

ORIGINAL ARTICLE

A Plan to Use a Moat as a Component of a Modern Water Landscape based on Its Functions

Yong Jo Jung*

Department of Greensmart City, Sangmyung University, Chungnam 31066, Korea

Abstract

The purpose of this study is to examine the possibilities of use as a factor of the water landscape in modern urban spaces such as parks and, apartments, through a case study of the concept, functions, and culture of moats in the East and West from ancient times to the Middle Ages. This study aimed to examine the concept, origin, and function of the moat as a theoretical consideration. Asian castles with moats, including those in Korea, China and Japan, and Western castles with moats in Britain, France, Belgium, and Germany were investigated and analyzed. By reflecting on these cultures and the functions of the moat in modern urban spaces and converting the environment damaged due to industrialization and urbanization into an eco-friendly and environment symbiotic city the quality of life can be improved, and sustainable development can be achieved. This study was conducted through a literature survey and field investigation.

Key words : Border, Hydrophilic space, Providing habitat, Urban space utilization

1. Introduction

From ancient times to the Middle Ages, a moat was built as a boundary between a castle and its military defense facilities outside the castle. It played an important roles as a component of a city along with a castle, both in the Orient and the West. In the ancient world, people set up wooden fences before their caves or mud huts gradually after using natural topography to defend themselves. As they became an increasingly larger group, they constructed a castle with earth and stone and put up a wooden fence before it to increase durability(Huh, 2001; Jung, 2011).

A moat was one of the castle structures to serve defense purposes and constructed by digging a ditch around the castle or taking advantage of natural topography. There were two types of moats: a natural moat constructed using a river or

sea as a barrier against an enemy attack, and an artificial moat constructed by manually digging a pond or ditch(Lee, 1980; Jung, 2011).

It is common practice to dig a deep and wide moat at a certain distance from the castle walls, with facilities inside and outside the walls. A moat constructed outside a castle plays an important role in hardening the ground, in addition to increasing the defensive power of the castle(Song, 2006; Jung, 2011). In Europe, a moat was first dug around a castle lot, the earth was piled up, and a cone-shaped site was established. Then, a building was built over it and a wooden fence was set up on the ground or a simple moat was dug around it to prevent enemy attack and hold water, contributing to microclimate regulation and providing a habitat for animals including fish and amphibians (Jung, 2011).

Losing its purpose of military defense, a moat

Received 13 December, 2022; **Revised** 12 January, 2023;

Accepted 12 January, 2023

***Corresponding author :** Yong Jo Jung, Department of Greensmart City, Sangmyung University, Chungnam 31066, Korea
Phone : + 82-41-550-5493
E-mail : smilejung@smu.ac.kr

© The Korean Environmental Sciences Society. All rights reserved.

© This is an Open-Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (<http://creativecommons.org/licenses/by-nc/3.0>) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

gradually had fewer roles. Water-filled moats, however, regulate microclimate and offer a habitat for animals in the modern environment, which has been deteriorated by the rising temperature due to climate changes and the decrease of animal habitats (Jang, 1987; Jung, 2011).

Most previous studies have focused on the history and roles of moats, and only few studies have attempted to a moat as a water landscape element based on its functions (Lee, 1980; Jang, 1987; Lee, 1997; Shin, 1998; Jung et al., 2010a; Jung et al., 2010b; Jung, 2011; Jung and Sim, 2011; Jung, 2017).

This study thus aimed to develop a plan for using a moat as a water landscape element in a modern city by constructing a moat around a park or apartment and connecting it to old water landscape facilities such as ponds, streamlets, waterfalls, and water fountains without posing any sense of difference from them.

2. Methodology

We aimed to develop a plan for using a moat as a component of the a water landscape in a modern urban space by considering the functions of a moat

The research scope was as follows:

First, we examined the functions of a moat as a theoretical review.

Second, we examined and analyzed Oriental, such as Korean, Chinese, and Japanese, and Western, such as British, French, and German, castles with a moat, which is a pond or ditch around the outer walls for military defense purposes to prevent enemies from approaching the walls directly or for a boundary distinction,

Third, we compared and analyzed moat culture between the Orient and the West from ancient times to the Middle Ages.

Fourth, we proposed a plan for high quality of life and sustainable growth in an environment-friendly or symbiotic city to promote coexistence between humans and nature in an environment damaged by industrialization and urbanization by analyzing the

culture and functions of a moat and reflecting them in a modern urban space.

The research methodology was as follows:

The investigator reviewed previous studies and conducted a field survey to select a target site where a moat could be applied properly used as a modern water landscape component before proceeding with the planned research.

First, data were collected from previous studies on the functions of moats and moat cases in the Orient and the West during literature review.

Second, the field survey covered moats in South Korea, China, and Japan, including the Nakan-eup Castle of South Korea, Forbidden City of China, and Edo Castle of Japan, with five or six field investigations for each case from May 2008 to ~ August 2020. The moats in the West, including the Leeds Castle of the UK, the Amboise Castle of France, and the Neuschwanstein Castle of Germany, were covered only through a literature review due to the difficulties with field investigation.

Third, the Hwarang Park of Pangyo in Sampyeong-dong, Bundang-gu, Seongnam City, Gyeonggi Province, was selected as the target area for the utilization of moats as a water landscape component. This is because it is a planar urban park with easy access to water due to its pond and great accessibility by many people.

3. Results and Considerations

3.1. Functions of a Moat

3.1.1. Functions of a Moat in the Orient

In Korea, moats were found in not only the castle towns of Goryeo, but also those of Silla and Baekje. A water-filled moat was excavated and surveyed using a platform system in Wolseong, Gyeongju, and partially restored. A moat was excavated around the castle in the Mongchon Earthen Fortress of Baekje and restored. Natural and artificial moats around the Guknae Fortress, Daeseong Mountain Fortress, Pyeongyang Fortress, and Anhak Palace in Goguryeo were used as primary defenses against

enemy attacks. The Pungnap Earthen Fortress of Baekje had a two-story moat with inner and outer walls. The Iseong Mountain Fortress used moats for drinking and military water. Sabi Fortress used the Geum River as its natural moat. In Goryeo, moats were built and used to defend against enemy attacks based on records of the construction of ponds and moats to block the retreat of enemies'. In Joseon Dynasty, a moat was used for defensive functions as reported in *Jeungbomunheonbigoyeojido*(增補文獻備考輿地圖), *Mangiyoram*(萬機要覽), *Yeolhagilgi* (熱河日記), and Damun's collection of poems(Jung and Sim, 2011).

In Japan, elaborate moats with many circles and various patterns were built around the castles. Japanese castles had three rings of moats, of which the outer ring usually protected other supportive structures in addition to the castle. Historically, many castles have been at the center of each city in Japan. Moats provided cities with waterways. Recently, activities involving leisure facilities such as boating, float fishing, and dining have been added to the royal palace moat system. In Asia, moats were used in the Forbidden City of Xian, China, the palace of the Kyoto Empire in Japan, India, Southeast Asia, Angkor Wat(moat width: 100m) in Cambodia, and Chiang Mai in Thailand(Jung, 2011).

3.1.2. Functions of a Moat in the West

1) Ancient Times

A moat is a deep and wide ditch that runs dry or is filled with water. Historically, moats have been used as obstacles against enemy attacks around buildings, castles, and cities. Natural moats include dams and lakes, and artificial moats, include artificial lakes. Moats were initially used for defensive measures, and then as ornamental water facilities. The oldest evidence of a moat was found in an Egyptian fortress. One example is the fortress excavated in Buhen Nubia. Another piece of evidence was found in Babylonian relics. Moats have been found in the cultures of Egypt,

Assyria, and many other areas. (Jung, 2011). In the fourth century, the Romans built large walls surrounding Constantinople to prevent enemy invasion. The walls had a three-layer structure, including the moats, outer walls, and inner walls. The moats 18 m wide(Jung, 2011).

2) Middle Ages

Moats were a part of the main defense system around the castle and fortress. Serving as a part of the obstacle system, they were situated under the walls. The moats at the appropriate locations were filled with water. During the Middle Ages, a moat was constructed around a tower and castle wall as an obstacle to resist enemy attack. Moats filled with water played defensive roles and provided ornamental water. In medieval France, they applied a moat was constructed to the low hills, small mountains, and central mounds where a fortress was built. Dry moats without water are associated with natural artificial structures, and similar functions have been applied to modern architecture(Jung, 2011).

3) Europe

Most moats were filled with water and associated with lakes. In Europe, a castle like water palace where water played a defensive role was built. Water filled moats were built with a natural island or an artificial lake, such as a dam. Keniworth Castle used water to defend against enemies and prevent damages. Basically, it is more moving to get a feeling like the sea from cornet-shaped walls and waterways performing their functions along with natural or artificial lakes. Areas surrounded by moats or artificial lakes have been found in the UK, Scotland, Wales, and Low Countries. Moreover, other areas have been found in Germany, Austria, and Denmark, thus spanning the majority of the European continent. Depending on the situation, people would dump urine, feces, rotting food, and animal carcasses in the moat to defend themselves against enemies. Fortresses designed

to defend against enemies, dry moats, or water-filled moats in the Middle Ages, perform multiple functions, including providing irrigation water as well as defense against enemy attacks. They depended on dry moats before the development of different types of moats in the 19th century. Over time, many castles (fortresses) were built to protect guests in a palace or mansion. Since such buildings were surrounded by a moat or lake, enemies could not approach them (Jung, 2011).

In Europe, a castle commonly refers to a fortress built by a king or lord in their territory. The term, however, refers to the earthwork of prehistoric times such as the Maiden Castle in a British city. Currently, it refers to a mansion or the residence of a rich nobleman with different forms among different nations. In Europe, castles have been developed independently since the Middle Ages. They gradually developed to an armed residence of a feudal ruler in the 11th~13th century. In general, medieval castles served as the residence of a lord, defensive facilities within the area, and shelter for people in case of emergency. A moat was dug around a castle to prevent invasion from enemies and filled with water to regulate the microclimate and provide habitats for animals, such as fish and amphibians. Castles mainly developed in the Middle Ages (Jung, 2011).

4) The USA

American moats are generally related to European castles and developed by Mississippian culture, which reinforced the defense of outskirts in parts of North American Indian villages. The waterway relics of the 16th century remain at the Parkin Archeological State Park in eastern Arkansas. Moats are important facilities for defending against certain threats such as enemy attacks, and efforts have been made to apply their creative and diverse functions to modern cities (Jung, 2011).

3.2. Case Study on Moats in the Orient and the West

3.2.1. The Moat of Nakan-eup Castle in South Korea

The moat of Nakan-eup Castle combines a natural moat using a natural stream and an artificial moat. The water of the Soisan Valley in the east of Mt. Geumjeon and north of the castle flows around the eastern part of the castle and exits through the southern gate of the castle before crossing the field, joining the Seo Stream, passing before Oksan, and finally moving into the sea (Song, 2006; Jung, 2011). The moat was 3 m wide and 1.5~2 m deep. It is estimated that the moat temporarily blocks and hinders enemy attacks. The water course originally crossed the area before Mt. Dang in Namdae-ri in the western part of Pyeongchon Village. The high flow rate had a substantial risk of flood damage. In addition, the energy of the Blue Dragon (Dong Stream) was substantially strong based on geomantic theory, according to a petty official of the village. Eventually the Blue Dragon flow was changed to form an "S" shape, thus weakening its energy. Another legend is that the water course originally moved from the northern section of the castle to the western gate, around which the concubine of the county magistrate lived. Being afraid that a flood would drown her home and cause her flood damage, he had a water course exit in the east direction. Whichever it was true, it is a fact that there was an old water course (moat) in the northern part of the castle and the topography beyond it. The remaining moat spans approximately 596m (Song, 2006).

3.2.2. The Moat of Forbidden City in China

The walls of the Forbidden City are 7.9 m in height and 3,428 m in circumference. They comprise 15 layers of brick, made of glutinous rice and earth dough and are thus very solid. There was a water clock at each corner. They not only work to watch over enemy moves, but also serve as precise and beautiful ornaments based on their design. Each water clock is a three-story building that consists of nine

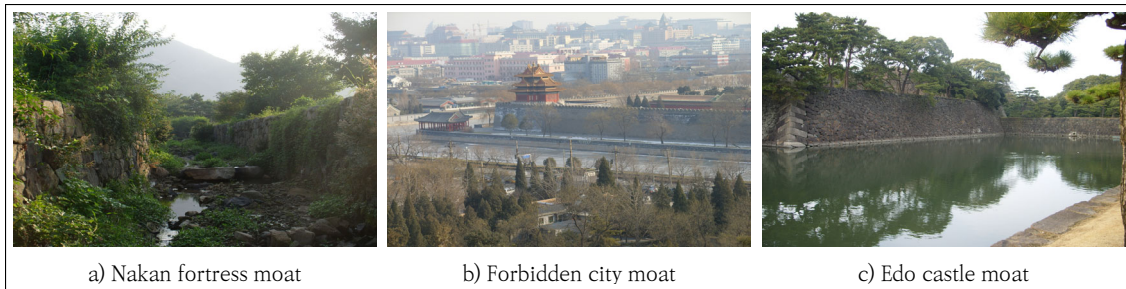


Fig. 1. Moats in asia.

crossbeams, 18 pillars, and 72 roof ridges, with views in four directions. It is representative buildings in an old palace. Hoseongha is also known as the Tongjaha. It is 52 m wide and 6 m deep, surrounding the walls of the Forbidden City (Manbak yerim book, 2008; Jung, 2011).

3.2.3. The Moat of Edo Castle in Japan

The moat of Edo Castle shows the typical features of a Japanese castle. The Edo Castle was built on flatland. Unlike the Nijo Castle which was the residence of Shogun of Kyoto and had a small moat, the Edo Castle, which served as the base of Tokugawa Ieyasu in the Sengoku Era, features a large moat and many defensive facilities. The moat was built outside the inner and middle areas, in which the moat was called Juho. The inside was the land for warriors during the Edo Era. The exterior was surrounded by an outer moat. The outskirts were built for castle and castle towns that divided Seongha Street. A fortress of Eomyeongeojon was built south of the outer moat, which also included the middle section. The moat has a bilayer system to block an enemy attack as the first line of defense. The moat is approximately 50 m wide and 30 m height (An, 2010; Jung, 2011).

3.2.4. The Moat of Leeds Castles in the UK

Leeds Castle was built in Kent, UK, in 1119. It was originally built with wood in the ninth century and renovated as a stone castle to become

a strong fortress for defensive purposes. It was the residence of Catherine, the first wife of Henry VIII. Being lauded as one of the most beautiful castles world wide, Leeds Castle has a lake surrounding it, which serves as a moat. It seems like a little palace built on a castle (Jung, 2011).

3.2.5. The Moat of Amboise Castle in France

The construction of Amboise Castle began in the 15th century and was completed in the 16th century. Amboise Castle presents a mix of the Gothic and Renaissance styles. It stands in the riverside of Centre-Val de Loire. Charles VIII, Louis XII, and Francis I were involved in its construction. In 1560, the castle witnessed the development of the Amboise conspiracy by the Huguenots, who attacked Francis II and the Duke of Guise to put the Prince of Condé in the throne and failed. The castle has the remains of Leonardo da Vinci, who spent his later years there. The riverside of Centre-Val de Loire serves as a natural moat (Jung, 2011).

3.2.6. The Moat of Neuschwanstein Castle in Germany

Neuschwanstein Castle was built in a valley (serving as a natural moat) in east Füssen in Bayern, Germany. It is also called Swan Castle. It took 17 years of intense labor from the first foundation stone laid in 1869. This beautiful white castle was built by Ludwig II, who wanted a place to enjoy thinking and meditation alone in

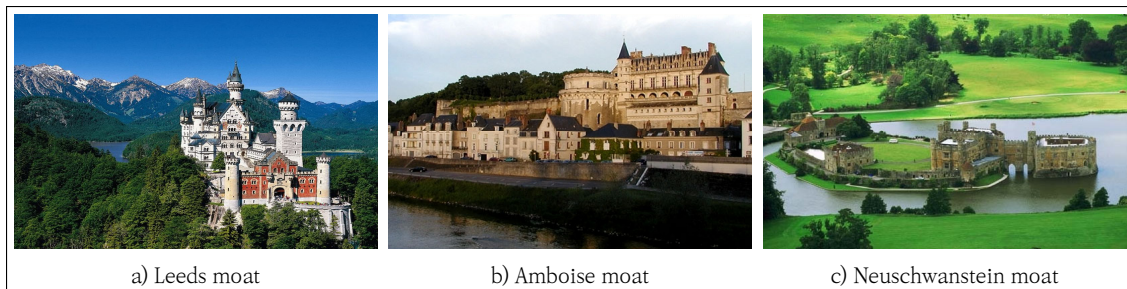


Fig. 2. Western moats.

nature and was immersed in music and operas. Although it looks like a medieval castle on the outside, it was built as an ultra-modern castle with splendid and artistic architectural aesthetics on the inside that was furnished with sophisticated water supply facilities, drinking water pipes from the underground, air heaters to heat the entire castle, and steam pipes for the kitchen and bathroom(Jung, 2011).

3.3. Plan to Use a Moat as a Component of a Modern Water Landscape

3.3.1. Backgrounds and Goals of the Plan

The plan was conceived against the backdrop of applying a moat, which existed from ancient times to the Middle Ages as a facility surrounding a castle for military defense purposes and boundary distinctions both in the East and the West, to an urban space and using it as a component of a modern water landscape. By applying the functions of a moat including spatial division, surroundings, hierarchy, and connection to a subject site, the plan set out to promote its various useful benefits including familiarity with parks, a pleasant environment, restored vitality in living, and the regulation of microclimate in a city based on the functions of water.

3.3.2. Survey and Analysis

1) Location Analysis

The subject site of the plan was located in Sampyeong-dong, Bundang-gu, Seongnam City, Gyeonggi Province, with 1,500m² area. The site is flat and has easy access to natural water because of the Geumto River. It serves as a neighborhood park to meet the diverse leisure needs of citizens in Seongnam and has easy access to the field of vision as a flat urban park.

2) Climate and Weather

Seongnam City, Gyeonggi Province, has a continental climate with high temperatures and heavy rains in summer and low temperatures and a dry spell for days due to seasonal winds. The average annual temperature for the last 10 years(2012~2021) is 14.5°C with the maximum and minimum temperatures being 26.6°C in August and -3.4°C in January, respectively. The mean annual precipitation is 1,608mm, with 60% precipitation concentrated in June, August. The main wind is the southeast wind in summer, with 2.6 and 13.7 m/s mean and maximum velocity, respectively.

3) Landscapes

The site of the plan is easily accessible via the urban central line and main roads. Housing districts, including apartments, business districts, and commercial districts around the site, are used by many citizens. The Geumto River flows in front of the site and creates a pleasant and beautiful landscape. The environment and energy facility(the food waste recycling center) and the



Fig. 3. Destination location map.

water quality restoration center of Pangyo are very close to the park, casting an overwhelming sense of presence. Thus, it is necessary to make plans to cover them to alleviate their visual effects and ensure pleasant placeness.

3.3.3. Basic Conception

1) Selection of the Site

The subject site is a city park that is widely used by citizens. Created on flatland, it has easy access to water, which is the most important element for introducing a moat. The site also contains a water space element(pond), which helps prevent any sense of difference after introducing a moat to the site. These are the reasons for the selection.

2) Space Organization

A moat, designed to flow between the pedestrian route and ridge, is connected to the pond in the park. The width of the moat varies from 0 to 3 m for efficient travel routes. A stone bridge was constructed to cross the moat. The moat was designed around the park so that the visitors can appreciate the water landscape from any location. Shrubs were planted in the landscape for a sense of surroundings around the moat, which would be connected to the existing

pond to create a water landscape.

3.3.4. Basic Plan

1) Plan for the Traveling Route

Setting a travel route is of significant importance in the plan. The old traveling route would be used without any revisions so that all park users would feel no inconvenience with the stone bridge built to cross the moat and boundary plants would be introduced to mark the traveling route clearly.

2) Infrastructure Plan

The water supply is based on pond water supplied to the management office and restrooms. The 300 m water pipe buried under the connecting road in the southern part of the park by the municipal government branches out to each facility for direct supply. Wastewater is treated in a safe gravity system, connected to a 350 m wastewater pipe buried under the nearby eastern road.

3.4. Expected Effects of Moats on Water Environment

It is expected to create several cultural spaces by



Fig. 4. Status of peripheral facilities.

using the moat as a traditional landscape element that alleviates the urban heat island phenomenon by controlling the local microclimate, using it as a water circulation system plan and living space, finding vitality in urban life, and providing a place to feel a natural atmosphere.

4. Conclusion

This study utilized a moat, which existed both in the Orient and the West from ancient times to the Middle Ages, in an urban living space such as a park or apartment to promote pleasant air influx into a city where air circulation is blocked and provide a habitat for creatures. The findings are as follows:

First, the moat has several functions. People use natural and artificial moats to defend against enemy attacks and introduce water for ornamental purposes. Moats also serve as important waterways in cities with leisure activities such as boating, float fishing, and dining installed around a moat. Moats were dug around a castle and filled with water to regulate microclimate functions and provide a habitat for animals, such as fish and amphibians.

Second, the study selected a neighborhood park on flatland as a case site. The park has easy access to water, remarkable natural landscapes, and easy accessibility to citizens. A moat of varying width within 3 m would be deployed between the pedestrian traveling route and ridge. Shrubs would be planted in the landscape to offer

a sense of surroundings around the moat. A stone bridge would be constructed to cross the moat. In addition, the moat would be connected to the old pond to create no sense of difference from the old design. The moat was designed around the park so that visitors could appreciate the water landscape at any position.

Finally, a moat can be used as a component of a traditional landscape to, regulate the local microclimate and alleviate the urban heat island phenomenon. A moat can also be used as a part of a water circulation system, a habitat for living organisms and a means of vigilance and defense, surrounding a park or apartment. Moreover, it can contribute to the creation of various cultural spaces by restoring urban life vitality through a water space and providing a place to feel the natural atmosphere.

In conclusion, moats existed both in the East and West from ancient times to the Middle Ages, but they are disappearing as an element of traditional culture as they no longer serve their old military defense purposes. If moats are highlighted for their symbolism and functionality as a part of superior traditional culture and reflected and utilized in a modern urban space, their old roles as a boundary and defense system transmitted from ancient times will be restored. Moreover, they will regulate the microclimate, promote the water circulation system, provide a habitat for living organisms, and contribute to the creation of diverse cultural life spaces through a water space.

REFERENCE

- An, D. T., 2010, Sin pan myung sung great deal of judgment, Book printing, 26-29.
- Huh, K. J., 2001, Korea eupseong, Daewonsa, 79.
- Jang, K. H., 1987, The origin of the moat and function, (II), 465-475.
- Jung, Y. J., 2011, Historical and cultural investigations of moats in the eastern asia, Ph.D. Dissertation. Graduate School, Korea University.
- Jung, Y. J., 2017, Review of the modern values of east and west moat culture, Journal of Korean Institute of Traditional Landscape Architecture, 35(1), 25-35.
- Jung, Y. J., Sim, W. K., 2011, An Historical and cultural analysis on the eastern and western moat, Journal of Korean Institute of Traditional Landscape Architecture, 29(1), 105-120.
- Jung, Y. J., Park, J. S., Sim, W. K., 2010a, Consideration on the moat of wolseong fortrees at gyuonjji, Journal of Korean Institute of Traditional Landscape Architecture, 28(2), 37-44.
- Jung, Y. J., Park, J. S., Sim, W. K., 2010b, A Comparative consideration of the moat at the east and west, Journal of Korean Institute of Traditional Landscape Architecture, 28(3), 29-38.
- Lee, S. J., 1997, A Study on the transition process of wolsung in gyeongju, 21, 123-162.
- Lee, W. K., 1980, The study of fortresses in kingdoms period. Master's Degree, Graduate School, Dankook University.
- Manbak yerim book, 2008, The forbidden city. Foreign languages press, 87.
- Shin, M. J., 1998, Landscape architectural application of moat - with a special reference to paris park in seoul-, Master's Degree. Graduate School of Natural Resources. Korea University.
- Song, K. D., 2006, Nakan-eup castle, Suncheon City, 128-129.
- 2007, <http://cafe.daum.net/joyzit/Jiy6/319>.
- 2009, <http://cafe.daum.net/greatchosunsa/BURT/51>.
- 2010, <http://blog.naver.com/3byuno/43836766>.
- 2010, <http://en.wikipedia.org/wiki/moat>.
- 2021, ko.weatherspark.com.

• Professor. Yong-Jo Jung
Department of Greensmart City, Sangmyung University
smilejung@smu.ac.kr