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Establishing a Covid-19 Defensible Space According to Urban Fabric Using Analytical Hierarchy Processes (AHP): Case Study in Bukit Bintang, Kuala Lumpur

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ABSTRACT

Since the start of 2020, people all around the globe have been subject to life-limiting limitations due to Covid-19 that is unprecedented. The world's population has been dealing with previously unheard-of restrictions on their way of life since the start of 2020. The proper urban planning is essential because it relates to land management to create a healthy environment free from epidemics. It analyses the planning effectiveness on space as defended space using GIS tools. This research has used five criteria such as walkability, sidewalk comfortability (obstacles on the sidewalk), sidewalk safety (sidewalk width and covid-19 area rate), building design, and open space. This study concentrated on the Bukit Bintang neighborhood. In response to the COVID-19 pandemic, a new zone with fortified boundaries was established to offer open space. Finally, the study's goals and objectives have been achieved using AHP method. Additionally, several suggestions were made for future action so that the Bukit Bintang region's red zone area design is being enhanced to minimize or lessen the effects of catastrophic epidemics, just like the case with the Corona outbreak.

INTRODUCTION

The world population has been facing unprecedented restrictions in life since the beginning of 2020. Since the beginning of 2020, the global population has been confronted with unprecedented constraints on their way of life. This was triggered by the fatal COVID-19 epidemic, which began in December 2019 in Wuhan, China. COVID-19 is the abbreviation for the 2019 outbreak of Corona Virus Disease, thus the phrase COVID-19. Suddenly, the whole population of the planet was ordered to stay in their homes. The World Health Organization (WHO) swiftly declared to the worldwide public vital tactics, including quarantine, social distancing, and self-isolation, to prevent the spread of this global pandemic (WHO, 2020). Nonetheless, these new social standards not only collide with the need of people for social connection but also with the design of cities, parks, squares, subways, and public places.

(Romanelli *et al.*, 2019) raised many questions that designers and urban planners should now consider harmonizing design trends towards increasing social relations between individuals. Another researcher (Kimmelman, 2020) also supports this paradigm. Nevertheless, the WHO stresses that "healthy cities and the city planning process are background papers supporting the work of the World Health Organization" But from the perspectives of urban planning and health, contemporary urban developments have not been very effective (Nieuwenhuijsen, 2020). Therefore, it is vital to emphasise the significance of designing cities and the urban environment to offer people health conditions. The interrelationships between city feature such as buildings, streets, public parks, and infrastructure substantially impact the quality and efficacy

of life in cities. (Kibert, 2016). COVID-19 is not the first pandemic in the globe. Other pandemics have already struck the globe and claimed millions of lives. (LePan, 2020).

In addition to Tuberculosis in South Africa in 2006 and Ebola in West Africa in 2014, COVID-19 has just been added to the list of quickly spreading infectious illnesses in this century. In 1908, Philadelphia was ravaged by Typhoid and Cholera epidemics due to the mingling of sewage and drinking water in the Schuylkill River. Also, the Athenian plague in 430 BC (14th century), popularly known as the Black Death in Europe, was the most disastrous pandemic ever inflicted in the history of humankind.

To stop the spread of the COVID-19 pandemic, researchers created "a Model for choosing the strategies of human mobility by producing and maintaining a space authorised in executing the social distance." The urban fabric, which encompasses safe and comfortable sidewalks, building design, and open space, is a significant pillar of the COVID-19 Defensible Space framework since it greatly affects how people move about a given area. The COVID-19 Defensible Space can be defined as "an environment whose quality of the physical characteristics enables us to create a space that can be defended. This means that a definable space zone can be developed depending on the quality of the place. This theory asserts that an area is safer when less crowded and has good urban planning designs, thus obliging its residents to reduce the need for movement. Creating defensible spaces or "bubbles" offers safety for people to move about and align their movement patterns, thus mitigating the spread of the epidemic.

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The Qualitative approach was used, and GIS Spatial and statistical Analysis was carried out on the defensible space criteria based on the urban fabric by using Analytic Hierarchy Process (AHP) analysis to establish Spectral indices. The output of this approach was demarcated the defensible spaces and zones. This Model was correctly forecasted where the most significant cases happen for the future.

LITERATURE REVIEW

The term 'urban' relates to cities and settlements of high population and infrastructure density. Urban areas are distinct from rural areas, which are more sparsely spread, often surrounded by open countryside or agricultural land, and with lower population densities. The Home Quality Mark suggests A metropolitan region is one with a population of at least 10,000 people and a primarily built-up landmass. The urban fabric refers to the constructed environment of urban regions such as cities and towns. Everything from the buildings and streetscapes to the signs, lights, roadways, and landscaping. The physical makeup of a city is referred to as its "urban fabric." This definition does not include elements such as traffic, people, or economic or political issues.

In a medieval town with fewer components, the urban fabric may be more easily examined than in a contemporary metropolis. These elements comprised the encircling wall, its towers and gates, the streets and linked circulation spaces, the marketplace (and hall, if it existed), other commercial buildings, churches, general town structures, and private garden areas (Designing Buildings, 2022).

In this article, streets and sidewalks that affect walkability, building design, and open green spaces are adopted as elements of the urban fabric.

Walkability

According to (Farr, 2008). A walkable urban area or an urban environment that adheres to the principles of walkability gives pedestrians the greatest priority, aiming for a more remarkable urban life and encouraging more socioeconomic contacts. A measure of pedestrian surroundings might be related to the presence or absence of variables that encourage walking. Walkability is "the extent to which walking is readily available as a safe, connected, accessible and pleasant mode of transport" (Alley, 2005), (Shamsuddin *et al.*, 2012). Pedestrians are given the utmost priority, which is reflected in environmental conditions and features (Kumar, 2010) and, therefore, pedestrian-friendly (Alley, 2005).

It is thought that walkability is mostly determined by the physical qualities of a location that influence individual motivation and behaviour. There is little consideration of how these characteristics influence the psychological sense of locations, such as place meaning and attachment. A pleasant and appealing walking experience may have a favourable effect on how people perceive a city. Researchers in this field employ both scientific and

subjective measures to measure walkability. These include the pleasure of the visitors with the physical features, such as the pedestrian's use of the pedestrian network.

Others illustrate the emotional comfort defined by how individuals respond to the characteristics they encounter while walking. The expertise of providing comfort in urban streets is crucial. While it's true that people's walking motivation and the distance they're willing to walk may be impacted by elements such as the quality of the walking environment, this is not always the case., thermal comfort may play a more important role in hot and humid settings like those found in Southeast Asian cities. (Southworth, 2005).

A distinction must be made between walkability and accessibility. It is hypothesized under the covid 19 defensible space hypothesis that a neighborhood's walkability decreases when it lacks amenities and points of interest that make it appealing to its residents and visitors alike. Therefore, public spaces get overcrowded. Alternatively, the accessibility hypothesis hypothesized that the individuals would be more likely to interact in places that were convenient to move. The authors proposed that sites with easy access encourage greater levels of social contact and, therefore, higher contagion rates of COVID-19 because of this proxy effect of accessibility on several variables associated with social interaction.

The safety of a region is an essential factor in deciding whether people centered or not. Several studies have shown the correlation between walkability in terms of environmental safety, the presence of sidewalks, and the availability of recreational amenities such as parks and walking trails (Brownson *et al.*, 2009) (Pelletier *et al.*, 2009) (Robitaille, 2009). Effective street design, which relates to the size and design of sidewalks and roadways, and their management (e.g., traffic signals, traffic calming design for speed and volume control) may influence walkability. Another crucial safety indication is if a community promotes and provides a range of balanced signage that serves as a guide for individuals to adhere to the standard operating procedures.

Building Design

The design of the building is the most comprehensive and developing method for improving the quality of life and minimising the building's influence on employee health and performance. In the present research, an ecological building is described as one that has high indoor air quality, natural light, variable temperature settings, layout, scale, and a healthy and safe workplace in order to limit the negative effects of the building on human health and performance (Cirrincione *et al.*, 2020) (Giang, 2012). The nutritious building idea focuses primarily on producing a pleasant and comfortable interior atmosphere, as evaluated by indoor environmental quality (IEQ) (Šujanová *et al.*, 2019). A healthy IEQ is predicted to have favourable physical, mental, and social effects on the residents of the most densely inhabited buildings. IEQ

refers to the quality of the indoor living environment inside a structure (Lai *et al.*, 2009).

In Malaysia, There are quite a number of residential property types to date, with the common ones being Serviced residents, Condominiums, Flat and Apartments (landed) and bungalows, semi-D, terraces, And townhouses (non-landed). There is no official and specific classification for the types of residential buildings in Malaysia; therefore, in this research, a category was adopted Brickz's website (Brickz, 2022) for building types in Malaysia, and they were classified into eight types as follows.



Figure 1: Residential property types classification based on (Brickz, 2022)

Open Space

(Smale, 2006) defines space as “the geometry of a physical location,” which correspondingly “has objectively defined properties characterized by points, lines or routes, areas, and surfaces.” This generally accepted positivist view has prompted researchers to describe space as “a meaningless domain.” (Cresswell, 2004) and “the basis for spatial and locational analysis” (Smale, 2006). Accordingly, most studies of leisure space have concentrated on location and distance, stressing the physicality of places and focusing on empirically visible characteristics of space, such as where individuals participate in leisure activities, where recreational places are placed (Mowen & Confer, 2003) and where recreational resources are dispersed across a community (Dahmann *et al.*, 2010) ; (Nicholls, 2001); (Tarrant & Cordell, 1999). A more in-depth and critical assessment of urban public space necessitates understanding space as a complex socio-spatial construct that transcends mere physical location.

Space in society generates conditions for the replication

and survival of social institutions. Our perceptions of a place provide complicated coded, re-coded, and de-coded representations of social life by animating, animating, and occupying it. Consequently, diverse perceptions of space produce environments that are fundamentally distinct. Examining the “Mount Trashmore” case described how local authorities saw the urban environment as a garbage site, whereas neighbourhood people valued the area as a great public play area. Additionally, told the storey of how locals recovered a corner lot that had been utilised for illegal activities and turned it into a community garden (Johnson *et al.*, 2009). In so far as white homeowners envisioned the garden as a flower garden and African American tenants as a produce garden, the garden's uses remained contentious. In critical geography literature, several interpretations of space have often been debated. Feminist geographers have claimed that space is differently gendered, while others have highlighted the unequal character of space based on who uses it and when (Massey, 1994); (McDowell, 1999). In these instances, identity categories represent the many functions and meanings of a particular location.

Natural regions such as woods and grasslands, working farms, ranches, and timberlands include open space. In addition to parks, stream and river corridors, and other natural places, urban and suburban regions also have open space. Lands designated as open space might be protected or unprotected, public or private (Thompson, 2002). Open space is any undeveloped territory in an urban environment, including any land and water that are not occupied by vehicles or structures.

Without imposing aesthetic requirements, urban open space may be described as the region between buildings in an urban area that is mathematically limited by varied heights. Nevertheless, the aesthetic value of each piece of urban space is determined by the structural interrelationships of its particulars (Krier, 1979). Streets and squares are the two primary aspects of urban space, according to Krier.

(Carr & Lynch, 1981) established a classification by type for open space that acknowledged Regional parks, squares, plazas, linear parks, adventure playgrounds, wastelands, playgrounds, and playing fields. This typology perhaps focuses more on spaces dominated by challenging landscapes, other than later typologies incorporating or focusing on green open spaces. On different levels, Lynch shared three types of open spaces by scale. As shown in table 1

Table 1: Open space classification type based on (Carr & Lynch, 1981)

Indicator	Description
Private urban open spaces	These include spaces that are integral within a housing area.
The neighborhood open spaces	Which is a part of a neigh-borhood and serves as an extension of the home such parks, playgrounds, playing fields and sports grounds, school playgrounds, streets, city farms, incidental spac-es, and natural green space.
The civic urban open spaces	The squares and plazas, ports, and docks.

Justification of Site Selection

on October 8, 2020, the Health director-general of the Malaysian Ministry of healthy said that Malaysia is entering the third wave of the Covid-19 pandemic. And The Malaysian Ministry of Health (MOH) worries that the movement of six million people in the Klang Valley and Negeri Sembilan contributed to an increase in COVID-19 cases in the States. He said nearly all districts in Selangor, Kuala Lumpur, and Putrajaya were currently COVID-19 red zones and that it would be difficult to control the movement of people in these densely-populated States (Bernama, 2020). The covid-19 cases significantly started increasing being of October 2020 Until the number reached 7995 cases in Kuala Lumpur and 718 cases in Bukit Bintang respectively on February 7, 2021 (MOH)

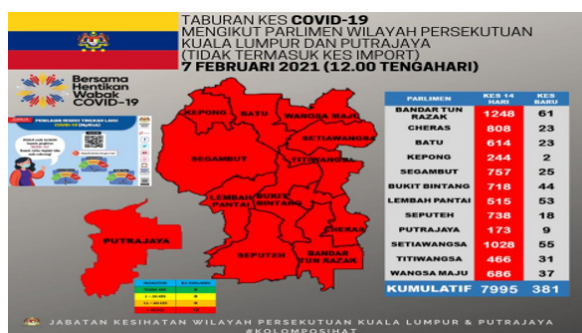


Figure 2: Kuala Lumpur cases by districts as of February 7, 2021 (source MOH 2021)

By zoning Kuala Lumpur city into sub-zones and using a covid-19 outbreak data and human movement data, we found that in the same period (RMCO) from December 1, 2020, and January 15, 2021, Bukit Bintang area recorded the most significant number of cases with 3555 cases, in addition, It ranked as the most visited places Figure (3) (Qwasm *et al.*, 2022) . Bukit Bintang is the retail and

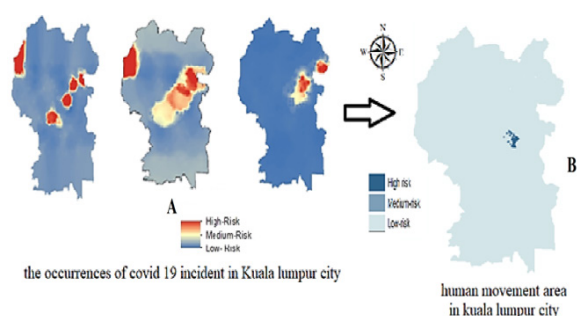


Figure 3: A Kuala Lumpur covid-19 cases using hotspot analysis showing Bukit Bintang area as a red zone; B showed the most visited place using kernel density analysis source

entertainment area of Kuala Lumpur, Malaysia. It is also known as Bintang Walk or Star hill, the latter of which is a literal translation of the Malay name. Jalan Bukit Bintang and its near surroundings are included. The region has long been Kuala Lumpur's most important retail corridor, home to several landmark shopping complexes, alfresco

cafés, pubs, night markets, food streets, Mamak vendors, and hawker-style restaurants. This region is popular with visitors and residents, particularly young people. Pudu and Cheras surround Bukit Bintang to the south, Petaling Street (Chinatown) to the west, Bukit Nanas to the north, Kuala Lumpur City Centre (KLCC) to the northeast, and Tun Razak Exchange and Maluri area to the east (Wikipedia Bukit Bintang) Figure (4)

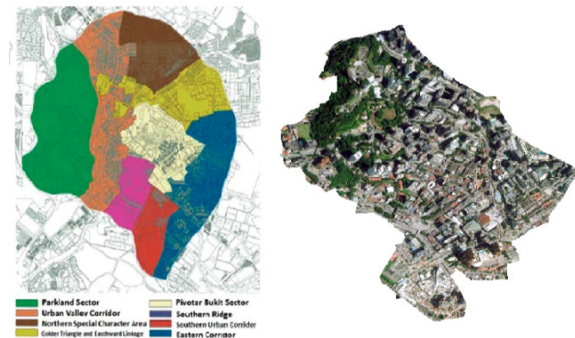


Figure 4: Left: City center boundary zones. Right: the study area zone (Bukit Bintang) Source: (Draft Structure Plan Kuala Lumpur, 2020)

METHODOLOGY AND ANALYSIS

This study uses Multi-criteria decision-making (MCDA) with the Analytic Hierarchy Process (AHP) to compute relative weights and the significance of each aspect important to the defensive space zone in order to design a defended space zone according to the Urban fabric. Once the relative weights have been set, a priority vector is estimated to get the overall relevance modifier value for each element to be utilised in GIS computations.

The selection of AHP as a more structured approach to measuring suitability by decomposing the problem into hierarchical criteria and conducting a more systematic and in-depth analysis of the factors, which can be better comprehended by examining their lower and more specific forms or indicators, respectively.

The AHP permits the engagement of professionals and interested parties in offering feedback. This framework provides for the absorption and accommodation of qualitative and quantitative criteria and expert knowledge information. Multi-criteria decision-making (MCDA) is a technique used to ease decision-makers' evaluation of numerous factors. MCDA is used to examine and compare many, sometimes contradictory factors in order to make the best possible conclusion (Ryan & Nimick, 2019)

the requirements for each factor were determined and justified based on Previous studies and the questionnaire results, which are Compatible with the covid-19 defensible space theory hypotheses for representing the judgments and expert knowledge with significant numbers, the values Transformed into a relative scale and importance of each criterion Weighted in regards to the objective which establishes the defensible space zones, finally the layers/ criteria Combine, synthesize and aggregate together. To produce a defensible space zone map, figure (5).

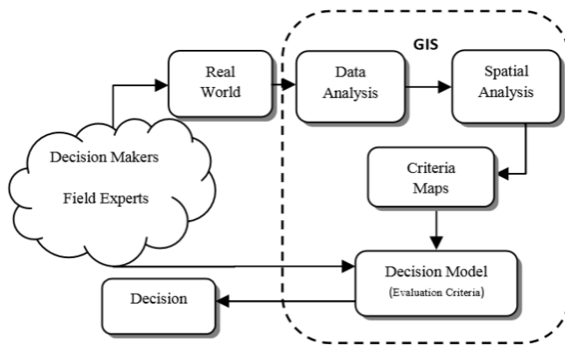


Figure 5: Integrated GIS -MCDA approach.

Preparing the Criteria

the urban fabric quality factors were identified and grouped into three categories which are walkability (sidewalk safety and comfortability), building design, and open space. Firstly, the sidewalk safety parameters are included the sidewalk width, which affects the Maintaining of social distance rules, and covid-19 area rate, Which affects the feeling of safety when walking in the area, in addition to the sidewalk comfortability, which Influences the decision of walking in the area sidewalks is depicted with simple lines for each sidewalk including the width only. It has no more information on the kind of walkway, number of lanes, or presence of sidewalk barriers. The sidewalk is classified as follows: Less than 3m (impossible to maintain social distancing rules), 3-4 meters (complicated to maintain social distance rules), 4-5 meters (difficult to maintain social distance rules), And More than 5 meters (easy to maintain social distance rules), figure (6). It is considered that these lengths are generally consistent with social distance guidelines for maintaining a two-meter separation.

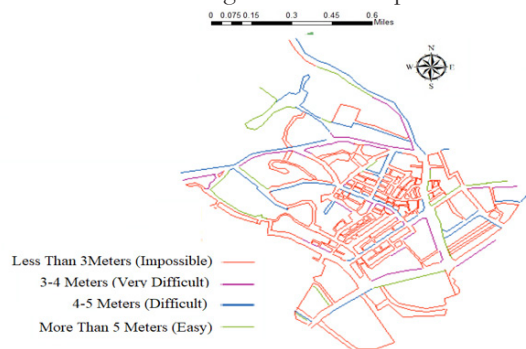


Figure 6: Sidewalk in the study area according to social distance rules

The value of the sidewalk was weighted according to the width. The importance of distances is commonly used to analyze the selection width depending on the sidewalk width. Eventually, each width corresponds to social distance rules which are given a specific value. The value indicates the relative importance of sidewalk width safety. Thus a sidewalk with 5 meters width is safety than 2 meters width

The sidewalk polyline is converted to a raster format. A buffer distance is given according to sidewalk width. The cells inside the sidewalk buffer distance of 5 meters

are given a value of 1, which means easy to maintain social distancing rules. The cells inside the sidewalk buffer distance of 4 meters are given a value of 2, which means acceptable to keep social distance rules. The cells inside the sidewalk buffer distance of 3 meters are given a value of 3, which means very difficult to maintain social distance rules. The cells inside the sidewalk buffer distance of 2 meters are given a value of 4, which means impossible to maintain social distance at this step. Lastly, the cell outside the buffering polygon has a value of 0, indicating that it contains no data. Each kind of sidewalk corresponds to a layer containing freshly produced

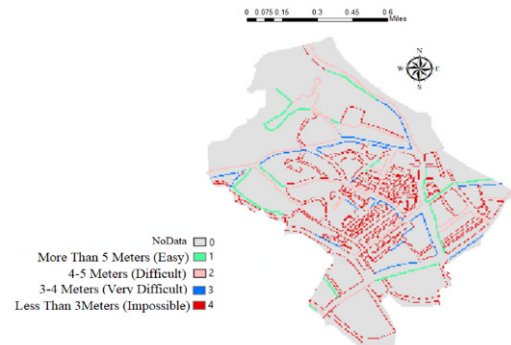


Figure 7: Sidewalk Width Safety Zone Value from Covid-19 Perspective.

buffers. Second, for sidewalk safety in terms of covid-19 area rate, each sidewalk inside the red zone area has been assigned a value from 0-4. Higher covid-19 rates indicate that a sidewalk area is less safe for pedestrians. A hotspot analysis was used to identify the covid-19 occurrences incidents in the Bukit Bintang area and reclassified into four zones.

The cells inside the zones are given a value between 1-4 according to the Pavement covid-19 occurrences incidents Scale, where zone number 1 is given a value of 1, which means accessible to defense. People avoid the red zone region and are forced to have meetings in designated spots because high covid-19 rates indicate that the sidewalk is not a safe place to stroll. In contrast, cells inside buffer 4 have a value of 4, suggesting that it is challenging to defend the figure (8).

The selection of the value and buffering zone were suggested to defend the space according to the covid-19 rezone area based on Previous studies. The value and

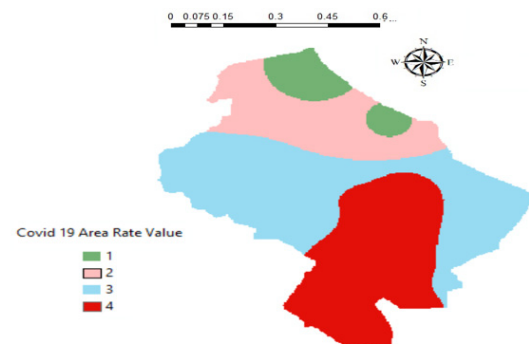


Figure 8: Covid-19 area rate zone value from a covid-19 perspective

weights indicate the relative importance of covid-19 red zone area. Thus zone 4 Indicates a non-defense sidewalk, while zone 1 Indicates a defense sidewalk area

Third, the sidewalk Obstacles in the study area were chosen to be included in the analysis. Qualitative Field Observation was used. The selection depended on the obstruction locations on the sidewalks, which had the trash locations points, motorbike's used the sidewalk as parking, and The aggressor restaurants on the sidewalk, all obstruction locations on the sidewalk were geocoded based on the GPS location data. They were mapped using ArcGIS/ArcMap software figure (9).

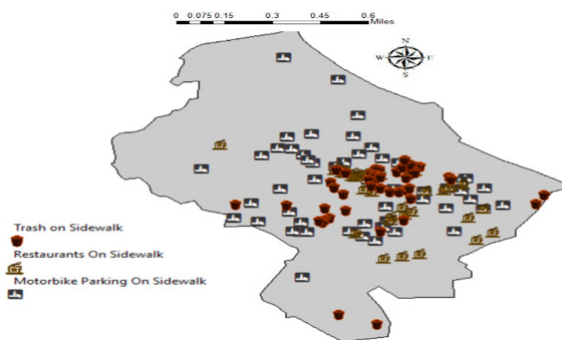


Figure 9: The location of the sidewalk Obstacles in bukit bintang area.

A kernel density analysis was used to identify the uncomfortable sidewalk area according to the existing obstruction, and the selection of the weights and buffering zone were suggested to defend the space according to sidewalk comfortability. The consequences indicate the relative importance of sidewalk comfortability. The kernel density was classified into four zones. The cells inside zones one are given a value of 1 according to the pavement Obstacles Scale, which means easy to defend Because it has fewer obstacles, while zone 4 Indicates a gathering area for sidewalk obstructions. Thus, there is less space to defend the figure (10). For the building

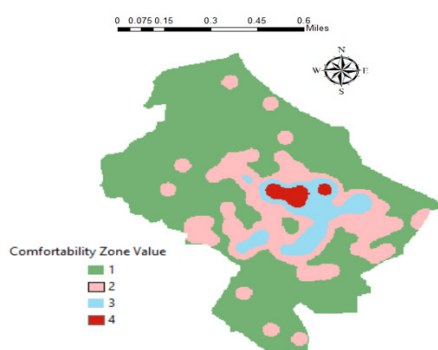


Figure 10: Sidewalk comfortability zone value from a covid-19 perspective

design parameter and based on the residential property types in Malaysia, a covid-19 affected residences dataset for the period from February 15, 2020, to January 15, 2021, was obtained from (Malaysiakini), an online news portal that is published in Malay, English, Chinese, and Tamil. Every day, they broadcast which buildings around

the nation have been hit. The affected buildings have been filtered, verified, and classified based on properties and house classification in Malaysia. The statistical results in table (2) indicate that the 'flat apartment' category attracted the most significant number of affected residential buildings with a percentage of 50.2%, followed by the 'condominium' category at 34.2% then the service residence at 7.5%, while the other types of affected building were (terrace house 5.1%) (townhouse 0.9%) (bungalow 1.4%) and finally the (semi-d 0.4%) and this confirms the impact of the design on the covid-19 epidemic

Table 2: The affected building type after being filtered, verified, and classified based on properties and houses classification in Malaysia

Type of Building	Number of affected building	Percentage
Condominium	73	34.2%
Flat apartment	107	50.2%
Service residence	16	7.5%
Semi-d	1	0.4%
Terrace house	11	5.1%
Town house	2	0.9%
Bungalow	3	1.4%

a buffering or containment zone is created, and the area where positive coronavirus cases are found. In our case, The affected buildings were considered instead of individual cases to determine the containment zone (buffer), and based on the results of the analysis of the affected structure, three types of buildings were focused, which are the Flat apartment, apartment, and condominiums however the three types of construction are the most common residential type in Bukit Bintang area The locations of the resident's buildings (Flat apartment, apartment, and condos) were located and

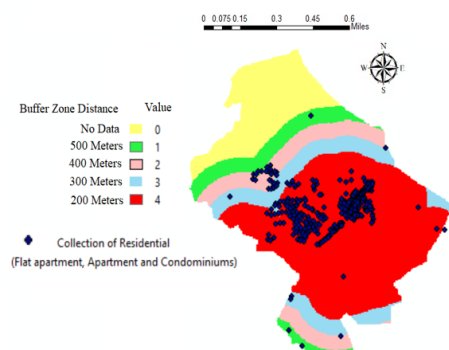


Figure 11: service area (multi buffer) and zone value generated around the building

categorised in the research area. A service area (multi buffer) was established surrounding each building with a distance of 500-400-300-200 metres. The cells inside the 500-meter buffer are assigned the number 1, which means they are accessible to defense according to the affected building. The 400 meters buffers are allocated

a value of 2, the 300 meters buffer has a value of 3, and finally, the 200 meters buffer is given a value of 4, which means challenging to defend the figure (11). At this stage, each distance corresponds to a layer containing freshly produced buffers.

The selection of the weights and buffering zone were determined to defend the space, according to Philippine. India (Noida, 2020) criteria that the buffer zone is a 500-meter radius around the containment zone if the critical zone is a home, building, commercial enterprise, market, roadway, or subdivision. The weights indicate the relative importance of distance, thus having value 1 with 500 meters buffer is more essential than having value 4 with 200 meters buffer in terms of finding enough space to defend,

For the open space factor and based on open space classification (table) (Carr & Lynch, 1981). These elements identified as markers of urban landscape quality in this research were manually extracted using extremely high-resolution satellite data in ArcMap10.3 GIS software derived from Google Earth tiles. Then, each tile was mosaicked to create the whole satellite image of the research region. The categorised markers for this research were then victimised manually and visually in ArcMap 10.3

the relative value of four hands selected and Domestic/Private urban open spaces have been considered as the most important indicator of open space analysis weight of (1) is given to it, which represents specs that are integrated within a housing area Domestic/Private urban open spaces have been deemed the most relevant indication of open space analysis, and a weight of one (1) has been assigned to their relative importance. with Only residents of the house or building are allowed to meet which mean that there is no density and crowding, followed by Neighborhood urban open spaces (including the forest and reserve area) which given. (2) Which represents a sufficient space for social distancing relatively, and then the Civic urban open spaces (including the commercial area and public facilities), which given (3) while population urban has assigned a minor weight with (4) as it has a negative impact on founding enough space for defense according to crowd level figure (12)

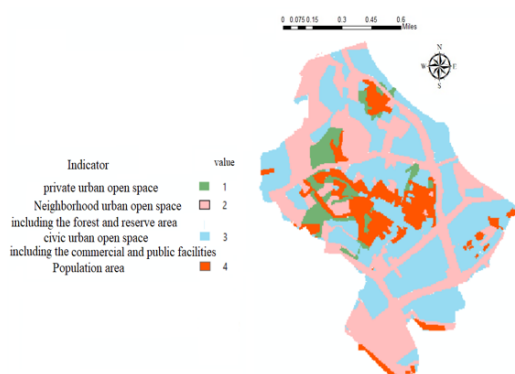


Figure 12: Open space classification and the zone value from the covid-19 perspective

Analytic Hierarchy Process (AHP)

Multi-criteria analysis is utilised to define the defensible space zone via weighted overlay analysis, which is regarded the trademark of ArcGIS and the most essential and widespread approach for geographic data processing (Bhatta, 2011). Considering all thematic layers, i.e. the urban fabric, which includes the safety of the sidewalk (sidewalk width, covid-19 area rate,) and the comfort of the sidewalk. All data layers (including building design and open space) are first converted to raster format and then classed to be unidirectional (Ziaul & Pal, 2017). In the raster overlay, the pixel or grid cell values in the thematic maps are merged using arithmetic and Boolean operators to form a new value in the composite raster map, which provides a robust capacity for quantitative modelling (numerical analysis) (Bhatta, 2011). Figure 13

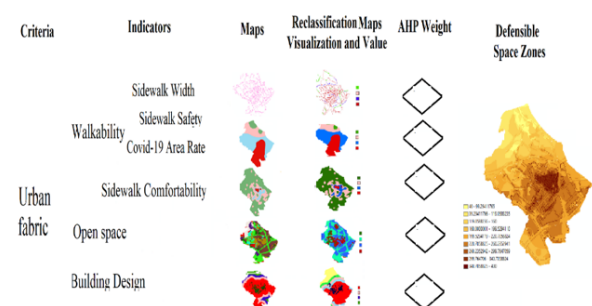


Figure 13: Process diagram of establishing defensible space using Analytic Hierarchy Process (AHP)

AHP (Analytic Hierarchy Procedure) is employed in the study, which is a complete approach that integrates both factual evidence and the subjective judgement of specialists in order to arrive at a good decision-making process (Şener *et al.* 2011). Accordingly, a decision matrix was constructed using a 1–9 scale for decision-influencing characteristics. The following factors comprised the rating scale: (1) exceedingly insignificant, (2) very unimportant, (3) unimportant, (4) somewhat unimportant, (5) equally important, (6) fairly important, (7) more important, (8) substantial, (9) significant (Saaty, 1980) (Şener *et al.*, 2011)

Table 3: AHP's quantitative evaluation and grading scheme for alternatives (Saaty, 1980;Şener *et al.*, 2011).

Relative importance	Definition	Explanation
1	Equal importance	Two activities contribute equally to objective
3	Weak importance	Experience and judgment slightly favour one activity over another.
5	Strong importance	Experience and judgement strongly favour one activity over another

7	Demonstrated importance	One activity strongly favour one activity over another.
9	Absolute importance	The evidence favouring is favouring one activity over another is of highest possible order of affirmation.
2,4,6,8	Intermediate values	When compromise is needed.

The defensible space factor weight was calculated using a new AHP excel template program with numerous inputs developed by (Goepel, 2013) and applied to the results of an online questionnaire. The defensible space theory was used to structure and manage the element figure's template appropriately. According to the existing literature on AHP

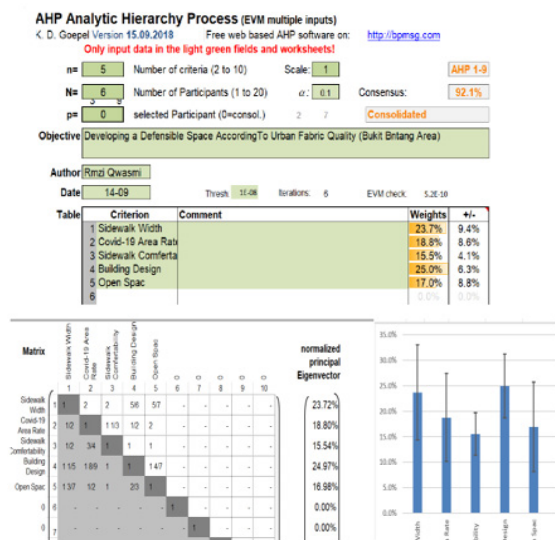


Figure 14: Entering and organizing data using new AHP excel template software

applications in management and engineering, there is no minimum sample size required for AHP analysis. Some research used sample sizes ranging from four to nine participants (Darko *et al.*, 2019). In our case, the average was considered, which is six expert Participants. Small sample sizes may have a negative impact on a variety of areas of research, including data processing and contemporaneous interpretation of findings. A notable benefit of AHP over other MCDM techniques is that it does not need a statistically significant (big) sample size to provide sound and statistically robust findings (Doloi 2008). Some academics contend that AHP is a subjective approach for issue-specific research. Therefore, it is not required to use a big sample size (Lam and Zhao 1998). Others contend that since AHP is based on expert assessments, even qualified expert opinions are often representative (Golden *et al.*, 1989). In addition, it may be counterproductive to employ AHP in a research with a high sample size since 'cold-called' experts are likely to make arbitrary responses, which might drastically impact

the consistency of the assessments (Cheng *et al.*, 2002). A large portion of AHP's appeal in CM may be ascribed to its ability to work with tiny sample sets.

Based on field experience and expert judgement that was standardised using Saaty's AHP approach, the weights given to distinct thematic maps and their particular characteristics were determined. The consistency of the normalisation that reduces the bias of the weights allocated to thematic layers was evaluated, as suggested by (Saaty, 1980). Figure (15).

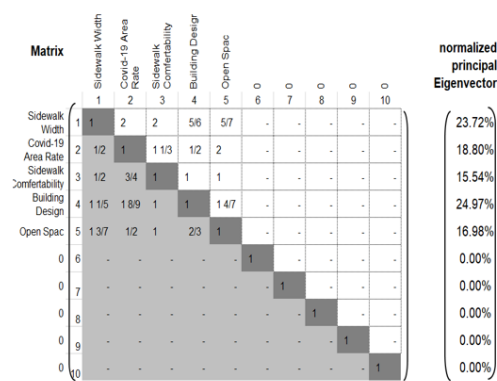


Figure 15: Pairwise comparison matrix by AHP for factors weight

RESULTS

When the weights sum up option is used, all the indicators map y are combined and given the same weight, yielding the overall map that emphasizes the defensible space zone according to the urban fabric factor. Afterward, the maps are reorganized from zone 1 to 9 based on the urban fabric component, as seen in figure (16).

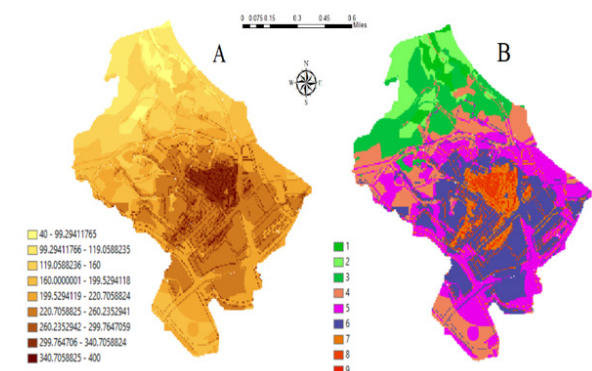


Figure 16: (A) The Overall Map of the Urban Fabric Factor Using the Weights Sum (B) Reclassification According to The Urban Fabric Factor

(UF - Equation 1) is a combination of FIVE suggested indices. based on the presented strategy, constant parameters of sidewalk width SW (corresponding to 32.7.0), Level of covid-19 area rate CR (corresponding to 18.8), Level of sidewalks obstruction SO (corresponding to 15.5), Level of building design BD (corresponding to 24.9) and Level of open space OS (corresponding to 16.9) urban fabric factor (Uf) (\sum constant parameters = 1).

Equation:

$$\sum UF = KSW Z_SWST + KCR Z_CRST + KSO Z_SOST + KBD Z_BDST + KOS Z_BDST$$

$k=0$

Where

UF: Urban fabric Index weight

SW Sidewalk Width

CR Covid-19 Area Rate

SO Sidewalks Obstruction

BD Building Design

OP Open Space

ST: Study Area

The final result was compared to the zones that can be defended to validate and verify the defensible space zone. It was found that the zones that cross the non-defensive areas were found, firstly, the zones that recorded the highest cases of Covid during the RMCO period. This confirms the validity of the results. Second, the foreign worker dwelling area zones correlate with what the Malaysian government declared on May 29, 2020, namely that the majority of the instances involve foreign employees living in close proximity to one another. That 78 percent of positive cases in May 2020 were from immigrant employees who battled to prevent infection owing to living circumstances, indicating that there is a relationship between the characteristics of foreign workers and the quality of the place of residence as a factor of increased cases (Malay Mail, 2020)

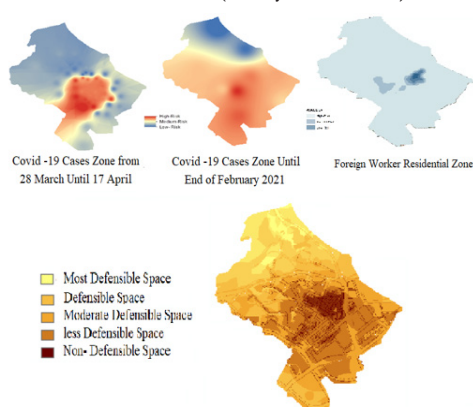


Figure 17: validation and verify the defensible space zone

DISCUSSIONS

Traditional sidewalks in the Bukit Bintang region are between two and three metres wide, which does not allow for the World Health Organization-recommended 2-metre spacing. Commonly six metres wide, shared use walkways may rapidly hit capacity with individuals maintaining social distance. The region must accommodate demands to develop areas for the growing number of pedestrians and cyclists, while maintaining appropriate social distance. Closing roads to private automobiles to provide room for bicycling and walking. Adding bike lanes or converting automobile lanes to bike lanes, and making municipal bike sharing systems accessible to all citizens and important employees. Removing crosswalk begging buttons to prevent contact-based virus transmission and

give pedestrians priority. If we want to build beautiful places for people to ride and stroll while keeping a safe distance, we may use park plans, bicycle master plans, and pedestrian master plans.

Although the plants on the sidewalk provide an aesthetic view and encourage people to walk in general, but is founded a potential problem In maintaining social distance while walking, and therefore it is considered a negative point in terms of safety from the Covid-19 perspective, Here is necessary to set priorities, as human health is more important than the aesthetic view, and therefore the plants on the sidewalk must be re-planned to occupy less space than the sidewalk, which preserves human health and the overall aesthetic of the city at the same time.

The things exhibited must be accessible for purchase within the business, and all transactions must take place on the premises. Merchandise display structures may not extend more than 1 metre onto the sidewalk from the building line or exceed 2 metres in height. However, “zero sidewalk display streets” are prohibited from having any displays on their sidewalks. In addition, sidewalk displays must not be permitted on the street when general or food vending is prohibited on that street. Usage shall be restricted to the area closest to the exterior wall of the business and shall be positioned such that there is a standard-compliant, unobstructed pedestrian walkway between the usage area and the adjacent street. Any approved uses must provide a minimum of 1.5 metres of unobstructed sidewalk space between themselves and all other items blocking the sidewalk, including but not limited to a sidewalk café, parked vehicles, light poles, trash cans, and the front bumpers of any parked automobiles. And must not impede vehicle traffic, parking, or the use of any crosswalk, wheelchair ramp, bus stop, or taxi zone. For residents of flat-apartment buildings in foreign worker residential areas, each step from the apartment’s front door to the outside world might raise their risk of contracting the virus.

Narrow corridors and tiny balconies may place us too near to our neighbours and their pathogens; door knobs and buttons provide a greater threat. Promoting seclusion requires adequate distance between buildings and a change in balcony orientation. For socialising, working, and studying, at least a two-person seating space should be provided. Balconies should be angled according to climatic conditions, and inhabitants should have access to shades to protect them from heat and rain. The best balcony access is from the living room. The area must be re-planned, and even the residential building itself. The private open space has to be associated with each building. The number of buildings must be reduced to allow sufficient space based on the density and the number of people living in each building.

Public places alter communities. In informal settlements, well-designed public areas may support local business development, boost public safety, and enhance aesthetics. For instance, provide public places that inhabitants may

enjoy and merchants can utilise to support themselves. In the meantime, high-mast lighting and other enhancements brighten public places and increase neighbourhood safety. During the age of COVID-19, better public areas may alleviate congestion, promote healthier lives, and function as improvised shelters or marketplaces. The accessibility of the green open spaces in the study area is quite difficult. People can't walk to space. Most green open spaces came within more than 5 minutes' walk. This situation may be caused by the problem of available space distribution and planning in the study area. A deep research study regarding this phenomenon needs to be done. It helped to clarify this question and reveal many more problematic open spaces in the Bukit Bintang area. Therefore, the problem pertaining to space can be solved from the leading root causes. Only then the management of the open space was better. It's the role of planners to locate the available space in an appropriate location and within a relevant walking distance even though those spaces are only scattered open spaces and not the main open space for an area. People can practice an active lifestyle when they just have to walk or cycle to the space. Furthermore, the link between the open space and the neighboring buildings is also essential in creating a protected feeling in the space, for instance, by placing the available space between the adjoining buildings. This made people inside the buildings more frequently visit the open space, Which reduces overcrowding in shopping malls, which are used as an alternative place of green open space Due to the far distance.

Conclusions

In summary, this study pertaining to the analysis of the planning effectiveness on space as defensible space by using GIS techniques is crucial in the urban planning field since it is related to land management to form a healthy environment from epidemics. Data availability is the essential point of any research, thus providing the necessary data for researchers to develop smart models and strategies related to establishing a safe zone to allow people to move freely in it during the epidemic to limit the spread of the epidemic. The Planning fundamentals and Standards are crucial in distributing essential community services and facilities. Therefore, the Structure Plan and Local Plans of Kuala Lumpur City need to be enforced to avoid piecemeal attractions and crowdedness in any zone. This research focused on the Bukit Bintang district using five criteria: sidewalk safety (sidewalk width and covid-19 area rate), sidewalk comfortability (sidewalk width and covid-19 area rate), and building design. In response to the COVID-19 epidemic, a defended space was created in order to provide open space, a new zone. Finally, the discussion and the result have accomplished the goal and objectives of this study. Also, several recommendations are drawn for future action so that the Bukit Bintang area as red zone area planning improved from time to time to avoid or attempt to reduce the consequences of catastrophic epidemics, as happened in the case of the Corona epidemic.

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