



BEST: Journal of Built Environment Studies

P-ISSN: 2746-9077 E-ISSN: 2746-9069

Journal Home Page: <https://journal.ugm.ac.id/v3/BEST>



CHARACTERISTICS MORPHOLOGY OF THE FORMER SALT FACTORY OF KALIANGET, SUMENEP

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ABSTRACT

Kalianget is known as a salt factory area since Colonial era. The Dutch colonial government built the first and largest salt briquette factory in the Dutch East Indies in 1897, located in Kalianget. The term morphology is widely used to describe the physical form of urban areas based on the history of the city. This study aims to identify urban morphological characteristics in the former Kalianget Salt Factory. Deductive qualitative method was used from the beginning to identify regional problems, field surveys and data analysis. This research uses urban design theory from Roger Trancik. The results show that the morphology of the area is formed from ground figures which have a unique pattern due to the repetition of the coupling building forms on several beams because the building around the factory is a factory employee's house. The road structure is formed with a grid pattern with intersections between roads and is dominated by T-junctions. The entrance to the factory emplacement area is oriented towards the sea which is on the south side, so that the road network structure is formed from the dominance of T-junctions which have the advantage of minimizing crossings.

Keywords:

Morphology, Old-City, Figure-Ground, Linkage, Place

ARTICLE INFO

Received 24 June 2021

Accepted 26 August 2021

Available online June 2022

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1. Introduction

Kalianget is an area that has the privilege of being a heritage area. Kalianget is known as a salt factory area since the Colonial era. The Dutch colonial government built the first and largest salt briquette factory in the Dutch East Indies in 1897 in Kalianget (Abendanon, 1907). The construction of the briquette factory started because of the salt monopoly policy for the entire Dutch East Indies region. The colonial government required all salt products from traditional farmers to be processed into briquettes (bricks) through factories. This step is taken to minimize salt spills in the process of transporting bulk salt from the warehouse to the seller. To overcome this problem, the Dutch colonial government suggested to make salt in several forms of briquette packaging.

The construction of a briquette factory in Kalianget was budgeted for by the colonial government in 1897 (Abendanon, 1907). The pilot plan for the construction of the Kalianget factory was completed in January 1899. Initially built in 1899 and completed as a factory area in 1904. The Kalianget plant was built with the first trial using two briquette press machines ordered from the Breitfeld Danek and Co. Plant. in Prague Austria. The results from the salt briquettes were distributed to the colonies of the

Colonial government such as Pasuruan, Probolinggo, and Besuki. The modern rail transportation known as *Madoera Stoomtram Maatschappij* (MSM) was also built in 1899 connecting Kalianget Port to Kamal Port Bangkalan. The MSM railway line connects the southern coast of Madura which was originally used to transport goods such as salt.

During the period of factory construction, factory supporting facilities were also built such as official residences, salt storage warehouses, industrial construction, and construction of railroads. The Dutch colonial government brought in many experts such as inspectors, experts in the steam industry, physicists and mathematicians to build the Kalianget factory area. The Kalianget salt factory area developed into an industrial area that prospered in the 1900s. Kalianget developed into a salt factory area with the largest salt production in the Dutch East Indies. Supporting facilities for the entertainment of factory settlements were also built such as a cinema building, swimming pool, garden, and tennis court. Provision of employee residences for factory staff built in the indisch architectural style.

Since independence, the Kalianget salt factory has been managed by the Indonesian government. Along with its development, salt production in Kalianget is no longer as

much as in the Colonial Era because the salt monopoly policy has been abolished. The factory did not operate until in 2000 the office area of PT. Garam was moved to Surabaya. For 18 years the Kalianget Salt Factory area was occupied by its main activities. The Kalianget Salt Factory area became an abandoned and dead area. In 2018 the head office of PT. Garam has moved back to operate in Kalianget. The current condition is that there are still many official residence buildings from the Colonial era that are not maintained so that they give a scary impression in the factory emplacement area.

Currently, the former Salt Factory of Kalianget condition is in a low vitality area or in a dead condition (Nuurlaily, Antariksa, and Sari, 2011). This condition is caused by three things. First, the lack of the government funding and the old building managers called the economic factors. Second, the building physical factor which is caused of the decreasing of the use ancient buildings. The last, the social factor which is caused of the low community participation in the historical areas.

The morphology of the former salt factory of Kalianget will be identified through the appearance of the original form of the factory area when it was still operating, then observing the changes that occurred. The identification of the spatial components was carried out through tracing an ancient map of the factory area in 1947 and literature sources discussing the Kalianget salt factory area or the briquette system in Madura. The purpose of discussing the morphology of the former salt factory of Kalianget is as a basis for future management of the regional landscape based on the identity of the area (salt production area) and its historical development.

2. Literature Review

Morphology is defined as the pattern of land use within the area (Helm and Robinson, 2002; Kropf, 2009). In simple terms, morphology relates to the physical form and the land use in a spatial scale. Urban morphology is an approach in the urban design. It aims to strengthen the characteristics, protect the building environment, and preserve the area based on the history and the city pattern.

Urban morphology refers to the city pattern including architecture, street layout, and residence density (Kropf, 2009). They are three components of urban morphology according to Conzen:

1. Ground plan (road pattern or building block).
2. The shape of building (the type of building).
3. Land or building utility.

According to Zahnd (1999), the components of urban morphology include:

1. The elements of road use.
2. The road patterns.
3. The type of building.

Urban morphology is an approach to study and design an urban forms by considering the physical and spatial components based on the urban structure of plots, blocks, roads, buildings, and open spaces as the part of the city development process (Sanders, 2008; Ravari and Mazloomi, 2015). A new approach in urban planning is to strengthen the characteristics of the area for the protection of the built environment and preservation of the area. Four approaches are used to identify urban morphology, namely

(Kropf, 2009):

1. Spatial analytical, by understanding the spatial structure and dynamics of a complex city using GIS models. The object modeled for the study of regional morphology is the development of built-up land, land use, and network routes. The development of built-up land is certainly influenced by the diffusion or migration of the population.
2. Configurational, can be used as an approach to find out the morphology of the city through space syntax. At the regional scale (settlement), it is used to determine the relationship between the spatial structure and regional circulation (movement). In other words, regional circulation is largely determined by the spatial configuration. The elements studied are related to road space, open space, and built-up land (solid and void).
3. Process typological, is an approach to determine the development of the built environment with details of its structure and historical processes (spatial differences and time relationships). Forms of cities that are found at various regional scales through historical and cultural developments. The elements studied are related to buildings and urban networks.
4. Historic-geographical, the analysis is to explain the geographical condition of the structure and character of the city through a systematic analysis based on the elements and development of the city from time to time.

3. Research Method

This research approach uses qualitative. Qualitative research is a multi-method that studies several things with a naturalistic approach, in other word the researchers try to understand or interpret the encountered phenomena (Groat and Wang, 2013). The type of the research is qualitative deductive. This qualitative deductive method uses theory from the beginning of identifying regional problems to conducting field surveys and data analysis. Theory is used as a measuring tool to answer the research questions. The first step identifies the research variables and indicators that have been compiled based on a theoretical review of regional morphology which is adapted to the existing conditions of the Salt Factory Former Heritage Area in Kalianget. The second step is processing the data obtained and analyzes based on the city design theory. This method is expected to answer the research question of the morphological characteristics of the Salt Factory Former Heritage Area in Kalianget.

The data was collected through the primary surveys including interview and observation, as well as the secondary surveys regarding to the literature studies and the agency surveys. The research unit of observation is all the regional objects located in the delineation of the Salt Factory Former Heritage Area in Kalianget. The object includes the physical units, such as buildings, open spaces, and roads. Below are the data needed to determine the morphological characteristics of the Salt Factory Former Heritage Area in Kalianget:

Table 1. The Type of Data

Research parameter	Data	Source of Data
Road	<ul style="list-style-type: none"> The name of road The dimension of road The orientation of road Permeability The circulation direction and park 	<ul style="list-style-type: none"> The measurement of road dimension Field observation
Building	<ul style="list-style-type: none"> The function of building The style of building The direction and orientation of building 	<ul style="list-style-type: none"> The archives of building Interview Field observation
Open space	<ul style="list-style-type: none"> The name of open space The spread of open space The wide of open space The active and passive activities The function of open space 	<ul style="list-style-type: none"> Photos by digital camera Field observation

4. Results and Discussions

Regional morphology is the study of the type and shape of an area or physical condition. Morphologists are interested in the historical generative structure of space. Understanding regional morphology is to study form and space as static features and are influenced by social aspects of spatial activity, as well as focus on transportation and movement. The steps taken are to look at the morphological-forming components at the time the factory was still functioning (in the 1900s) and the former factory area at this time (in 2021). The approach used as the basis in this research is the regional design theory proposed by Roger Trancik. These approaches are figure ground theory, linkage theory, and place theory.

4.1 Linkage

Linkage is a theory that emphasizes the relationship of movements that occur in regional blocks such as the relationship between one place and another (Trancik, 1986). The linkage analysis begins by making a relationship based on the axis line formed from the existing conditions that connect the plaza and roads in the area. The first thing to consider is the determination of the regional axis line. The construction of the Kalianget salt factory was built on the southern coast of Kalianget and is located between the Sumenep salt field and the Kalianget Harbor. The axis which is the main axis of the factory area is the road space that serves as the vehicle route and the salt transportation train line on Jalan Raya Kalianget which stretches from west to east. Jalan Raya Kalianget since the 1900s has become the main link between the factory area and the City of Sumenep and the salt area. The location of the salt factory is closer to Kalianget Harbor which is used as the busiest sea transportation node in Sumenep.

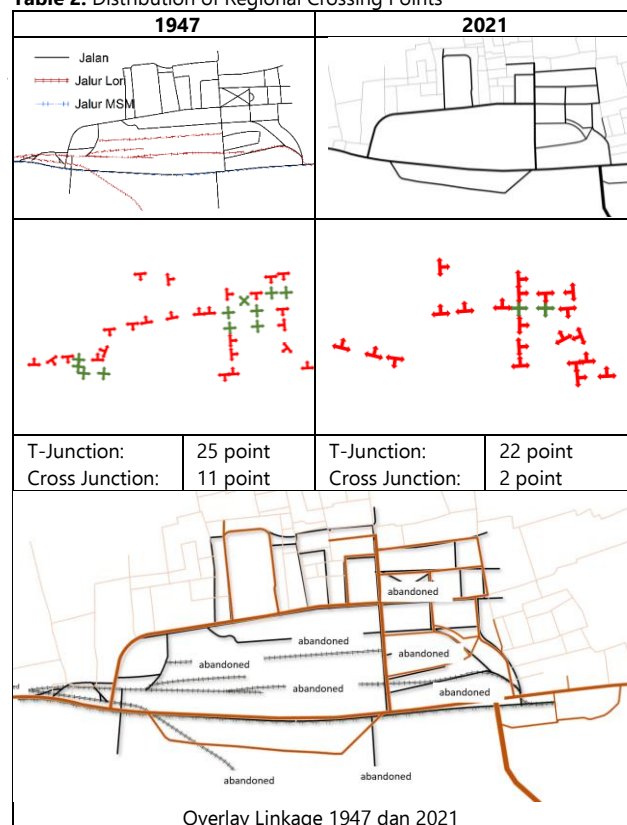
Vehicle routes and railway lines are built on the southern coast because the area is more sloping than the northern area. This topography is suitable for the construction requirements of railroads and lorries. Based on this map, the determination of the axis of the area in this study is Jalan Raya Kalianget (main linkage). Why is the physical area of the Kalianget salt factory formed based on the path that forms the framework of the area. The path used to enter the area is Jalan Gajah Mada whose character forms a fork with Jalan Raya Kalianget. Jalan Gajah Mada is the main corridor that covers the facade of the factory building.

Jalan Gajah Mada connects Jalan Raya Kalianget with the official residences of factory employees. When entering Jalan Gajah Mada, you will meet an open space which is currently known as the East Brawijaya Field.

In 1947 the linkage in the salt factory area consisted of roads (vehicle lanes), lorry lanes, and MSM lanes. The MSM line passes along Jalan Raya Kalianget connecting Sumenep City Station with Kalianget Harbor. Some of the lorry lines also cross Jalan Raya Kalianget, but have branches through the factory operational area. This lorry line has the function of transporting salt from the salting field to the Kalianget factory to the loading and unloading area at the Kalianget Port. Within the factory's operational area, each building is also connected by lorries and trolleys for processing bulk salt into briquettes. The road network pattern is formed based on the main network structure and road dimensions or road width. The regional linkage structure in 1947 was formed by a network of roads, lorries, and MSM lines. The meeting point for the lorry line and the SMS line is located at the last station of Kalianget port. The remaining regional linkage cannot be separated from the circulation network.

To see the development of the regional structure related to the inter-block linkage, a map of the regional linkage in 1947 and 2021 is shown (Table 2).

Table 2. Distribution of Regional Crossing Points



Source: The result of analysis (2021)

The comparison of the distribution of T-junctions between 1947 and 2021 is shown in Table 2. The development of the linkage structure in 2021 based on the pattern is not much different from that in 1947. The difference is that there are no lorry lines and MSM lines, thereby eliminating regional circulation in the factory operational area. Another difference is that some of the

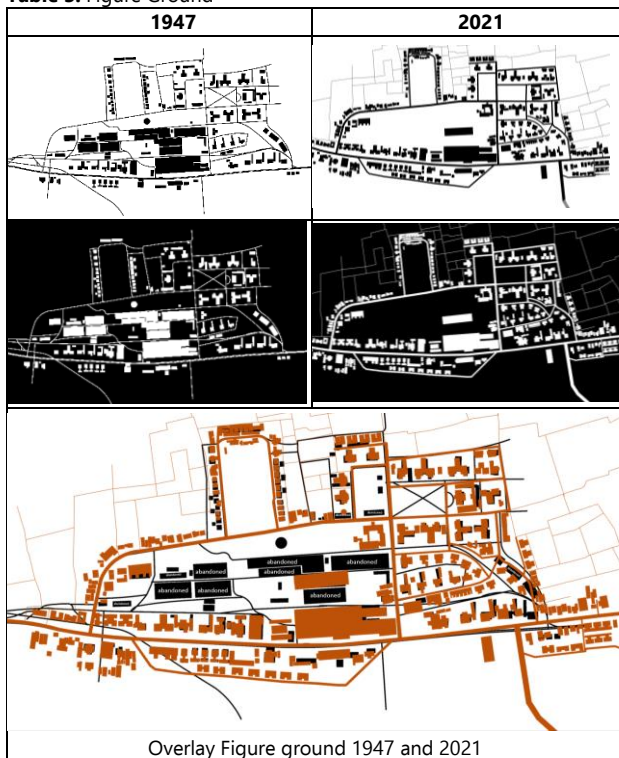
road network in the staff settlement area is missing, thus uniting the two previously separated blocks. The linkage structure in 2021 is simpler than in 1947. In 1947 there were a total of 36 intersection points consisting of 25 forks and 11 intersection points. Meanwhile, in 2021 there will be a total of 24 intersection points consisting of 22 fork points and 2 intersection points. This shows that the salt factory area is indeed designed with a T-junction junction type. This type of intersection has the advantage of minimizing crossings between roads so as to facilitate circulation access.

4.2 Figure Ground

The ground figure shows the textural relationship between the built form (building mass) and open space. The ground figure is shown in two-dimensional form (map) to explain the structure and layout of the former Kalianget Salt Factory Area. Based on the 1947 regional map, the morphological elements forming the factory area at that time were buildings (official houses and factories), road networks (MSM lanes, lorries, and roads), open spaces (Adirasa Field, East Brawijaya Field, and Central Brawijaya Field).

To see the changes in the morphology of the factory area in 1947 and today, the researchers overlay the ground figures from those two years so that several missing buildings appear and new buildings are added. The image is shown on the following map.

Table 3. Figure Ground



Source: The result of analysis (2021)

Based on the results of the overlay, it is known that several buildings that have been demolished are marked with black buildings. In the factory operational area, there are only 2 buildings left to date. The building is a salt briquette storage warehouse which is currently the head office of PT. Garam. The second building is a briquette

packaging building and is currently a salt storage warehouse and a bad mint field. The factory's operational area is currently left as an open space without utilization. The remains of the structure of the building still remain like a former chimney. The next missing element is the lorry line. In 1947 all the factory buildings were connected by lorries, but today these lines and rails are gone. Including the MSM train line, it was also dismantled in 1950. The elements that remain are the official residence building and the road that connects the area of the former Kalianget salt factory. The figure ground map shows that the settlements in the area of the former Kalianget Salt Factory have a planned form. This can be seen from the regularity of the land plots and the geometric shape of the building.

In 1947 the Kalianget salt factory area had a heterogeneous nature where there were configurations formed with building masses that had different sizes, shapes and densities. The solid elements of the salt factory area in 1947 showed a physical appearance consisting of buildings with large masses and buildings with small masses. The large mass is identified as the operational building of the factory building, while the buildings with the small mass are identified as the official residences of employees and factory supporting facilities.

The most visible difference is that the factory operational area in the form of large buildings has been replaced by empty space. Some of the circulation paths in the factory area are not visible at this time. The loss of buildings in the operational area of the factory was due to the demolition of the building when the factory was not functioning. The second finding is that the legacy of the factory's supporting facilities, such as the official residences of European staff located on the east side of the factory, still exists today. Some of the open spaces in 1947 turned into a new residential area with the size of the building adapting to the surrounding plots. The thing that makes the difference between the buildings built for European staff before 1947 and the buildings after that is the shape of the house without a service room that extends to the right and back.

Based on the figure ground analysis, it is known that the physical appearance of solid and void elements in the former salt factory of Kalianget has developed into a residential area. The block left by the European staff's official residence in the Brawijaya Field area and east of the factory has a unique configuration. There is a repetition of the shape of the building with the character of a couple house. The house that was built after independence is smaller than the European staff house and there is no service room that extends to the back of the building.

The void elements of the Kalianget salt factory area are indicated by roads and open spaces in the residential area of the employee's official residence. There were three points of distribution of open space in 1947. The locations are Adirasa field in the middle of a medium-sized residential area, Brawijaya Field which is separated by Gajah Mada Street, and undeveloped open space located in the eastern part of the factory operational area. Adirasa Field and Brawijaya Field have characteristics as regional bouldards because the houses are oriented to open spaces. Brawijaya field is known by the Kalianget community as lon alon or alun-alun. This large private open space is provided as one of the facilities for factory employees who come

from Europe.

The relationship between solid and void in the factory supporting area is the orientation of the building to open space or roads. The identification results show that there are two building orientations, namely buildings oriented to open spaces and buildings oriented to roads. The front layer of the area, namely Jalan Raya Kalianget and Jalan Gajah Mada, has a road-oriented building character. While on the back layer there are three open spaces with buildings oriented to them. Judging from the shape of the building, the building which is oriented towards open space is dominantly the coupling house.

4.3 Place

Place relates to user perception and human interaction with space that has value. Place analysis aims to observe the existence of space or space in the Kalianget Salt Factory Area which has been in progress even though its current activities have changed. Since the factory activities were not functioning and the office area was moved to Surabaya, the area of the former Kalianget salt factory became the area where the main activity was inhabited. There have been several changes to the physical form of the area, which was originally dominated by large factory buildings, to become vacant land areas.

The Kalianget salt factory area is a central point that is very influential in the salt briquette production process. The activity of processing bulk salt into briquettes makes the spaces in the factory emplacement have a strong meaning and place. The salt processing process makes the factory emplacement divided into two rooms, namely the factory operational room and the support room for the factory facilities. To give meaning to the existing space, place identification was carried out in 1947 and 2021.

1. Edges

The edge element in the factory area is the coast. In 1947 there was a kesong which still functions as a berth for ships carrying salt from the fields to be brought to be processed at the factory. The coast is in the southern part of the factory area. Loading and unloading activities of bulk salt from storage warehouses to factories are carried out on the coast. This activity makes along the Kalianget coast the edges or physical boundaries of the area.



Figure 1. Salt unloading activities make the coast as the edge of the area

Source: <https://scharrelaar-p3.leidenuniv.nl>

2. Path

The identified path is the circulation route of the factory area for movement or movement. In 1947 there were three circulation routes, namely for walking paths, steam engine pipelines, lorry lines, and MSM lines. The destination of this path is Kalianget port and factory area. The results of the regional linkage analysis

identified several paths in the former Kalianget Salt Factory Area, namely:

- a. The road network, with a total of 13 roads.
 - b. The railroad track, the former salt factory of Kalianget was once passed by a train line that connected the Kalianget Port with Kamal Port, Bangkalan. But now the line has been dismantled in 1939. This train carries passengers and goods from the station at Kalianget Harbor with the final route of Kamal Bangkalan. The railroad during the colonial period crossed along Jalan Raya Kalianget on the north side.
 - c. The lorry track, the Salt Briquette Factory has a mode of transporting salt from ponds and ports to the factory area. This lorry train uses former railroad tracks that were closed in 1939. Unfortunately now all of these tracks have been dismantled. Only the lorry carriages remain which are currently used as monuments in front of the PT. Garam.
3. District
The Kalianget factory area consists of the factory operational area and supporting areas such as the employee's official residence. The identified district area is a salt factory emplacement which consists of 10 large factory buildings. The buildings consist of a salt storage warehouse, a briquette machine building, a dryer building, a packaging building, and a salt briquette storage building that are ready to be shipped.
 4. Landmarks
The point that became the object of the salt factory area in 1947 was the twin building in the middle of the factory operational area. The twin buildings are the face of the factory facing east on Jalan Gajah Mada. This building has a height of 12 meters and a length of 100 meters.
 5. Nodes
The nodes of the factory area which became a strategic area in 1947 were the Adirasa field and the East Brawijaya field. Adira field is the widest open space in the factory area and is used as a gathering place for factory workers. While the East Brawijaya field is used as a park for European staff settlements that surround the park.

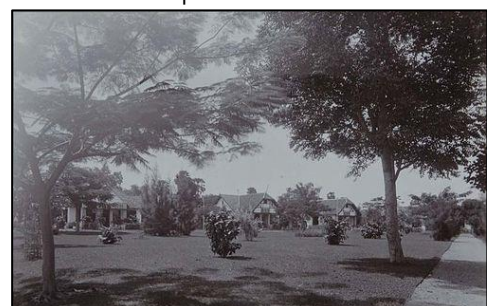


Figure 2. Brawijaya Field as Regional Square

Source: <https://scharrelaar-p3.leidenuniv.nl>

Based on the survey results, the place element was identified when the factory was not functioning, namely:

1. Edges

The edge is on the boundary between two specific regions and acts as a linear breaker. The edge element

in the former salt factory of Kalianget is the physical boundary between the sea and land areas. This beachfront has been emphasized by mangroves along the coast. The element that becomes the current edge is the boundary of the house with indisch architecture in the area that marks the area of a former salt factory.

2. Path

The paths in the former salt factory of Kalianget are Jalan Raya Kalianget and Jalan Gajah Mada. These two roads are the main roads in the area that provide access for circulation in and out of the former Kalianget salt factory. Unlike in 1947, there are no MSM train lines or lorry lines since the factory was not functioning.

3. District

District areas have similar characteristics (shape, pattern, and form) and are also unique in their boundaries, where people feel they have to end or start. The District of the Former Kalianget Salt Factory is a salt factory emplacement and factory employee settlements around the factory. The physical limit when viewed based on the existing one is starting from the Kalianget Islamic Hospital to the Kalianget port. It includes indisch buildings from the colonial era.

4. Landmarks



Figure 3. Landmarks of the Former Kalianget Salt Factory

Source: Primary Survey (2021)

Reference points are like node elements, but one cannot enter them because they can be seen from the outside. Several objects that act as landmarks in the former salt factory of Kalianget are the Japanese heritage bunker at Taman Merdeka and the PT. Garam.

5. Nodes

A strategic node or area with several activities that meet each other and can be changed to other activities or directions. The center is an open space that is used by the community as a forum for activities. This node can be found at the T-junction between Jalan Raya Kalianget and Jalan Gajah Mada, precisely at the PT. Garam and the intersection between Jalan Brawijaya and Jalan Gajah Mada. The intersection becomes nodes because of the existence of a magnificent open space in Brawijaya Field.

5. Conclusion

The morphological characteristics of the Old City of Kalianget area is organized based on the morphology elements. They are roads, buildings, and open space which is still existing. Strong linkage connects major places through the corridors of Jalan Raya Kalianget and Jalan Gajah Mada. These two roads are the regional axes that form the T-Junction intersection and become the entrance to the factory emplacement area. The regional structure is formed from the dominance of the T-Junction which has the advantage of minimizing crossings between roads.

Place occurs in an area where the figure ground is regular. The location of the place is in a strong linkage corridor and figure ground with the same density. Brawijaya Field is a strong place because Jalan Gajah Mada is the axis of the area and the main route to enter the factory emplacement area. The existing buildings around the Brawijaya Field are also oriented towards open spaces, resulting in a positive and active space. This is what makes Brawijaya Field a regional square since the 1900s.

Places, such as landmarks and nodes, occur in areas with regular figure ground. This shows that the regular and unique ground figure (has a repetition of the form of a coupling building) causes space to be interpreted as a forum for community activities to this day.

The void element of the open space of East Brawijaya Field and Central Brawijaya Field is the center or bouldard of the factory area. So this open space needs to be developed into an active area with the availability of appropriate supporting facilities, such as park chairs, bicycle parking, shade, and pedestrian facilities.

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