

Walkability Of Sidewalk In Commercial Corridors

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Abstract— In a Walkability Survey in Asian Cities, Jakarta occupies the bottom four. Having been its low level of walkability, Jakarta in implementing the sustainable city concept arranges the walkable pedestrian ways. As the center of commercial activities, Jakarta needs the walkability measurement for commercial corridor. This research aim is to identify the level of walkability in commercial corridors. The unit of analysis is a commercial corridor. Field observation and questionnaire survey were used as the methods. Field observation is to identify the condition of pedestrian facilities, pedestrian flows, and land use along the left and right sides of the corridor. There were three variables of the condition of the corridor's sidewalk associated with the level of pedestrian's comfort, that were safety, amenity, and accessibility. These three variables are measured by several indicators measured using a Likert scale. The number of respondents was 96. To test the data's reliability and validity used a reliability test and bivariate correlation test. Meanwhile, to measure the significance of each variable in each corridor, the k-independent samples were used. The results showed that the level of walkability of the sidewalk in the Sudirman corridor was high, while in Dr. Satrio and Casablanca corridors were a moderate level. This difference is due to the accessibility indicators. In Sudirman corridor meet the integrated public transportation as well as the absence of interference from street vendors and motorized parking. Therefore, accessibility of pedestrian way is the determining factor for the level of walkability in commercial corridors.

Index Terms—walkability, commercial sidewalk, safety, amenity, accessibility

1 INTRODUCTION

Walkability is the basis or foundation for the sustainable city [1, 2, 3]. It provides social, environmental, and economic benefits [2, 3]. Social benefits are promoting mental and physical health [1] related to reducing obesity and cardiovascular [3]; raising well-being [4] and quality of life of citizens in cities [4] as well as creating active community [2, 3] by promoting social contacts [5] and social interaction [3]. Environmental benefits of walking are become part of the solution of global warming [6] with the creation of a safer [3] and healthier city environment [2, 3]; more environmentally friendly [2, 3] as is reducing traffic congestion [1, 6]; lower environmental impact [1] by reducing oil dependency [3, 6] and gas emission [3], as well as conserving energy without air and noise pollution [1]. Economic benefits come from social and environmental benefits. Walking is a basic requirement of mobility [5]. Every trip begins and ends with a walking trip [3, 5]. Only by walking many people can access everyday activities [3]. But, still walking has been often considered as the *forgotten mode* of transport [3] and underrepresented in the overall transport system [5]. At the almost cities in Indonesia, walking as part of transportation activities, is not preferred mode [7]. The level of walkability in Indonesia based on [8] which is represented by Jakarta occupies the bottom four positions as cities with low walkability levels. In creating a walkable pedestrian way, the measurements are needed as a reference. Walkability shows how much the built environment supports pedestrians by providing comfort and safety, connections to various destinations (such as where to work, shop, etc.) in a decent duration and effort, and offers visual appeal during the trip [1]. The basic principle of a walkable city is to create public spaces for pedestrians and be friendly to them [9]. So objectively referring to the physical environment and subjectively the environment is perceived and felt by the walkers [5].

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The quality of pedestrian environment is the key to encouraging people to choose walking over driving [1]. In [3], key qualities include: connectivity, convenience, comfort, conviviality, conspicuousness, coexistence, and commitment. Alfonzo in [10] presents a socioecological model of walking that encompasses five hierarchical levels, namely, feasibility, accessibility, safety, comfort and pleasure-ability that represent the causal factors influencing a person's decision to walk. In [11], there are four aspects supporting the creation of a walkable pedestrian environment, namely access, aesthetics, safety and security, and comfort. Such is the extent, then in [2, 3], to measure walkability there is not a "one size fits all". On the other hand, there are three different spatial hierarchies, namely city, street, and detail which are complementary [9]. This study selected safety, amenity, and accessibility of sidewalk (street level) in commercial corridors. Sidewalks are a critical part of sustainable transportation systems [12]. In [12], sidewalk width, a buffer between sidewalk and street, and presence of amenities are predictors of pedestrian travel, perceived safety and quality of the pedestrian environment. The research could be divided according to different walking purpose [4]. The narrower definition leads to specific goals [5] such as to shop and to work. Commercial activities are chosen. These activities are the driving force for Jakarta's economy and depend on the level of walkability in commercial corridors. According to Bishop in [13], commercial corridors are corridors with space utilization along the road used for commercial activities, office complexes, and shopping centers. Based on the project for public space in [14], the characteristics of commercial corridors include comfort, identity, accessibility, land functions, activities and supporting social functions. Based on [15] pedestrian path (or sidewalk) is pedestrian sections that is integrated or separated from the road and is intended for pedestrian facilities and infrastructure and connect between activity centers and intermodes change facilities. The criteria for sidewalk is the availability of sections for pedestrians without interruption to their movements accompanied by the availability of facilities which include green lanes, lighting, seating, safety fences, bins, signage, bus stops/shelter and waiting booths. Table 1 shows the variables and parameters for measuring walkability related to the pedestrian comfort, namely safety, security and accessibility.

**TABLE 1
MEASUREMENT OF COMMERCIAL CORRIDOR
WALKABILITY LEVELS**

Variables	Parameters
The Global Walkability Index (GWI), H Krambeek (2006) in [8]	
Safety	<ul style="list-style-type: none"> Pedestrian path conflicts with other modes of transportation Security from crime
Amenity	<ul style="list-style-type: none"> Availability of supporting facilities Infrastructure for people with disabilities
The US Department Health and Human Service (2010) in [16]	
Safety	the condition of the pedestrian path up and down
Amenity	<ul style="list-style-type: none"> Geometric conditions of pedestrian paths Availability of ramps and path for disabilities
Accessibility	<ul style="list-style-type: none"> Condition and location of diffable paths & ramp diffable path size
The International Journal of Tourism Cities, Tulin (2018) in [17]	
Safety	<ul style="list-style-type: none"> traffic when crossing Security from crime
Amenity	<ul style="list-style-type: none"> Completeness of pedestrian facilities Use of facilities in accordance with their functions
Accessibility	<ul style="list-style-type: none"> Convenient access design for pedestrians
Minister of Public Works Regulation No. 03 PRT/M/ 2014 in [15]	
Safety	<ul style="list-style-type: none"> Slippery/bumpy physical condition Safety crossing
Amenity	<ul style="list-style-type: none"> Shelters, green lines, lights, fences, signage, public telephones, seats, trash bins, crossing facilities Building to building
Accessibility	<ul style="list-style-type: none"> Public transit transportation area to buildings Parking area to building

2 RESEARCH METHODS

To find out the level of walkability by conducting surveys, questionnaires and using the available indicators [16]. Based on the level of pedestrian comfort in commercial corridors, it is necessary to develop indicators based on the parameters stated in Table 1. Table 2 shows the indicators used in this study.

**TABLE 2
VARIABLES AND INDICATORS**

Variables	Indicators
Accessibility	Easy movement between buildings
	Easy to reach bus stops
	Availability of signage
	There are no obstacles from street vendors when walking
	Absence of illegal motorbike parking
Safety	Safe from physical disturbance of perforated/ slippery pedestrian paths
	Safe from disturbing movement of motorbikes entering the pedestrian path
	Feel safe with the crossing facilities
	Safe from interference criminal acts

Variables	Indicators
Amenity	Availability of shade plants
	Seat availability
	Availability of lighting
	Bus stop availability

The research method used was a questionnaire survey and field observation. Respondents were pedestrians in corridor of Sudirman, Dr. Satrio and Casablanca streets in Jakarta, Indonesia. The questionnaire used a Likert scale. The research was conducted from June 21 to July 21, 2019. The sampling technique used was random sampling. The number of samples was 96 which determined by using the Lemeshow formula. To validate the collected data used bivariate correlation statistical tests and reliability analysis. From the test results it can be seen all the data collected were valid. Data analysis techniques used descriptive statistics to describe the level of walkability in commercial corridors. The level of walkability were determined by the number of interval classes, the range of data, and the length of the interval class [18].

3 RESULTS AND DISCUSSION

3.1. Characteristics of Pedestrians in Commercial Corridors

Characteristic the majority of travel destinations are for working and walking around. Land use types in Sudirman corridors are generally offices; in Dr. Satrio corridor are services and trade; while in the Casablanca corridor is service activities but its biggest attraction is the Casablanca shopping center which is a source of traffic jams on this road section. See the land use map in Fig 1, Fig 2, and Fig 3.

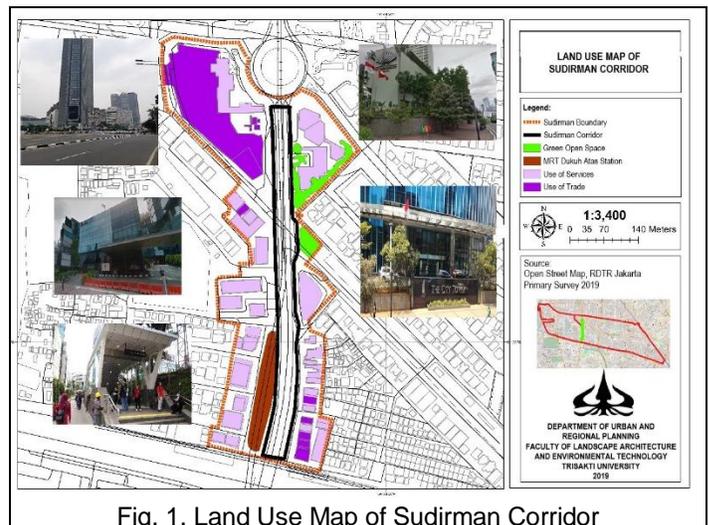


Fig. 1. Land Use Map of Sudirman Corridor

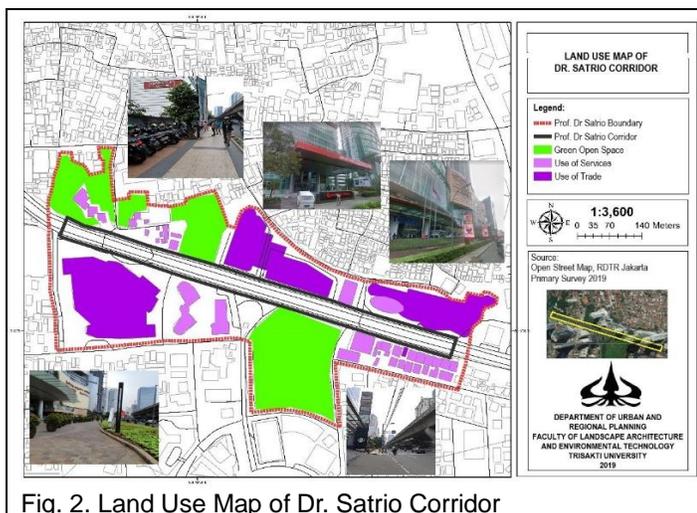


Fig. 2. Land Use Map of Dr. Satrio Corridor



Fig. 3. Land Use Map of Casablanca Corridor

3.2 Pedestrian Facilities in Commercial Corridor

Based on [15] concerning the provision of pedestrian infrastructure and facilities detailing pedestrian facilities as follows:

- 1) 150 cm wide green strip with shade plants
- 2) The distance between the lights is 4 meters, the maximum height is 4 with metal material and concrete with high durability.
- 3) The distance between seats is 10 meters with a width of 0.4-0.5 and a length of 1.5 with weather and damage resistant materials, such as metal and concrete.
- 4) The distance between bins is 20 meters with high durability materials such as metal and precast concrete.
- 5) Signage is available as needed, is at the point of social interaction on the dense pedestrian path.
- 6) Distance between stops 300 meters at a potential point in the area.

Each commercial corridor studied was 700 meters along in the Sudirman street, 800 in the Dr. Satrio, and 600 in the Casablanca street. Comparisons among the three corridors from the aspect of amenities, particularly the conditions of pedestrian facilities are shown in Table 3.

TABLE 3
THE COMPARISON OF THE FACILITIES OF PEDESTRIANS
BASED ON THE PUBLIC WORKS REGULATION NO.
03/PRT/M/2014

Facilities	Corridors		
	Sudirman	Dr. Satrio	Casablanca
Green line	suitable	suitable	suitable
Lighting	suitable	suitable	suitable
Seat	exist	not exist	not exist
Safety fence	not exist	not exist	not exist
Garbage bins	2 pieces available	12 pieces available	5 pieces available
Signage	suitable	suitable	suitable
Bus stops/ shelters & booths waiting	1 busway stop	there is a bus stop sign	1 bus stop, not good condition

The availability of pedestrian facilities in the three corridors can be described as follows:

- 1) Need a green line which also functions as a guardrail between the pedestrian lane and the vehicle lane to avoid interference with pedestrians.
- 2) The lighting in the three corridors is up to standard.
- 3) The need for seats in each corridor: Sudirman 63 units, Dr. Satrio 80, and Casablanca 60 units.
- 4) Safety fence which is in accordance with the standard is made only at certain points that need protection. Safety fences were not found in the three corridors. In Sudirman, a fence separates pedestrians from queues of people waiting for buses so as not to disturb the flow of pedestrians. While on the corridors of Dr. Satrio and Casablanca, a safety fence is needed to prevent motorized vehicles from entering the pedestrian lane.
- 5) Needs of 33 units garbage bins in the Sudirman corridor, in Dr. Satrio 28, and Casablanca corridor 25 units.
- 6) In three corridors, signage needs to function as a signpost and information boards on public transport routes located at each stop.
- 7) In the Sudirman corridor needs 1 stop waiting with the canopy. In the two corridors of Dr. Satrio and Casablanca need 2 canopy stops.

3.3 The Level of Walkability in Commercial Corridors

The level of walkability of pedestrian ways in the aspect of user comfort was measured through three variables: safety, amenity, and accessibility. In the safety variable, the condition of a good sidewalk follows the design principles that can prevent accidents and/or crime. Indicators on the amenities include the availability of facilities such as the presence of public benches, resting places, etc., which gives comfort to pedestrians. While the indicators on the accessibility variable is a measure of the ease of pedestrians to reach the destination, including the width of the lane, the availability of road signs and public transportation stops [11].

TABLE 4
ANALYSIS OF SAFETY INDICATORS OF COMMERCIAL CORRIDOR

Commercial Corridor	Safety (%)		
	Low	Medium	High
Sudirman	10.4	54.2	35.4
Dr Satrio	18.8	75	6.3
Casablanca	32.5	51.2	16.3

TABLE 5
ANALYSIS OF AMENITY INDICATORS OF COMMERCIAL CORRIDOR

Commercial Corridor	Amenities (%)		
	Low	Medium	High
Sudirman	14.6	45.8	39.6
Dr Satrio	25	66.7	8.3
Casablanca	32.6	60.5	7

TABLE 6
ANALYSIS OF ACCESSIBILITY INDICATORS OF COMMERCIAL CORRIDOR

Commercial Corridor	Accessibility (%)		
	Low	Medium	High
Sudirman	6.3	43.8	50
Dr Satrio	16.7	77.1	6.3
Casablanca	32.6	67.4	-

The level of walkability in the commercial corridors is divided into three categories: low, medium and high. The sidewalk of Sudirman corridor has a high level of walkability category. The value of its accessibility indicator is higher than two other corridors, while the value of the amenity and safety indicators is at the same level as the other two corridors. See the Tabel 7. The condition of Sudirman corridor is integrated with public transportation modes such as the electric train, MRT and busway and there is no disruption to space utilization by street vendors and motorized parking. The sidewalks in corridors of Dr. Satrio and Casablanca have a moderate level of walkability, due to their moderate accessibility. There are disturbances of street vendors, parking and many motorized vehicles using pedestrian paths making pedestrians less comfortable, and lacking integration with public transportation in these two corridors.

TABLE 7
LEVEL OF WALKABILITY IN COMMERCIAL CORRIDORS

Commercial Corridor	Level of walkability			
	Safety	Amenity	Accessibility	Total
Sudirman	medium	medium	high	high
Dr Satrio	medium	medium	medium	medium
Casablanca	medium	medium	medium	medium

Based on [8], [15], [11], [16], [17], the following discussion of each variable measuring a walkability level of the sidewalks in the commercial corridors are as follows:

1. Safety

The problem with indicators of safety are: the existence of slippery pavement in Dr. Satrio's sidewalks, the presence of motorized vehicles entering the pedestrian lane and the low security of pedestrians when crossing in the two corridor of Dr. Satrio and Casablanca. Improvement of physical condition of pavement paths in the form of paving blocks is to avoid pedestrian accidents. Safety fences can be provided to prevent motorized vehicles from entering the pedestrian path. Provision of CCTV facilities in every pedestrian pathway can function to improve pedestrian safety. This relates to the control of motorists' behavior and law enforcement. CCTV recordings of motorists violating regulations make it easier for local governments to follow up on these violations to provide a deterrent effect. Provision of speed control facilities serves to force motorists to decrease speed when approaching the crossing facility. If these things can be applied by the DKI Jakarta government, then one of the variables of walkability has been achieved so as to realize sustainable transportation to reach a sustainable city. The safer the sidewalks, the more pedestrian will walk [10].

2. Amenity

The condition of indicators of amenities or public facilities on pedestrian paths is still lacking. There is an imbalance in the width of the sidewalk between the sidewalk in front of the mall and in front of the office. Attention to the hierarchy of pedestrian networks serves to maximize land use in the commercial corridors in the commercial areas. Consideration of the width of the sidewalks and the availability of supporting facilities can increase land use in the concerned corridor. The reason is the condition of pedestrian paths equipped with various amenities will be an attraction in itself. For the commercial land use such as malls, it is better if crossing facilities such as zebra-cross or crossing bridges are provided. For pedestrians who have a shopping destination, zebra-cross is more comfortable for them. By bringing shopping goods they are more facilitated with zebra-cross crossing facilities than crossing bridges. To increase the amenity, the available shelter needs to be equipped with a seat, shade plants, as well as a type of pavement and canopy shelter that is heat resistant to provide comfort for pedestrians. Likewise, the bus stop facility needs to be equipped with a canopy in addition to being a place of waiting as well as a shelter from hot weather. To be comfortable it is necessary to provide a seat with a type of material that does not conduct heat and is waterproof so it is durable.

3. Accessibility

The accessibility conditions are felt to be lacking, especially in accessing public transportation modes. Under these conditions, it is necessary to integrate with public transportation to facilitate pedestrians in accessing this location. In integrating inter modes of transportation, bus stops need to be equipped with signs containing information on public transport routes that pass through this corridor. Another accessibility issue is the disruption of pedestrian path space utilization by street vendors and motorized vehicle parking. In this case it is necessary to provide business space for street vendors in commercial areas so as not to reduce the capacity of the pedestrian path.

3.4 Efforts to Increase the Level of Walkability in Commercial Corridors

There are various efforts that can be made to increase the level of walkability of commercial corridors. Some of these efforts are:

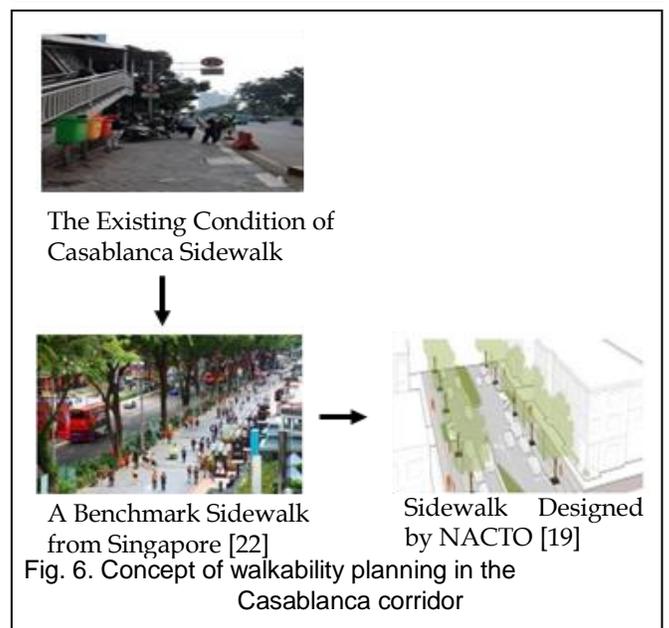
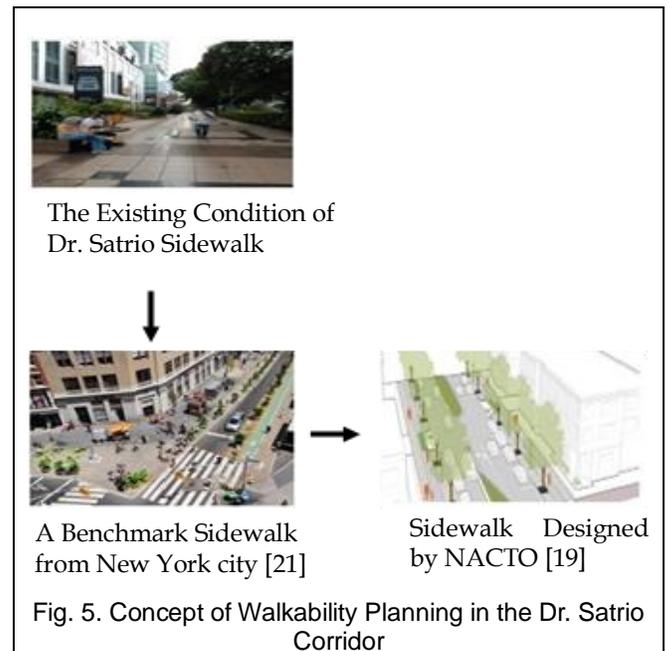
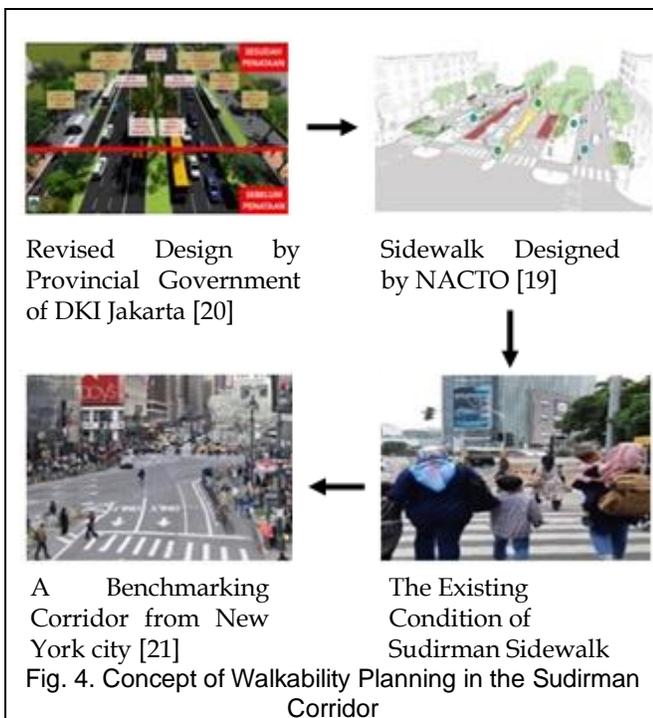
1. Provision of regulations on sidewalk such as detailed pedestrian mall arrangements, pedestrian path control standards, providing sanctions for motorists and street vendors using illegally pedestrian space, technical instructions on path design and pedestrian facilities, guidelines for walkability assessment as an integral part of transportation planning, guidelines for assessing the need for providing pedestrian paths due to physical construction of socio-economic-cultural facilities, guidelines for measuring walkability levels. Procurement of transportation projects that integrate with pedestrian pathways with adequate quality of supporting facilities in accordance with city weather conditions and pedestrian behavior for various purposes of movements.
2. Promulgation of the roles, functions and benefits of pedestrian pathways in building urban sustainability and building and supporting initiatives to increase the interest of parties to actively support the development of comfortable pedestrian paths.
3. Design input for improving the level of walkability. By comparing between existing conditions and the benchmark of study sites having the same characteristics and design models. See the Fig 4, Fig 5, and Fig 6. Design examples take from NACTO [19]. The sidewalks of two corridors of Dr. Satrio and Casablanca have the same design example because the biggest attraction is trade, so the road activities are not as busy as the Sudirman corridor. In Sudirman, pedestrian are denser, especially workers compared to the other two corridors. This corridor is also following the pedestrian way design plan composed by the Jakarta provincial government.

4 CONCLUSION

The level of walkability for the convenience of pedestrian in commercial corridors can be seen based on indicators of safety, security and accessibility. The accessibility becomes a differentiator of the level of walkability in the commercial corridors. The level of walkability in Sudirman corridor is high, its accessibility has the highest value. While the walkability level of the other two corridors is moderate.

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REFERENCES

- [1] M. Southworth, "Designing the Walkability City", *Journal of Urban Planning and Development*, Berkeley, 2005, DOI: 10.1061.
- [2] F. Moura, P. Cambra, and A.B. Gonçalves, "Measuring Walkability for Distinct Pedestrian Groups with a Participatory Assessment Method: A Case Study in Lisbon" *Landscape and Urban Planning*, pp. 282-296. Portugal, 2016.
- [3] F. Moura, P. Cambra, and A.B. Gonçalves, "IAAP-Pedestrian Accessibility and Attractiveness Assessment Tool When Planning for Walkability." *Joint Conference CITTA 7th Annual Conference COST TU1002 Final Conference Bridging The Implementation Gap Of Accessibility Instruments And Planning Support Systems*, Portugal, 2015.
- [4] X. Tong, Y. Wang, and E.H.W. Chan "International Research Trends and Methods for Walkability and Their Enlightenment in China," *Procedia Environmental Science*, pp. 130-137. 2016
- [5] Dörrzapf L, Kovács-Györi A., Resch B. & Zeile P, "Defining and Assessing Walkability: A Concept for an Integrated Approach Using Surveys, Biosensors and Geospatial Analysis, *Urban Development Issues*, vol. 62, pp. 5–15. Austria, 2019.
- [6] P. Minhas and A. Poddar, "Walkability Index by Global Walkability Index Method," *International Research Journal of Engineering and Technology (IRJET)*, vol 04, issue: 07, p- ISSN: 2395-0072 e-ISSN: 2395-0056. India, July 2017.
- [7] S.S. Wibowo, N. Tanan, and N. Tinumbia, "Walkability Measure for City Area In Indonesia (Case Study of Bandung)." *Journal of The Eastern Asia Society for Transportation Studies*, vol. 11, Bandung, 2015.
- [8] CAI Asia Center. Asian Development Bank, Fredkropset, and the Shakti Foundation, *Walkability Surveys In Asian Cities: Issues and Challenges*, Philippines, 2014.
- [9] Turon K., Czech, P., and Juzek, M., "The Concept of Walkability of A Walkability City As an Alternatif Form of Urban Mobility," *Scientific Journal of Silesian University of Technology, Series Transport*, vol. 95, pp. 223-230. ISSN:0209-3324. Polandia, 2017. DOI: <https://doi.org/10.20858/sjsuts.2017.95.20>.
- [10] R. Tiwari, "Designing a Safe Walkable City," *URBAN DESIGN International*, pp. 1-16, DOI: 10.1057. Australia, 2014, doi:10.1057/udi.2013.33. available at <https://www.researchgate.net/publication/264534543>. January, 2014.
- [11] Government of Western Australia, *Walk WA: A Walking Strategy for Western Australia 2007-2020*, Australia, 2007.
- [12] A. Frackelton, A. Grossman, E. Palinginis, F. Castrillon, & V. Elango, "Measuring Walkability: Development of Automated Sidewalk Quality Assessment Tool," *Suturban Sustainability*, vol 1:Iss.1, Article 4, Florida, DOI: <http://dx.doi.org/10.5038/2164-0866.1.1.4>. Available at <http://scholarcommons.usf.edu/subsust/vol1/iss1/4>, 2013.
- [13] M.D. Setyowati, "Utilization of Pedestrian Ways in Commercial Corridors in Jalan Pemuda Magelang City," *RUAS Journal*, vol. 15, no. 1, ISSN 1693-3702. Yogyakarta, 2017.
- [14] Project for public spaces "Broad way boulevard: Transforming Manhattan's most famous street", available at <https://www.pps.org/article/broadway-boulevard-transforming-manhattans-most-famous-street-to-improve-mobility-increase-safety-and-enhance-economic-vitality>, July, 2019
- [15] Regulation of the Minister of Public Works Number 03/PRT/M/2014 Guidelines for Providing Utilization of Pedestrian Infrastructure and Facilities in Urban Areas, Jakarta, March 11, 2014.
- [16] T.A. Arslan and S. Durak, "Assessment of factors influencing walkability in shopping streets of tourism cities: Case of Bursa, Turkey", *International Journal of Tourism Cities*. vol 4, no. 3, ISSN 2056-5607. Turkey, 2018.
- [17] I. W. Agustin, "Application of the Concept of Walkability in Malang City Square", *Journal of Urban Development* vol. 5, no. 1, pp. 45-57, 2017.
- [18] Sugiyono, *Quantitative, Qualitative and R&D Research Methods*, 26th edition, Alfabeta, Bandung, 2017.
- [19] National Association of City Transportation Officials "Urban Street Design Guide" available at <https://nacto.org/publication/urban-street-design-guide/>, July 2019.
- [20] A.A.M, "The New Face of Sudirman-Thamrin Sidewalk is More Comfortable, More Humane", *Sindo Newspaper*, available at <https://metro.sindonews.com/read/1288677/171/wajah-baru-trotoar-sudirman-thamrin-lebih-nyaman-lebih-manusiawi-1520736949>, March 2018.
- [21] Project for public spaces "Broad way boulevard: Transforming Manhattan's most famous street", available at <https://www.pps.org/article/broadway-boulevard-transforming-manhattans-most-famous-street-to-improve-mobility-increase-safety-and-enhance-economic-vitality>, July, 2019
- [22] J. Sen, "Blueprint to add buzz to orchard road over next 20 years", *Jakarta Post*, available at <https://www.thejakartapost.com/travel/2017/12/15/blueprint-to-add-buzz-to-orchard-over-next-20-years.html>, July, 2019.