, forming a grid pattern. These canals shaped the urban macro form of Batavia in two ways. The first was as hard infrastructure to facilitate the movement of goods and flow of water. The second aspect was cultural, in that being located along a canal had a higher status. Figure 1 shows the transformation from Batavia's early development to the east of the still curvaceous Ciliwung River (*Groote Rivier*) up to the final construction of Batavia, which was considered to be a perfect

canal city. In the maps of 1619 and 1622, the initial canal construction process in Batavia was to the east of the Ciliwung River. The castle (Aanleeg Kasteel) was the first building that was constructed in Batavia. At the mouth of the Ciliwung River, there was a water toll (tolhuisken) and a boom that served as the entrance for ships.



**Legend:**  
**A:** Great River; **B:** Aanleeg Castle; **C:** Toll House and Boom;  
**D:** Fish Market; **E:** Church of Stadhuis **F:** Plaisant Huis

Figure 1

The map of 1627 shows the eastern part of city building that extended to the south. This map shows Batavia Castle surrounded by moats of varying depth. Many canals had been created, such as Tigers Canal (*Tijgersgracht*), Tayole Canal (*Tayolingracht*), *Vierdedwargracht*, *Oudekerkgracht*, and *Derdedwargracht* canals. The width of 300 feet with a depth of 10 feet in the southern part of the city demonstrates the defenses of the city (Haris, 2000). To the south of the city, there was the entrance and the bridge over the Ciliwung River, at Brassenburg. The city was surrounded by walls, which included a number of bastions and lookouts (Haris, 2000). Batavia had a variety of public buildings, such as churches, hospitals, schools, town halls, and markets. The map of 1632 indicates that the canals surrounding the castle appeared to be finished. Some buildings, such as churches and the *Stadhuis* (City Hall), were also shown on this map. During the administration of Governor-General Hendrik Brouwer (1632-1636), built Rotterdam-styled gates, breakwaters and sea walls along the 810-meter pier at the mouth of the Ciliwung River (de Haan: I, 1922). This infrastructure was constructed to avoid either sedimentation from the rivers or sand intrusion from the sea. Batavia was divided into 10 blocks (Haris, 2000) which were formed by the grid of intersecting streets and canals.

The map of 1635 shows the completed canals, although the sides of the canals were not yet completed. At this time, many canals had been created, such as the Jonker Canal (Jonkergracht), Rhinoceros Canal (*Rhinocerosgracht*), and Melayu Canal (*Melayugracht*). In the eastern part of the city, Banda Canal (*Bandagracht*) and Malabar Canal (*Malabargracht*) were excavated. The completion of the canals in Batavia was also achieved through the improvement of the buildings in the city. At this time, the VOC issued a prohibition against using wood materials and instead advocated the use of stone in buildings by providing soft loans and remitting tax rebates for homeowners and landowners (Breuning, 1954).

The canals began to be fully utilized starting in 1645, after the construction work in Batavia had been completed on both sides, on the east and west of the Ciliwung River (Abeyasekere, 1989).

In this period, the canals were built to meet the strategic and functional conditions needed to fulfill the city's purpose as a trading post. Also, a canal is a representation of defense, whether physical, economic or cultural. The castle fortifications, city walls, and canals had guard posts at each corner. These guardposts formed a system of defense for the VOC to protect themselves from outside attack, namely the local army of Mataram and the British as their rivals. Culturally, the canal was a medium used to accommodate the living habits of Europeans. The canals and the culture around the canals mirrored their country of origin, including how to live, dress, clean, move, and transport goods, and so forth. The grid patterns of the canals were built not only in order to separate buildings but also to divide a diverse group of populations, consisting of native Europeans, Batavians composed of mixed Europeans and Asians (Eurasians), Chinese, Indians, Moors, Javanese, Malay, Balinese and slaves of unknown origin. The canals in this period had the function of maintaining the pride and the representation of the European lifestyle in Batavia. The level of prestige of a person or group of people in Batavia was determined by which canal they lived (de Haan, I., 1922). The closer to the channel, the higher the value of the area, and the more expensive and prestigious the canal would be. The channel was not only related to economic needs but also served as a convenient means of transportation, so it can be said that the canal, in its heyday, was able to meet the recreational needs of its people.

However, the glory of the canal in this period did not last long. By the middle of the 18th Century, the canals were degraded in quality, both due to natural conditions and as a result of human actions. Therefore, after their heyday, the canals experienced periods of destruction and closure in Batavia.

### **3.2. 'Period of Canals Deterioration' (Middle of 18<sup>th</sup> Century - Early of 19<sup>th</sup> Century)**

The early 18th Century was the most prosperous period for Batavia. Many people had benefited from the spending of the VOC throughout this time, when the city's population was about 20,000, with about 15,000 people in the suburbs (de Haan, II, 1922). On the contrary, this period saw the degradation in the physical conditions of the canals, which led to their deterioration and further demise. The canals were filled with mud, dirt, and garbage, and eventually underwent sedimentation, thereby blocking the flow of water. The various attempts at dredging the canals to solve these problems were unsuccessful. Batavia was surrounded by marshes, causing an epidemic of malaria. The city had an increasingly dense population with unhealthy lifestyles. This led to outbreaks of cholera and mumps, thus reducing the population of the city. Finally, Batavia was not a compassionate city and it even became a "ghost town".

For some Europeans, Batavia at this time was considered to be a place unfit for human habitation (de Haan: I, 1922). The canal system could not solve the problems of drainage. The tide carried sand into the canals and mud washed from upstream impeded the flow of water in the canal. The increasing population with their bad behavior of throwing garbage and sewage into the water also added to the canal blockage (Blackburn, 2000). Travelers who knew the beauty of Batavia when it was once "the Queen of the East" felt disappointment. Stavorinus (1798) stated that Batavia had become a dead city with canals that were buried and neglected. Various efforts had been made to tackle river and canal pollution, but these did not solve the environmental problems in Batavia. Canals filled with mud, dirt, and garbage could not be maintained, and eventually, Batavia became a dormant city. Furthermore, one-by-one, canals were destroyed and removed, until only a few remained. Figure 2 shows the process of the decreasing number of canals from 1770 to 1904. The 1770 map shows the original number of canals passing through the city. Whereas the 1853 and 1904 maps show only a few canals were left after many canals were closed.

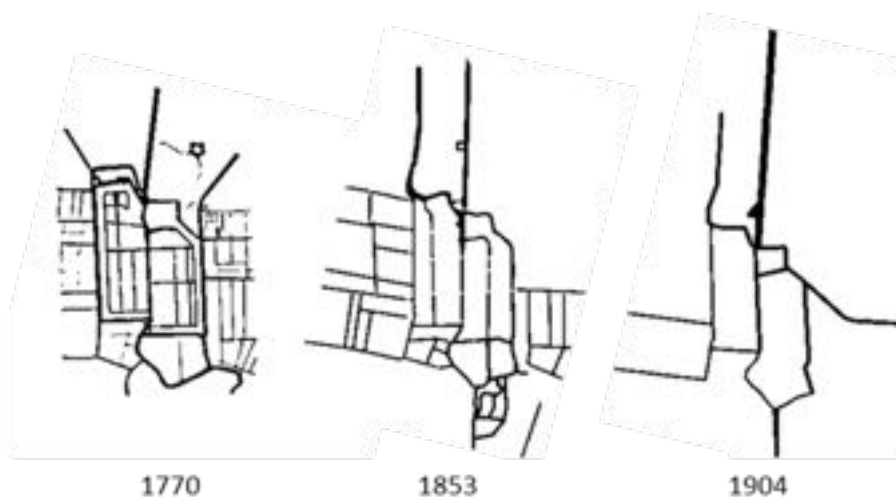


Figure 2

The beauty and splendor of Batavia as "the Queen of the East" was increasingly not found. Canals were ever buried and the city was hollow, flat and neglected. This condition worsened when Daendels decided to dismantle almost all entire buildings in Batavia. As a result, most Batavian people, especially rich Europeans and Chinese, moved to higher and healthier areas, such as Molenvliet, Rijswijk, and Noordwijk (Blussé, 1988). The decline in the quality of the canals was finally in line with the bankruptcy of the VOC. Batavia was taken over by the Dutch East Indies government also went and Weltevreden was built. Under the rule of Daendels, the city center was moved to Weltevreden and Old Batavia was no longer much told. Old Batavia came to be known as "the Graveyard of the East". It was newly rebuilt in the late 19th century as a commercial and service area of Batavia. A residential area of low status society (Merrillees, 2000),

Low geographical location, population growth and bad behavior towards the canals contributed to canals damage. Population growth causes the expansion of the region to the suburbs (*Ommelanden*) and coastal area in the North with various plantation activities. Blusse (1986) mentions that sugar cane plantations in Ommelanden contributed greatly to the decline of conditions in Batavia in the mid-18th century. While in the northern region, Brug (2007) ensured that the construction of ponds in coastal muddy seaside areas worsened the canal conditions in Batavia. New canals that have been built since the century to the south, east and west to support urban development. Due to the city's canals had been damaged and lost, new canals were built into the south, east and west of Batavia city. In addition to getting a cleaner water supply, the canals were built to support urban development activities to the suburbs as a means of transportation.

### 3.3. 'The Function Changes of Canals' Period (Middle of 19<sup>th</sup> Century- Early of 20<sup>th</sup> Century)

Damage to canals and the unhealthy environment in Batavia caused the movement of cities from low areas to higher and healthier areas. The higher region was named Weltevreden (derived from the Dutch language) which means "very satisfactory". The new city was expected to be a city that could provide greater satisfaction and comfort for the people of Batavia. In the 19th Century, the focus of the Europeans was on Weltevreden, as a new city center. The nickname of "the Queen of the East" moved to this area (Abeyasekere, 1989), thus restoring the image that was upheld during the heyday of Old Batavia (Hanna, 1988). The government, led by Daendels, successfully relocated the administrative center in Old Batavia port (downtown) to a cleaner area on higher ground (uptown) in Weltevreden. Batavia was divided into benedenstad (downtown) and bovenstad (uptown), as shown in Figure 4. With the creation of the Batavia City Council in 1905, the separation between "downtown" and "uptown" was finally formalized (Abeyasekere, 1989).

Canals in this period had a different role in terms of commerce and water management when compared with the Heyday Period. The six remaining canals, such as the Grand Canal (Kali Besar) was the only the remaining original canal within Old Batavia, Ancol Canal, Molenvliet Canal, the New Market (Pasar Baru) Canal, Gunung Sahari Canal, and the West Flood Canal (Banjir Kanal Barat) (see Figure 3) gave new life to the New Batavia. As the name indicates, the West Flood Canal was built as an attempt to control annual flooding from the monsoon rains. Molenvliet Canal was a liaison canal and a corridor between Old Batavia and Weltevreden. Along the sides of this canal, there were buildings erected in conjunction with the movement of the city. With the development of the city, Batavians witnessed the progress of civilization over time. Important buildings, such

as European housing and military buildings, were located along the canals. Slum dwellings called Kampongs also occurred in the face of the New Batavia (Weltevreden) as the dwelling of the workers for residential, hotel, and infrastructure workers. Kampongs, where the indigenous people lived, were behind the European buildings (see Figure 4). This arrangement demonstrates that Europeans still favored living along the canals. The traditional status symbol of living along the canals was still apparent. However, in this period, the canals were functioning neither as a means of transportation nor as a recreation place nor a water supply for the Europeans. Canals at this time were also no longer regarded as an element of pride for Europeans. As a function of pride, the city of the canals had been replaced by large garden squares, surrounded by large houses in a tropical context of a garden city. The canals' transportation facilities had been replaced by roads and various alternative land vehicles, such as the tramway. Bataviasche Tramweg-Maatschappij or BTM (Dutch "Batavia Tramway Company") started with horse-drawn trams in 1869. The washing areas along the canals were replaced by private and luxurious bathrooms with amenities.

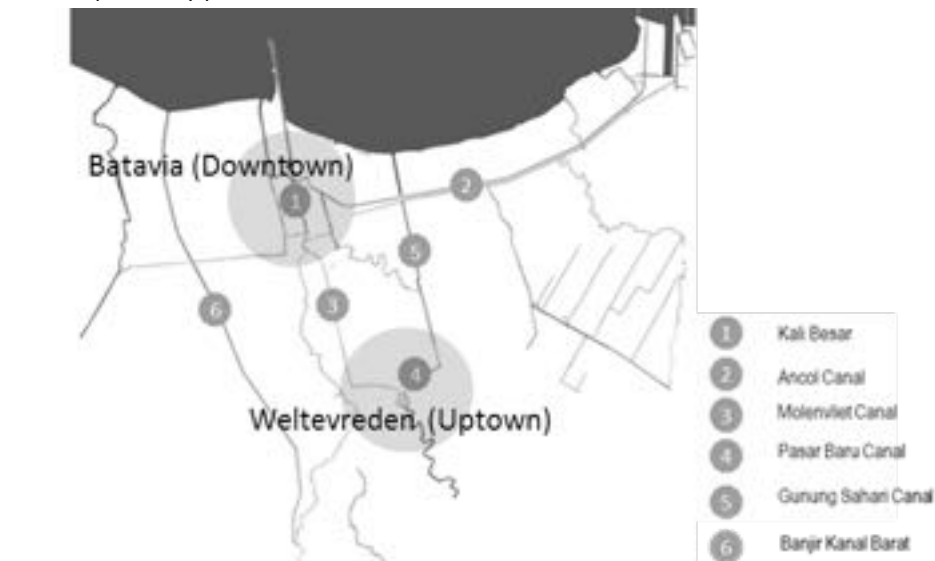


Figure 3



Figure 4

#### 4. The Transformation Of Canals In Colonial Batavia

##### 4.1. From Canals with A Grid Pattern into A Canals without A Grid Pattern

As mentioned above, the canals of Batavia were amended from time-to-time. At the time of the VOC, Batavia was a city that was divided in two vertically by Kali Besar. This was the main canal that bisected the city and canals and connected the secondary canals. A grid pattern of canals was the method used to divide the land and as a means of organizing the population (Kostof, 1992). A grid is a way of spatially defining the social, political and economic order (spatial imagination) (Upton, 2009). The lower the occupant status (such as a laborer, etc.), the further away from the canal (in a less desirable zone or hidden from public view). The grid was identified as a form of egalitarianism and pragmatism (Higgins, 2009). Canals were created to fit the grid, with the wall surrounding the city of Batavia functioning as a barrier (see Figure 5). The walls and canals of the city constituted a further barrier to some segments of the Batavian population, though they were initially intended to be a form of defense against competing sea powers and indigenous armies (Kehoe, 2015).

The grid pattern and geometric design of canals in Batavia were inspired by Simon Stevin's Ideal Plan for a City, (1590). Kostof (1992) states that canals were prepared based on this ideal port plan, with the aim of meeting the needs of the economy and defense. This concept is in line with the objective of building the VOC's Batavia as a trading center and a place to defend the inhabitants against enemies, both from sea and land. Batavia was a city made up of a mix of people; as such, the grid concept was likely considered appropriate to divide or separate the various community groups in Batavia. Locations closer to the canal were of higher value due to the ease of access to transportation and the good view towards the canal they provided (Kehoe, 2015).

Canals in the post-VOC period no longer formed a grid (see Figure 5) . Many canals in the Batavia area were not visible any longer. Although the canals in the post-VOC period did not form patterns or a geometric grid, they were still considered to be the determinant of a new life in Weltevreden. In fact, since the 17th Century, along with the Molenvliet canal, there were several buildings that were used as resting places for rich Europeans. One of these was the residence of Governor-General Reinier de Klerk (1777-1780) and it is now the site of the National Archives building. Until the 19th century, Batavia was expanding towards the south. Along the Molenvliet Canal to the areas of Noordwijk and Rijswijk, there were expensive residential and commercial buildings. The Molenvliet canal was a witness to Batavia's development and it became a connecting area between the old and new Batavia.

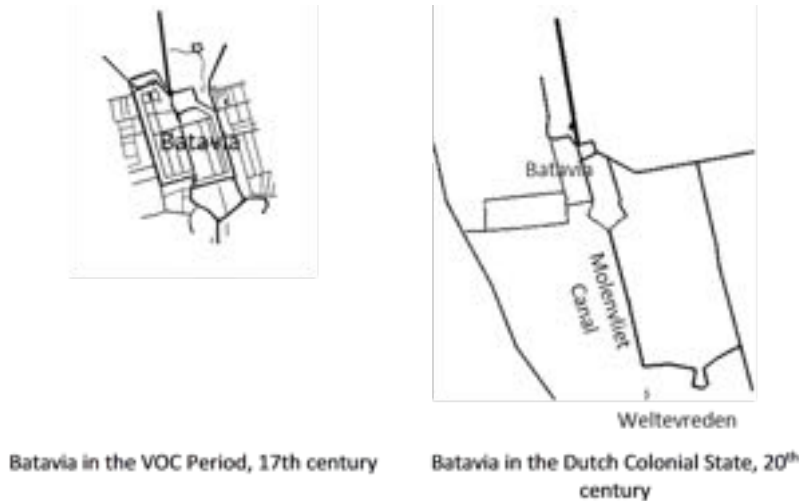


Figure 5

The residential concept of Weltevreden was very different from that of Old Batavia. In the 17th Century, Europeans constructed buildings along the canals. The houses were built to resemble the houses in the Netherlands: single story buildings, huddled together beside the wall, with closed windows. The insides were cramped and stuffy so that the hot air was trapped in the narrow courtyard. There was a compromise in the architecture with a slanted roof that protruded outward (see Figure 6). Meanwhile, Weltevreden was transformed into a city with large buildings and open spaces. Existing buildings along the canals had plenty of ventilation due to air circulation in the rooms to avoid the hot and stuffy conditions. The front yard of the building was made spacious with lush trees and a fairly wide range of roads and canals. Structuring processes



for the city and the buildings were based on an awareness of Batavia's tropical climate with high humidity levels. In this period, Europeans were already aware of the tropical climate in Batavia (see Figure 7)



Figure 6



Figure 7

#### 4.2. From the Canals City into the Streets City

Canals built in colonial Batavia continued to change, both in form and function. During the time of the VOC, canals were very important for the city. However, in the Dutch Colonial State period, canals had changed and were no longer important as a means of transportation. The development of transportation technology shifted the role of the canals and they were replaced by roads as a means of transportation. Batavia changed from a city filled with canals (see Figure 8) to a city that was full of streets (see Figure 9).

Starting in the 20th century, the means of transportation had become increasingly diverse and there were numerous alternatives. Tanjung Priok Port, which was built in 1877, provided significant changes to the development of transportation in Batavia. Batavia experienced a threefold increase in population from 1900 to 1930 (Blackburn, 2010). Population growth resulted in the expansion of Batavia and demanded the additional transportation. Migration from one place to another in Batavia added to the need for alternative transportation. In the end, the need for highways was increasingly high in order to facilitate the movement of people in Batavia. The early colonial canals, which had been the primary means of transportation, continued to be replaced by increasingly numerous roads.



Figure 8



Figure 9

Efficiency in time became the reason Batavia people used motor vehicles as an alternative to canals. However, beyond that, they eventually became a growing parameter for demonstrating a person's class. Land transportation by private vehicle was more dominated by upper-class society, while the canals were used only by indigenous people. The canal was no longer a choice for a means of transportation for the European community in the last period. Finally, Batavia increasingly has shown its identity as a city of streets.

#### 4.3. From the Front Yard into the Back Yard

During the VOC period, the canals were very important as a representation of life in Batavia. Physically, canals became a major consideration in building the city of Batavia. The canals served as a tool to defend the city and to accommodate the living habits of Europeans, as in their in countries of origin, including how to live, dress,



cleanse, and transport. The canals in Batavia held the position of a high-value front yard. The canals acted as determinants of the level of establishment (de Haan, 1922) and were a form of pride for Batavian society at that time. Living in front of a canal was the ultimate source of pride because this area had the best view. The Tiger Canal (*Tygersgracht*) was the most luxurious location in which to reside. In this area, the line of houses was displayed regularly, in the shadow of the trees. In 1678, most Europeans lived around the Tiger Canal (*Tijgersgracht*). Luxury buildings in the Dutch style and the rows of coconut trees along the side of this canal added to the area's beauty and luxury. The front area of this canal was the most enjoyable area, so it was often used as a social and recreational space.

In the heyday period, the Europeans used the canals for many activities that could be seen by all people, such as bathing, swimming, fishing, boating, and playing music. The canals were clean and beautiful and these canals determined the comfort of the city of Batavia. The people of Batavia used the canals as a recreational area in which to relax in the evenings and on weekends and holidays, bringing umbrellas and food, and listening to the live music. The canals that were designated as front yards demonstrated the people's pride in the existence of canals in Batavia.

In the post-VOC period, the canals no longer had important roles, as they had in the early days of the VOC. The canals were used only as a space for the cleanliness and daily activities of the indigenous people, such as washing, bathing, taking the water, as well as for sanitation (see Figure 10). Canals were the source of water for all the necessities of life. The indigenous people were faced with poor conditions, but they did not have a choice because they could not afford to buy clean water. As a result, Batavia experienced the growth of pockets of indigenous settlements behind European community buildings called *kampong*. *Kampongs* have the characteristics of a house made of bamboo and wood, with a roof of rumbia. There were no hygiene or sanitation facilities. Therefore, the canal became an area for washing and bathing for indigenous communities. At the end of the 19th century, Batavia had two faces. There were the *kampongs* and the city (see Figure 11). These two areas are seen as a contrast: the city for the European community, which is beautiful and full of facilities, coupled with the country, which lacks public facilities and sanitation (Blackburn, 2010). Batavia was transformed into a beautiful city that was convenient for Europeans, while the indigenous villages were left in poor conditions that went relatively unnoticed.



Figure 10



Figure 11

## 5. Conclusion

The canals in colonial Batavia changed over time and produced the morphological and functional differences between the periods of the VOC and Dutch Colonial State. The canals were transformed from bringing an element of romanticism and colonial exoticism to merely being flood canals in a cosmopolitan city. There were three important differences between the two periods: 1) differences in form, with a grid-patterned city in the VOC period, and the absence of grid patterns during the Dutch Colonial State period; 2) the difference in character between the city of canals and the city of streets; and 3) the functional difference of the canals from their role as a front yard to being relegated to the back yard.

This study yielded the findings of a transformation process that could contribute knowledge, both scientifically and practically to the canals in Batavia (now Jakarta). Scientifically, this process of transformation has shown that canals can also serve as subjects able to construct life between people and to build a civilization. Practically speaking, the planning and design of the canals were not only related to the basic conception of texture, smell, or color and visibility but these canals can also be defined as part of the ideology and culture of Batavia. In planning and designing the canal as part of the urban space, it is not enough to emphasize beautification, but the canal must be seen as an element that is integrated with other aspects, such as environmental, social, cultural, and political attributes.

## Acknowledgment

This paper is a part of a Doctoral thesis plan, entitled "Politics of Space and Discourse of Canals in Batavia: Cleanliness and Dirtiness Transformation during the Colonial Era", which is financially supported by PITTA UI (Indexed International Publication Fund for Students of Universitas Indonesia).

## References

- ABEYASEKERE, S., 1989. *Jakarta: A history*. Singapore: Oxford University Press.
- Arsip Nasional Republik Indonesia (ANRI)*
- Blackburn, S., 2010. *Jakarta: sejarah 400 tahun*. Jakarta: Masup Jakarta.
- BLUSSÉ, L., 1988. *Strange Company: Chinese settlers, mestizo women, and the Dutch in VOC Batavia*. Dordrecht, Holland: Foris Publication,
- BREUNING. 1954, National Archief (ANRI), which are collected in the Grote Atlas van de VOC (Comprehensive Atlas of the Dutch United East India Company)
- BRUG, P. V. D. 1997. Malaria in Batavia in the 18th century. *Tropical Medicine & International Health*, 2(9), 892-902
- CALJOUW, M. and NAS, P., 2005. Flooding in Jakarta: towards a blue city with improved water management. *Bijdragen tot de Taal-, Land-en Volkenkunde (BKI)*, 161(4), 454-484.
- DE HAAN, F., 1922. *Oud Batavia. Vol.I. G*. Batavia: Kolff & Company.
- DE HAAN, F., 1922. *Oud Batavia. Vol.II. G*. Batavia: Kolff & Company
- GUNAWAN, R., 2010. *Gagalnya sistem kanal: pengendalian banjir Jakarta dari masa ke masa*. Jakarta: Kompas.
- Grote Atlas van de VOC (Comprehensive Atlas of the Dutch United East India Company)*;
- GRIJNS, K. and Nas, P., 2000. *Jakarta-Batavia: socio-cultural essays*. Leiden: KITLV Press.
- HANNA, W. A. (1988). *Hikayat Jakarta*. Yayasan Obor Indonesia.
- HARIS, T.. (2007). Kota dan Masyarakat Jakarta: dari kota tradisional ke kota kolonial (abad XVI-XVIII): *Wedatama Widya Sastra*.
- HIGGINS, H. 2009. *The grid book*. MIT Press.
- KEHOE, M.L., 2015. Dutch Batavia: Exposing the hierarchy of the Dutch colonial city. *Journal of the Historians of Netherlandish Art*, 7, pp.1-35.
- KOSTOF, S., 1992. *The city assembled*. London: Thames and Hudson.
- MERRILLEES, S., 2000. *Batavia: In nineteenth-century photographs*. UK: Curzon Press.
- MOORE, C. 1994. *Water and architecture*: Thames and Hudson London.
- STAVORINUS, J.S., 1798. *Voyages to the East Indies*. Translated by Samuel Hull Wilcocke. London: GG and J. Robinson.
- UPTON, D., 2009. Grid as design method: The spatial imagination in early New Orleans. *Architecture–Design Methods–Inca Structures: Festschrift for Jean-Pierre Protzen, ed. Hans Dehlinger and Johanna Dehlinger*. Kassel: Kassel University Press.

## Captions of Visual Material

- Figure 1. Maps of the Construction Period, 1619-1650 (Source: Breuning, 1954)
- Figure 2. Transformation of Canal's Existence (Source: Tracing of Maps from Het Nationaal Archief of Netherlands)
- Figure 3. Existence of Canals in the Development Period, 1878
- Figure 4. Land Use of European Housing and *Kampongs*, 1878
- Figure 5. Canals with and without Grid Patterns
- Figure 6. House of 17th Century (Source: van der Zee, D., 1926)
- Figure 7 Typical House of the 19th Century Dutch-Indies Style  
(Source: Collectie\_Tropenmuseum)
- Figure 8. Canals in Batavia, 17th century (Source: KITLV Collectie, Leiden)

Figure 9. Street in Batavia, 20th century (Source: Collectie\_Tropenmuseum)

Figure 10. Washing Activity, 20th century (Source: KITLV Collectie, Leiden)

Figure 11. Map of European Housing and Kampong, 20th century (Source: ANRI)