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## Landscape Design Toward Covid-19 in the Old Town Semarang, Indonesia

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### ABSTRACT

A significant increase in Covid-19 cases worldwide disrupted many sectors. The virus transmission through the air requires that people limit outdoor activities and apply social distancing. However, outdoor activities cannot be avoided because it is how people meet their daily needs. The urban landscape design arrangement is crucial, especially in public spaces. Old Town Semarang is a location with the potential for high outdoor activities, especially tourism. CCTV data shows that tourists could reach up to 500 people per day, and the average visitor does a comply with health protocols. This is worsened by the unadopted landscape conditions in this area to the current pandemic conditions. Therefore, a landscape design approach is needed to adapt to visitors' needs and minimize virus transmission. This research examined the effect of landscape design on Covid-19 in the Old Town area. Data were collected on the existing landscape conditions, cultural heritage, and the distribution of positive Covid-19 cases and analyzed using spatial analysis, design simulation, and quantitative descriptive. The results were presented as simulation or landscape design recommendations according to cultural heritage elements and health protocols. The recommendations are a division of activity zones with a visitor quota system, and optimization of health facilities, signage for physical distance, as well as a clean and healthy lifestyle for visitors.

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### 1. Introduction

The global emergence of the Covid-19 is currently the biggest challenge for humans. The significantly increased cases led to an international emergency status by the World Health Organization (WHO) in January 2020. By April 2021, there were 135 million cases of Covid-19

spread across various countries (WHO, 2021). This phenomenon has become a hard economic blow in various countries, with many workers losing their jobs and businesses collapsing or shutting down (Hakovirta and Denuwara, 2020; Nicola et al., 2020). Furthermore, it forces people to make changes in their activity patterns. Variants of a new virus began to mutate, some of them

spreading quickly from human to human (BBC, 2020). The highest rate of spread occurs outdoors because of the high interaction, accelerating virus transmission through the air. Barbarossa (2020) stated that most positive cases occur outdoors, especially in urban areas with a relatively high population density.

The high vulnerability to the spread of the virus in outdoor areas indicates a lack of adaptive planning to minimize the Covid-19 cases. Infectious disease outbreaks have occurred since the 18th century, especially in urban areas of European countries, such as the emergence of cholera (IALI, 2020). They were mainly caused by inadequate environmental sanitation systems, resulting in the term Miasma Theory. This theory explains that the landscape design conditions are strongly relevant to the potential for disease transmission. Furthermore, other studies have stated that pollution, temperature, and air humidity, especially in outdoor spaces, affect the spread of the virus from human to human (Pluchino et al., 2020; Travaglio et al., 2020; Fattorini and Regoli., 2020). High biodiversity could also minimize the transmission of pathogens and the impact of infectious diseases on humans (Ostfeld, 2017). Moreover, other research stated that plants and green spaces minimize human stress and create a safe and comfortable landscape (Mohamad & Hussein, 2021). Therefore, the design landscape is vital in creating the comfort of city life. Subsequently, planning experts consider creating adaptive and resilient landscape design solutions, especially against infectious diseases, such as Covid-19.

Landscape design is the creation or planning of outdoor space by placing plants and structures for a pleasant, beneficial, and sustainable natural environment (Motloch, 1991; VanDerZaden and Rodie, 2008). In "Basic Principles of Landscape Design, Ingram (1991) stated that a design requires an analysis of existing plants, landform, architectural style (building), and local activity. According to Booth (1983), six components must be considered in landscape design, including landform, existence, and function of plants, buildings, pavements, site structures, and the surrounding water bodies. In this case, landform comprises topography, while the plant component was its placement and environmental function. Moreover, the arrangement of the buildings could affect the functional organization of the landscape and create a microclimate, while the pavement is a landscape element that determines the land cover and uses the intensity of the area. Site structures are elements built in three dimensions in a specific landscape formed by landform, plant materials, buildings, and pavement. Additionally, landscape design

could be divided into soft and hard (Zakaria, Ahmad, & Abd Rashid, 2016). The soft landscape is a horticultural component related to plants, such as flowers, trees, and shrubs. In comparison, the hard landscape is a component with solid properties, such as gravel, paving, and stone.

In developed countries and cities such as New York, cities in England and Italy, landscape design planning develops sustainable road space that integrates public transportation modes with pedestrian walkways to connect with community activity centers. These two elements are important opportunities to create efficient urban community movements after the pandemic. The applications made in developing sustainable road space are creating special cycling lanes, widening sidewalks, procuring special transit routes and lanes for slow-moving activities, and having pick-up and special zones for emerging commercial spaces (NACTO, 2020).

The World Health Organization (WHO) data showed that Indonesia is one of the Southeast Asian countries with a relatively high spread of Covid-19. Until 2021, there were 1.56 million cases recorded, mostly in big cities, such as Semarang City (Covid19, 2021). In its development, Semarang City cannot be separated from complex activities, such as trade and services and tourism. In line with this, Semarangkota (2021) showed that 196 tourist attractions were operating in the city of Semarang. Most of the tourism sectors use outdoor space for their activities. Semarang City has many historical tourist locations, such as the Old Town of Semarang, which offers tours of Dutch colonial heritage. Tourist visits to these locations are extensive yearly and have become the main destinations for local to international people. The determination of the Large-Scale Social Restrictions implemented since mid-2020 in the City of Semarang has not stemmed from the massive tourist activities in the Old Town. Furthermore, the arrangement of outside space is less adaptive to Covid-19 because of tourists' many violations of health protocols due to the minimal distance between humans.

The arrangement of the regional landscape from 2018 to 2019 did not consider the emergence of infectious diseases, such as Covid-19. This causes the need for further adjustments or redesign of the area's landscape under pandemic conditions to ensure the health of the environment and society. The development of an area with high historical value is minimal, and the redesign process must consider conservation indicators. For this reason, this study determines the design landscape suitable

for the conditions of Covid-19 and cultural heritage in the Old Town of Semarang.

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## 2. Methodology

### 2.1 Description of Study Area

This research was conducted in the cultural heritage area of the Old Town Semarang. Figure 1 shows that this area is between Tanjung Emas Village and Purwodinatan Village, Semarang City, Central Java, Indonesia. Old

Town, also known as Outstadt, is located in the northern part of Semarang City, which is physically different from the surrounding area. In this area, a main road of transportation was built as a fast lane connecting the three main gates known as Heeren Straat or Jalan Letjen Soeprapto. One of the locations for the entrance to the fort that exists to date is the Berok Bridge called De Zuider Por. Also, this area has about 50 ancient buildings still standing strong, with a history of colonialism in Semarang.

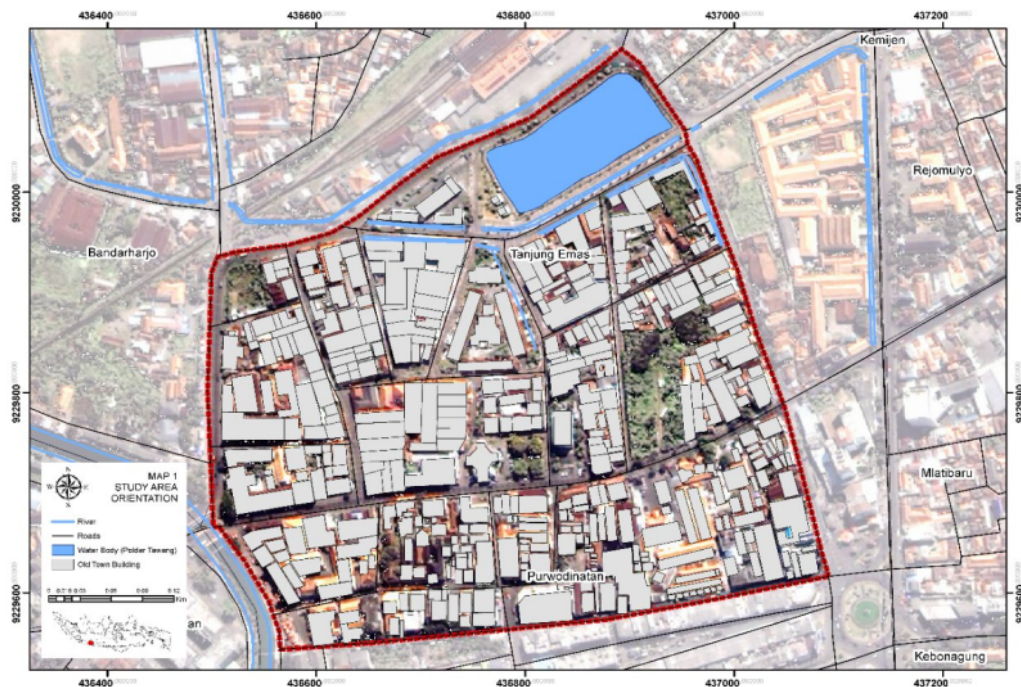


Figure 1 Study Area Orientation Old Town of Semarang

The policy regarding the Old Town area is contained in the BEP (Building and Environmental Planning), stipulated in the Regional Regulation of the City of Semarang. about Architectural, aesthetic, scientific, and cultural values are high and need direct preservation and restructuring to adapt to the times. The vision of Old Town Semarang is "The realization of the Old Town Area as a Dynamic and Living Historical Area for Social, Economic, Tourism, and Cultural Activities." Judging by space use, the Old Town Area is determined based on the composition of its functions of housing, trade and offices, as well as recreation and culture. This area has been used as a historic tourist destination, included on a tentative or quick list of world heritage sites by UNESCO in 2015. It

has around 50 historical buildings with different functions and conditions.

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### 2.2 Data Collection and Analysis

Data in this study were collected through natural observation methods supported by secondary online and institutional data. The natural observation method was carried out directly in the field and by observing the current conditions at the research location in July 2020. Moreover, field surveys were used to obtain data on community behavior and the landscape conditions of the Old Town of Semarang during Covid-19. Secondary data were obtained from government websites and networks



related to research, particularly on positive cases of Covid-19, area land use, tourism characteristics, as well as building and plant distribution. The overall data were analyzed using descriptive analysis and simulation methods supported by ArcGIS and Sketchup applications.

Figure 2 shows that the data on the distribution of Covid-19 cases in Semarang City and Old Town were processed using the Query Analysis method in the ArcGIS application. In the specification analysis, sample locations were determined for recommending the landscape design

in the Old Town area utilizing data on community activity patterns and vulnerability to virus transmission. Moreover, data on the road network, plant and building distribution (including heritage building and regulation), and land cover were used to describe the landscape characteristics towards Covid-19 using the ArcGIS Query Analysis method and Sketchup design simulation. Overall data were then accumulated to determine recommendations for landscape design under the conditions of Covid-19 and cultural heritage.

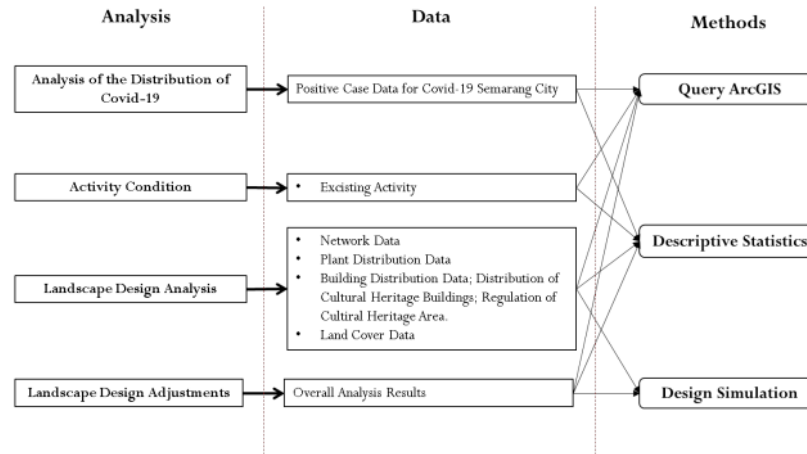


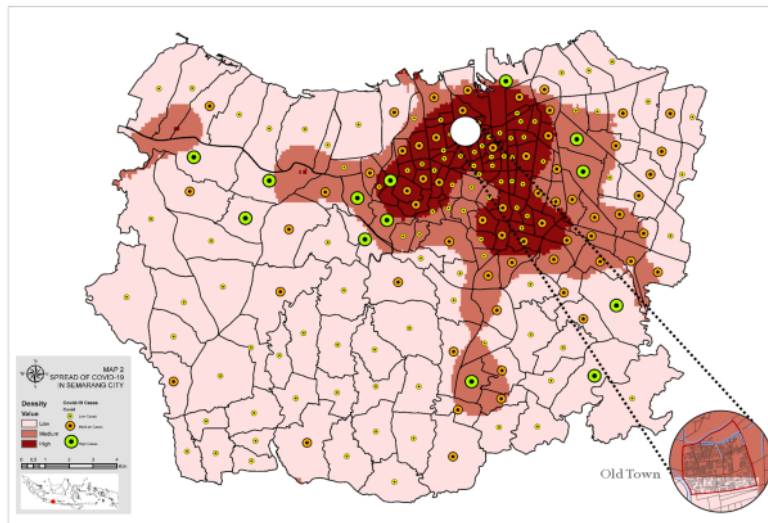
Figure 2 Diagram of the Research Process

### 3. Result and Discussion

#### 3.1 Covid-19 Cases in Semarang City

Data from Semarangkota (2021) showed 34,000 positive cases of Covid-19 and are predicted to increase. There are many health protocol violations, especially in public areas (Nasional Tempo, 2020). Figure 3 shows that the entire Semarang City has a high potential for the spread of Covid-19, with most cases occurring in the densely populated residential areas in the western region. In comparison, Figure 3 shows that the virus distribution in Old Town is in the moderate to low category. Furthermore, the high and low distribution is in the northern and southern regions, respectively. Old Town

Semarang is a potential distribution point because it is the city center with a high population density. One Semarang City-Data shows a decrease in visitors to historical tourism such as Old Town by 32% between 2019 and 2020. This shows the significant influence of Covid-19 on historical tourism activities in the Old Town of Semarang. However, since it reopened in 2021, Old Town tourism has become active again, with more visitors than in 2020. Also, the mobility of tourists from outside the city is unavoidable. Murgante et al. (2020) stated that the spread of the coronavirus occurred in Wuhan, China, quickly through mobility or massive population movements from one place to another. Therefore, it is feared to have the same impact on tourism activities in the Old Town of Semarang.



**Figure 3** Distribution of Covid-19 in Semarang City and Old Town (Researcher Analysis, 2021)

Figures 3 and Figure 4 show that this area is a high potential point for the spread of Covid-19 in Semarang City. This is due to the many daily outdoor tourism activities, especially from the afternoon until evening. The points of movement awakening originate from the parking area in the western and northern regions, as shown in Figure 4. All activities are collected and concentrated in the Blenduk Church and Srigunting Park areas and extend to the surrounding area. However, the provision of facilities that minimize the spread of Covid-19 is still relatively minimal. There are only a few sink facilities around the area whose availability is limited. Also, chairs are still used freely without any sign of the physical

distance between tourists, and banners warning of the spread of Covid-19 and procedures for the Old Town during the pandemic are not available. Furthermore, the outdoor temperature gauge was not working because the air temperature and humidity in the area could affect virus transmission (Pluchino et al., 2020; Fattorini and Regoli, 2020; Travaglio et al., 2020). Therefore, the public needs real-time information about the area's air temperature and humidity conditions during tourism activities. Raids on the use of masks have been carried out by security officers, especially at night due to violations of health protocols, especially along Letjen Soeprapto Street.



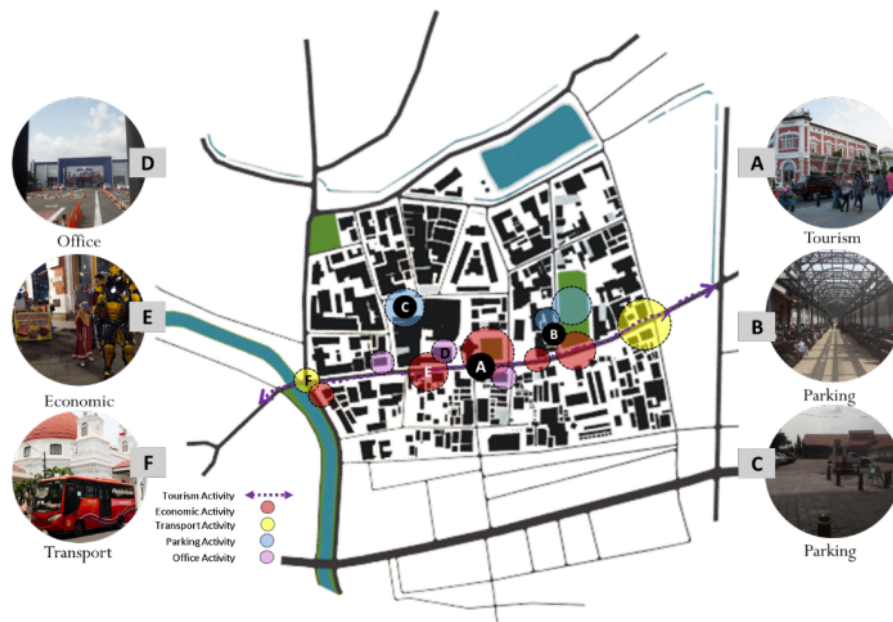
**Figure 4** Implementation of Health Protocols in Old Town (Researcher Analysis, 2021; Detik, 2020)

### 3.2 Activity and Accessibility Condition in Old Town Semarang

#### 3.2.1. Activity Pattern

Physical and social distance is still the main challenge in handling Covid-19. The many outdoor activities cause the need for adjustments to the shape of outer space to minimize the virus transmission from humans to other humans. For this reason, a good adaptive landscape design to current conditions is needed and recommended. Motloch (1991); VanDerZaden & Rodie (2008) stated that, in planning outdoor design, it is necessary to consider aspects of its sustainability and benefits. This planning could indirectly control the movement of people

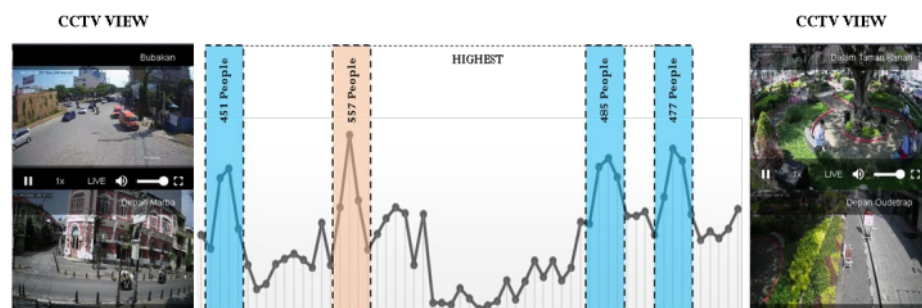
in outer space. Figure 5 shows that the Old Town of Semarang is mostly dominated by social and tourism activities, which require interaction with the surrounding environment and between people. Based on field conditions, tourism originates from parking activities, starting from the northern (Parking DMZ) and the western areas, as in Figure 5. Furthermore, many tourist activities occur along Letjen Soeprapto Street, especially around the Srigunting Park area, Blenduk Church, Marba Building, and Spiegel Building. The activity patterns include slow walking, sitting relaxed, and taking pictures without considering the distance among people. Additionally, tourism is mixed with the busy activities of motorized vehicles from morning to night along the main road.



**Figure 5** Patterns of Activities in the Old Town Area (Images source Jatengtoday, 2021 (E); Liburmulu, 2019 (F))

The many activities in the Old Town area could also be shown quantitatively based on data from CCTVs stationed at 21 location points (CCTVsemarang, 2021). Figure 6 shows that the number of visitors in the Old Town Semarang area fluctuates, with the highest on March 6 and April 10, 2021. On these dates, the number of visitors per day could reach 557 people from morning until night, with the peak occurring on Saturdays and Sundays (weekends). However, the number of visitors to the Old Town area is predicted to increase based on the trend diagram of visitors from February to April 2021. Furthermore, data on April 10, 2021, showed that 44

visitors to the Old Town area did not wear masks, which is a big challenge to handling Covid-19 in Semarang City. The increase in visitors every day without appropriate outdoor space arrangements increases the emergence of new cases in Semarang City and the area of origin of tourists in the Old Town. Also, practices regarding the Stay-at-Home regulations are only obeyed by certain circles of society (IALI, 2020). The high population with middle to lower economic conditions means that many people must fulfill their daily needs outside the home, including recreation or travel.



**Figure 6** Dynamics of Visits in the Old Town of Semarang (CCTVsemarang, 2021)

### 3.2.2. Accessibility and Road Network

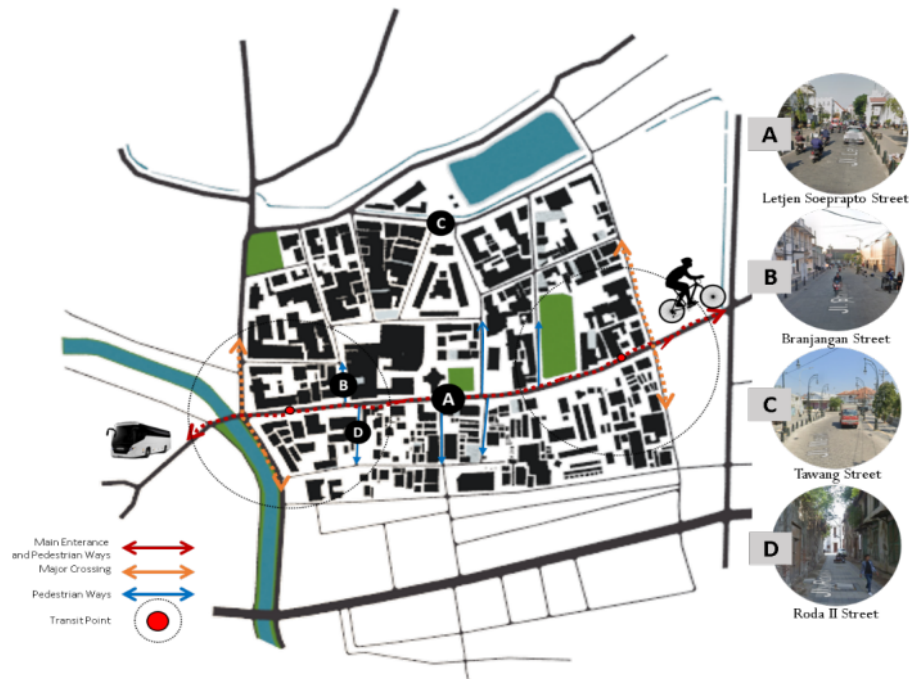
The road network and accessibility conditions are important components in planning the landscape design in

the Old Town area. In this regard, the road network becomes a place for people to move and enter the area every day freely. Figure 7 shows that the road network in Old Town is divided into main and local road networks.



The main road network, Letjen Soeprapto Street, is the entrance for activities and motorized vehicles to the area and around the Old Town. Furthermore, the transit points traversed by public vehicles, such as the Bus Rapid Transit (BRT), make the Old Town area easily accessible to local

people and visitors. However, the road network with paving materials causes vehicles to move slowly when entering the Old Town. As a result, there is a frequent accumulation of vehicles and community tourism activities, especially along Letjen Soeprapto Street.

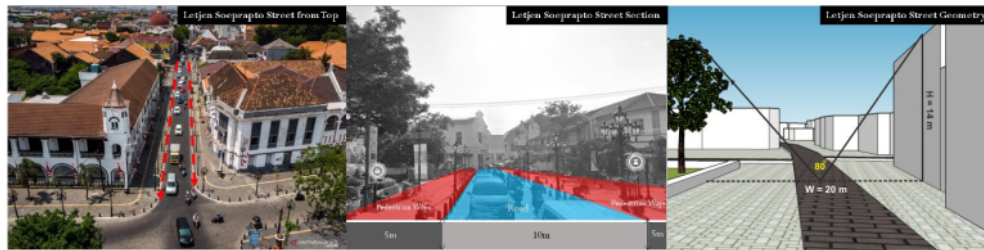


**Figure 7** Accessibility in the Old Town Area (Researcher Analysis, 2021; google street view, 2021)

Significant infrastructural improvements have been made, especially the road network in Old Town since 2018, making roads better with more complete facilities (Kompas, 2018). Consequently, the number of visiting tourists has increased to date. Figure 8 shows that the main road, Letjen Soeprapto Street, has a width of 10 meters, with a pedestrian lane as broad as 5 meters on each side. Additionally, there are complimentary road facilities, such as street lights, benches, bollards, and plants along the pedestrian walkways. However, the conditions of outer space, especially in high activity zones such as Letjen Soeprapto Street, have not been adjusted to health protocols such as physical distance restrictions.

Bourbia and Awbi (2004) stated that the position of the sun and the characteristics of urban geometry influence the formation of the shadow of its lower surface. The geometry is a ratio of building height to road width (H/W) and is oriented towards north-south, East-West.

The increase in high-rise buildings forms narrow pathways, trapping hot air and inhibiting airflow (geometry effect), increasing air temperatures and leading to Urban Heat Island (UHI). Figure 8 shows that the geometrical condition of the Old Town road on Letjen Soeprapto Street is 0.7 or 80 degrees from the building to the road. This results in very few shadows during the day, though the air circulation is smooth, with a good wind trapping system in the shade vegetation in Srigunting Park. Field observations showed that the high activity of tourist visitors and motorized vehicles crossing Letjen Soeprapto Street causes vegetation and wind circulation from the road geometry not to reduce the temperature in the Old Town area significantly. Travaglio et al. (2020) stated that high temperatures and minimal humidity accelerate virus transmission through the air from humans to other humans. Therefore, it is important to maintain the quality and condition of outdoor air temperature to remain comfortable for humans and their activities.



**Figure 8** Road Conditions of the Old Town Road Antaraneus, 2019 (left) and Researcher Analysis, 2021)

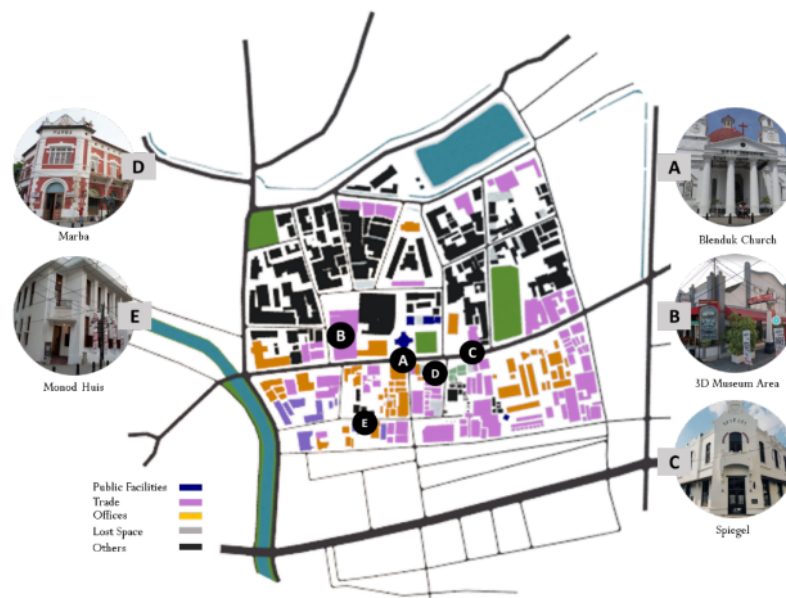
### 3.3 Urban Landscape Analysis

#### 3.3.1. Building and Cultural Heritage Analysis

Figure 9 shows that its function as a cultural heritage area of the Netherlands causes the distribution of buildings in this area to evenly and neatly form a grid system. This causes air circulation to flow smoothly, and the effective road network system makes it easier for people to find certain locations. Buildings in the Old Town of Semarang are mostly used for commercial activities, such as cafes, offices, and warehouses. Office, economic, and tourist activities have caused this area to always have visitors and human activities. Furthermore, the dominance of activities along Jalan Letjen Soeprapto is also caused by the many buildings functioning as trade and office centers and major tourism. Only a few buildings in the Old Town of

Semarang are abandoned and generally used as warehouses or temporary housing for immigrant communities.

Some heritage buildings have courtyards used as small gardens, such as the Blenduk Church. This building uses vegetation as a barrier separating it from the surrounding activities because it is a private room usually used as a place of worship. The function of other nearby areas is in stark contrast due to its location on the main road, with a public open space busy with activities, such as Srigunting Park. Figure 9 shows several Cultural Conservation buildings with specific functions, such as the Blenduk Church as a worship facility (A), 3D Museum as modern tourism (B), Spiegel as a café (C), Marba as an office (D), and Monod Huis as a location for art exhibitions and events (E).



**Figure 9** Sample Heritage Building in Old Town of Semarang (Images source: google street view, 2021)

The buildings' orientation facing north or south of the area causes direct sunlight to fall on the object, casting no shadow, especially during the day. This causes the air and temperature to be bad, making outdoor activities during the day uncomfortable for visitors. Therefore, many visitors prefer tourist activities in the afternoon until the evening. The theory regarding the position of buildings in landscape design was also conveyed by Ingram (1991) in the document "Basic Principles of Landscape Design." It explains that the building's position is vital in creating a comfortable landscape design for its occupants. This knowledge is essential for design planners to create shade for important places.

Figure 10 shows some samples of the building shapes and the surrounding design landscape. Some buildings in the Old Town have canopies that create shadows during the day, such as a residential building with a two-level canopy,

a height of 3 meters, and a width of 1.5 – 2 meters. This canopy creates cool spaces for passing pedestrians. However, the foundation that blends with the pedestrian walkways causes an imbalance in the design of the outdoor space. Moreover, the canopy support posts are only 0.5 meters from the street lamp posts, creating a narrow space less likely to be used by pedestrians. In contrast, other buildings such as the Blenduk Church have a large landscape design with vegetation and guardrails between private and public areas. This building has a distinctive ornament and architecture compared to other buildings in the vicinity. Another building, Spiegel, functions as a commercial building in the form of a café. The building has an outdoor landscape that blends directly into the street and pedestrian walkways, creating a large public space for visitors. Also, its function as a commercial building causes no clear boundaries with other public spaces in the vicinity.



**Figure 10** Sample Heritage Building in Old Town of Semarang

As a cultural heritage area, Old Town has regulations in developing and managing historic buildings. Changes, especially in the physical sector, must go through a clear permit and meet the requirements to maintain the sustainability of the cultural heritage area. The requirements for restoring or developing the Cultural Conservation Area, according to Law no. 11 of 2010, are as follows:

- Pay attention to the authenticity of materials, shapes, layouts, styles, and artistry technology.
- Pay attention to the original condition with the smallest possible change.
- Use of non-destructive techniques, methods, and materials.
- Paying attention to competence in restoration or development.

### 3.3.2. Soft Landscape Analysis

Soft Landscape is a form of design when viewed from its constituent elements or materials (Hakim, 2012). Softscape is a landscape design element that comes from nature, such as plants and water bodies. The vegetation in this area could be divided into shade and ornamental. Based on Figure 11, shade vegetation is found only at some points, such as Srigunting Park and Tawang Polder, and its presence is still relatively minimal. In contrast, ornamental vegetation is found on each side of the road as single trees, plants in vases, hanging plants, to plants on the walls of buildings, especially along the pedestrian walkways of Jalan Letjen Soeprapto. The vegetation in the parking lot is still very minimal, causing high temperatures during the day. Additionally, the average land cover paves with low heat reflectance and absorbs and releases heat. As centers for generating regional visitors, parking lots are



very vulnerable to extreme temperatures and Covid-19 transmission. Furthermore, there are limited open lands, such as water bodies and vacant land in this area. The only water body is located in the northern part of the Tawang Polder, while rivers and artificial ponds are on the main road outside the area. Moreover, there is no location for regional dividing activities, and the activity center is only on Jalan Letjen Soeprapto, which causes minimum

physical distance between tourist visitors. Previous studies stated that pollution, temperature, and humidity in the air, especially in outdoor spaces, influence the spread of the virus from human to human (Pluchino et al., 2020; Travaglio et al., 2020; Fattorini and Regoli., 2020). Also, high biodiversity could minimize the transmission of pathogens and the impact of infectious diseases on humans (Ostfeld, 2017).



Figure 11 Soft Landscape of Old Town

The pattern of vegetation distribution in Old Town, especially along main roads and pedestrian walkways, is seen in Figure 12. There is no balance between the barrier function and contribution in creating a microclimate for the surrounding area. Hanging, potted plants and small trunked border plants are found in plenty only along the main road. However, shade plants with a wide canopy are needed to create thermal comfort in this location, especially during the day. Tall buildings with minimal sun shade do not help in controlling the microclimate of the area. The centers of good circulation and wind are only around Srigunting Park and the side of the Indonesian

Trade Building Ltd. Furthermore, the wind generated in Srigunting Park is quite high but can only be felt from a maximum distance of ten meters from the vegetation center. The vegetation along the pedestrian walkways only functions as a barrier to the main road, not as a shade or controlling the distance between people. This contradicts the principle of the function of vegetation to help minimize Covid-19 transmission in outdoor spaces through microclimate control. Therefore, the main functions in the softscape should contain health indicators and climate adjustments.



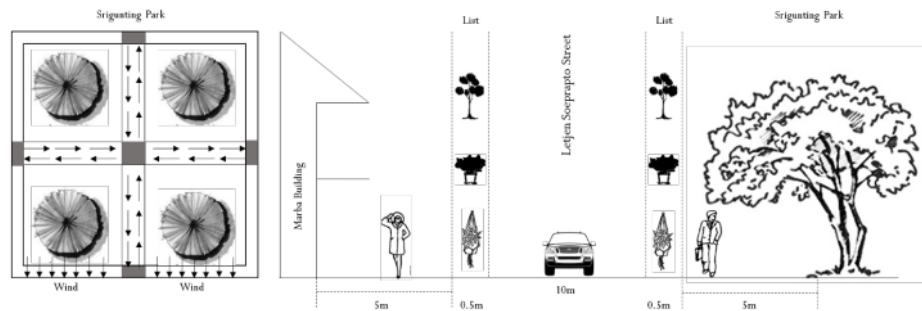


Figure 12 Vegetation Patterns in the Old Town

### 3.3.3. Hard Landscape Analysis

Landscape design elements could also be viewed as hard. According to Hakim (2012), hardscape is artificial material elements other than vegetation that support vegetation in an area. Figure 13 shows that Old Town Semarang has more paving materials from natural stone. This component is included in the hardscape classification because it is formed from natural stones. The paving materials throughout the Old Town are used to control

vehicle speed and emphasize the need to maintain the sustainability of cultural heritage buildings. The building walls are made of concrete, which on average, has brightly colored paint. Concrete is included in the composite materials found in most buildings in the Old Town. Additionally, several locations, such as the Samsat Building, have a yard made of asphalt commonly used for vehicle testing. However, this building has a guardrail to separate office activities inside from public activities outside.

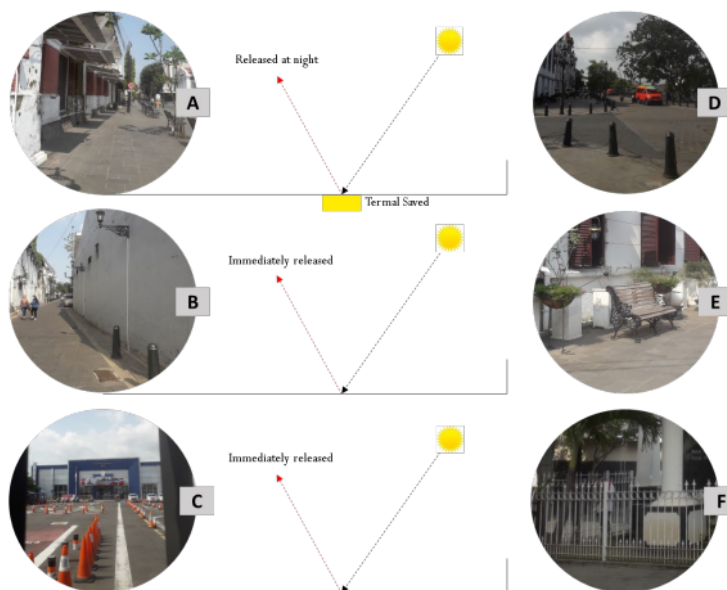


Figure 13 Hardscape Components in Old Town; (A) Andesite; (B) Concrete; (C) Asphalt; (D) Bollard; (E) Park bench; (F) Fence (Researcher Analysis, 2021)

Materials and pavements in the area function as a microclimate controller reflecting and absorbing heat. Bright colored buildings have the ability to reflect heat into the air, keeping the surrounding air hot (Anambyah & Setyowati, 2010). Also, Figure 13 shows other hardscapes that support the existence of softscapes in Old Town,

including bollards, garden chairs, and plant fences in gardens and buildings. Bollards are scattered throughout the area, especially along the main road, which serves as a safe boundary for pedestrians and motorized vehicle users. Park benches are lined along the pedestrian walkways and parks. During field observations in July 2020, most of the

park chairs in the Old Town area were not equipped with markers to maintain a safe distance for health protocols. This made many visitors sit close together and without keeping their distance. Therefore, physical forms of such a landscape should conform to the current health protocols. In this regard, secure fences are usually used to limit private and public activities, and as barriers for plants. Other hardscape components, such as paving on pedestrian walkways, lack special markers and settings to control the distance between tourists. However, pedestrian walkways are still mixed, and tourists from opposite directions do not cross paths to make physical contact.

### 3.4 Adjustment of Landscape Design to Covid-19

The analysis shows that each component of the landscape design relates with Covid-19 by intermediary microclimate or regional air temperature conditions and physical environmental settings. Furthermore, the components making up the design landscape produce functions that create certain thermal conditions and increase environmental resistance to the spread of viruses in the air. This supports Ostfeld (2017) and IALI (2020), which found that biodiversity inhibits the transmission of viruses in the air. Additionally, structuring a green landscape, such as an open space, could reduce the stress of the humans active in it and create a comfortable landscape (Mohamad & Hussein, 2021). In dealing with Covid-19, health becomes vital, and the environment becomes a major container that could affect human health.

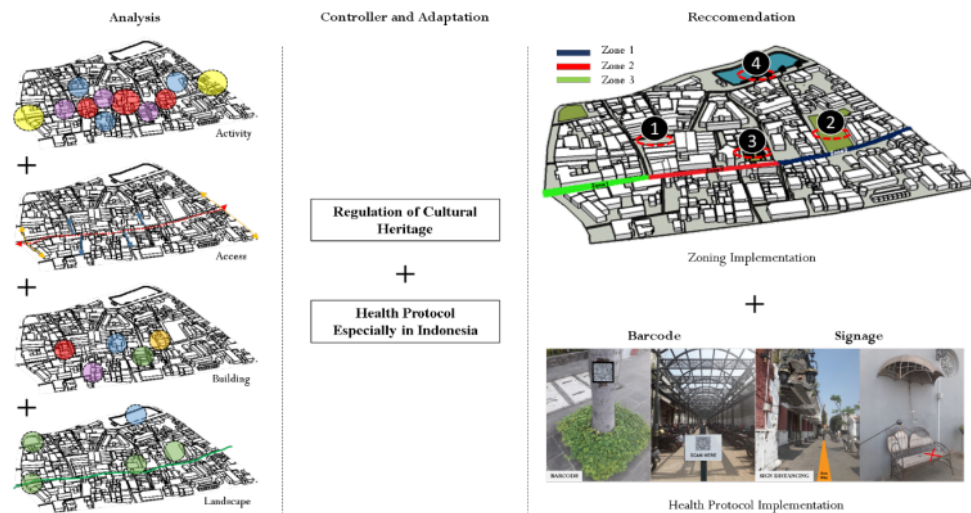


Figure 14 Design Recommendations and Approach

Figure 14 shows that overlaying several components of the design landscape resulted in an integrated approach between health protocols and landscape design recommendations. As a historical tourism area and cultural heritage, regulations regarding cultural heritage areas control design recommendations. Therefore, the approach taken is not too technical in preserving the cultural heritage of the Old Town of Semarang. Furthermore, Figure 14 shows that Letjen Soeprapto Main Street focuses on implementing the design recommendations because it is the center of human and motorized vehicle activities in the Old Town area. Therefore, zoning and limiting visitor quotas are recommended along Letjen Soeprapto Street, divided into three main zones.

Zone 1 starts from the main entrance area at the end of the eastern base of Letjen Soeprapto Street to the intersection between Jalan Gelatik and Jalan Srigunting Park. This zone has the potential for high activity emergence due to its location at the area's entrance, with Lantern Park Parking for tourists' vehicles. Zone 2, with the highest activity level, stretches from Srigunting Park to Jalan Branjangan, while Zone 3 stretches from Jalan Branjangan to the exit at the west end of Letjen Soeprapto Street. Several busy tourist spots in Zone 3, such as the Klitikan Market and the DMZ Building. Also, there are two potential locations for activities in the DMZ Parking area and Samsat Parking. Every tourist entering these zones must scan the barcode available at several points to check the quota and the latest health conditions. This system has been implemented in several public locations in Indonesia, one of which is in the

Malioboro Cultural Heritage area of Yogyakarta. However, the City Government's assistance is needed to provide security officer services in each zone to ensure smooth implementation of health protocols.

Characteristics of building and land materials with high heat reflective potential could be overcome by providing additional vegetation along the walls of the building. However, the recommended vegetation is potted, creeping, or hanging vegetation to minimize damage to building structures. Furthermore, the zone system could be integrated into good health protocol facilities, such as applying several signage on hard landscape components, including pedestrian barriers and physical distance markers on park chairs. Several residences along Letjen Soeprapto Street with a canopy foundation that blends with the pedestrian walkways could be given a sign or direction for tourists to go only through one path. Parking lanes should be made one way and integrated to minimize encounters between tourists and parking activities, such as in the DMZ Parking area. Furthermore, sections numbered 1 to 4 on the zoning map are locations with high activity

generation potential but could make adjustments to more optimal green landscape design.

Implementing the recommendations would also become clearer by providing numerical data, especially on applying the quota system for each zone. The quotas in Table I are determined using the 2018 PUPR Ministry Pedestrian Guidebook and the 2020 Indonesian Health Protocol Guidelines. This provision states that the standard width of space for pedestrians per person is 1.5 meters (standard for wheelchairs and one person carrying a wheelchair or two shopping baskets). Therefore, in the current conditions, social distancing regulations require an additional distance of 1.5 meters between humans. This is the basis for applying a quota system in each zone using the accumulation of pedestrian space standards and physical distances from health protocols in Indonesia. Therefore, the overall results obtained along Letjen Soeprapto Street are 1,807 visitors, with 520 people in Zone 3, 890 in Zone 2, and 397 in Zone 1. This system could use the in-out barcode method to ensure quotas are fulfilled and sufficient for visitors.

**Table 1** Old Town Zone Capacity Calculation

Zone	Standart		Formula	Large	Capacity (People)
	Per	Protocol			
	16 person				
Zone 1	0.75m	1.5m + 1.5m = 3m Large = 3m x 1m = 3m <sup>2</sup>	Large = L x W Capacity = Large : 3m <sup>2</sup>	156m x 10m = 1,560m <sup>2</sup> 267m x 10m = 2,670m <sup>2</sup>	1,560m <sup>2</sup> : 3m <sup>2</sup> = 520 2,670m <sup>2</sup> : 3m <sup>2</sup> = 890
Zone 2	0.75m			119m x 10m = 1,190m <sup>2</sup>	1,190m <sup>2</sup> : 3m <sup>2</sup> = 397
Zone 3	0.75m				

(Based on the Indonesian pedestrian guideline, 2018 and Indonesian health protocol guidelines, on KemenKes, 2020)

#### 17 4. Conclusion

The adjustment of the landscape design of the Semarang Old Town area focuses on environmental sustainability and the preservation of cultural heritage. The analysis showed that the landscape design adjustments to Covid-19 did not change the physical or environmental form of the Old Town cultural heritage area. Moreover, changes or additions to conformity components are carried out with minimal damage to the original condition of state heritage buildings or historic landscapes. The adaptation process carried out to the Covid-19 pandemic emphasizes the existing landscape functions and improvements based on health protocol guidelines and best practices. The adjustment involves zone recommendations and visitor

load capacity that could be accommodated on weekdays and weekends, especially along Jalan Letjen Soepratman. Furthermore, public facilities are adjusted to the needs of physical and social distance activities, such as providing markers or barriers for direct interaction between visitors. Every corner of the area should provide a special sink for hand washing and a body temperature detector. Also, the geometric conditions of roads and buildings need to be considered to create a microenvironment temperature that supports the comfort of outdoor activities in the Semarang Old Town area.

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