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Literature Study of the Sustainability Model of Transportation Facilities and Infrastructure in the Management of Public Transportation with the Concept of Inter-Regional Cooperation

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ABSTRACT

Traffic in the city of Bogor is relatively high. With this level of density, the city of Bogor is classified as the second most congested city after DKI Jakarta. Achieving the process of transporting passengers and goods as optimally as possible in a certain space and time taking into account several factors such as safety, comfort, smoothness, time efficiency and costs according to these needs. The balance and needs of transportation facilities and infrastructure in achieving its goals is the real movement of each user. The main objective of this study is to formulate a model for the sustainability of transportation facilities and infrastructure in the management of public transport with the concept of inter-regional cooperation. The originality/novelty in the research is a) the handling of the model of sustainability of transportation facilities and public transport transportation infrastructure in the two regions of Bogor regency and Bogor city, b) the sustainability of the public transport management model with the concept of inter-regional cooperation, namely Bogor regency and Bogor city in reducing congestion between the two buffer city. The methods used are survey methods, interviews and studies of expert opinions. This concept is called MODEL SUSTAIN-SARPRASKOKABO_2023. By referring to this initial concept, it is hoped that a balanced and sustainable traffic pattern in Indonesia will soon be realized.

Keywords: means of transportation; transportation infrastructure; continuity; cooperation; model SUSTAIN-SARPRASKOKABO_2023.

INTRODUCTION

The history of the founding of the city of Bogor can be identified with the city of Rain. Bogor has a higher annual rainfall compared to other cities in the Indonesian region. The average rainfall is high, ranging from 4,000 to 4,500 mm/year. Along with the nickname of the city of Rain, the city of Bogor is a city with quite a lot of urban public transportation, so it is nicknamed the city of a thousand public transportation. The city of Bogor has an area of 11,850 ha, is located at 106º 48' East Longitude and 6º 36' South Latitude, ± 56km south of the capital city of Jakarta and ± 130km west of the city of Bandung. The city area of Bogor is bordered by, to the north: Kemang sub-district, Bojonggede sub-district, and Sukaraja sub-district, Bogor district. Eastern part of Bogor city: Sukaraja sub-district and Ciawi sub-district, Bogor district. While the western part: Dramaga sub-district and Ciomas sub-district, Bogor district. Southern part: Cijeruk sub-district and Caringin sub-district, Bogor district. Bogor City has an administrative area consisting of 6 sub-districts, 68 sub-districts, 750 RWs and 3,349 RTs. The average air temperature every month is 26oC. Bogor City is at an altitude of 190–330m asl, slopes ranging from 0-2% to > 40%, with an area according to the slope of 0-2% (flat) covering an area of 1,763.94 ha, 2-15% (sloping) covering an area of 8,091 .27 ha, 15-25% (rather steep) covering 1,109.89 ha, 25-40% (steep) covering 764.96 ha, and > 40% (very steep) covering 119.94 ha (Bogor City in Figures, 2011). The population of the city of Bogor is 1.097 million in statistical data collection (BPS city of Bogor, 2018).

Bogor Regency has an area of 2,663.81 km2 and is located at 106° 01' and 107° 103' East Longitude and 6° 47' South Latitude and 6° 19' North Latitude. This area has various morphological levels with an altitude of 15-100m asl by 29.28%, 42.62% at an altitude of 100-550m asl while 19.53% is in the range of 500-100m asl and 8.43% is at 1000-2000m asl. The mountainous part is > 2000m asl, which is 0.22%. Road infrastructure in the Bogor district is 69.5% good, 7.5% is heavily damaged, while 15.5% is moderately damaged and 7.5% is slightly damaged (Bogor district in figures, 2018). Bogor Regency has a population of 6.088 million people (BPS Bogor district, 2020).

Transportation in improving transportation facilities is a type of activity that is very important for social life in Indonesia. The journey of people in improving transportation infrastructure facilities is seen from transportation services in supporting their activities. The role of road traffic and transportation is very important so that it must get optimal priority and service from the government and transportation service providers. The majority of Indonesian people still depend on public transportation to facilitate their mobility due to several factors. Communities who move with different goals need means of supporting movement in the form of private transportation (cars, motorcycles) and public transportation (Paratransit, Masstransit). The handling of transportation problems is faced with very complicated and unresolved problems. The connection between transportation facilities and infrastructure is indeed closely related to social problems, human awareness, and the willingness of all parties to help minimize the damage that has been caused. The increasing costs of traffic jams, air pollution, environmental noise and others, it is necessary to take steps to guide, control and supervise.

High economic growth in urban areas generates urban flows from villages to cities. High human movement results in wasted fuel, wasted time, air pollution and noise pollution, high levels of stress and a decrease in the health of the population.

Vehicular traffic begins with regular lanes and public transport with very regular route permits. This regularity will result in orderly traffic. Good and correct driving is followed by obeying traffic signs in a proven manner. Drivers are expected to comply (Munawar, 2011; Gudmundsson and Regmi, 2017; Shafabakhsh and Motamedi, 2016). The relationship between speed, volume and density is the relationship between speed (v), volume (q) and density (k) called the basic diagram of road activity levels. This relationship in the form of a curve empirically can be described. The increase in vehicle speed is affected because the traffic volume on the road is low, if the traffic volume is high, the vehicle speed is vice versa, which is low (Sadeghi and Askarinejad, 2007; Mwebesa et al., 2018; Jung et al., 2013).

Traffic in the city of Bogor is relatively high. With this level of density, the city of Bogor is classified as the second most congested city after DKI Jakarta (Bogor City Government, 2012; Ministry of Transportation of the Republic of Indonesia, 2015). Based on these criteria, the authors provide a real picture in the field of the current condition of Bogor. The description of Bogor city traffic can be used as material for consideration in making policies regarding transportation.

Transportation modeling in the concept of movement generation is connecting one characteristic with another. Such as socio-economic characteristics with movement behavior from one zone to another. So that the movement patterns with the various characteristics above are based on movement patterns in the city transportation system (Ahferon and Svensson, 2009; Banerjee et al., 2012; Baum-Snow et al., 2014; Cristobal et al., 2017). This pattern is described in the form of movement flows, namely motorized vehicles, passenger transportation and goods transportation. This movement starts from a zone to a destination zone at a certain time. Efforts to organize transportation with the concept of equality between all levels of society. Movement in the transportation system is the physical movement of people and goods with or without means of transportation (Pfaffenbichler and Shepherd, 2002; Sun et al., 2017; Roshandeh et al., 2016). The transportation system is a form of interrelatedness between actors within its scope, such as users, goods, infrastructure and facilities, both natural and planned. This system means coordinating movement with components that use media in measurable transportation processes (Li et al., 2017; Mampearcachchi, and Masakorala, 2018; Rymarz et al., 2015; Stogios, 2018).

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Achieving the process of transporting passengers and goods as optimally as possible in a certain space and time taking into account several factors such as safety, comfort, smoothness, time efficiency and costs according to these needs. The balance and needs of transportation facilities and infrastructure in achieving its goals is the real movement of each user. The process that covers the movement of users, namely with different characteristics, especially in the purpose of traveling, transportation costs and time used. The transportation system uses the main components, namely spatial configuration, transportation technology and institutional systems (Atallah et al., 2018; Buehler, 2018; Fellner et al., 2018; Jittrapirom et al., 2018).

Characteristics of the movement of people and goods (travel flows) is a concept with the characteristics of the movement of people and goods with infrastructure and means of transportation. The implementation of a transportation system with these characteristics is supported by four interrelated concepts and will lead to an integrated system. The four concepts are multimodal, multidimensional, multistakeholder and multiagency (Sloop et al., 2013; Swierstra et al., 2017; Wasike, 2001; Wright, 2015).

The pattern of organizing the transportation system in the development of all interrelated sectors. The role of transportation is very important with the linkages between the economic sector, transportation and needs in the development of regional development (Wismans et al., 2019; Hatefi, 2018). This has an effect on the potential of supporting sub-sectors in carrying out their functions as drivers of development and serving economic activities directly. An overview of economic activities in supporting transportation and production processes in carrying out these activity processes. Activities in transportation that are a concrete manifestation of the role of traffic are 2 activities, namely land use from one region to another administrative area (Coyle and Rosewell, 2014; Esmaelzadeh and Nakhaie-Jazar, 1997; Goodbody Economic Consultants, 2017). Areas that touch in the transportation system are two or more administrative areas that support and influence each other. This influence is utilized in managing transportation simultaneously and influences the role of each region. Inter-regional cooperation in managing transportation facilities and infrastructure is needed. Likewise the infrastructure network and service network for each transportation with all the routes that cover it. The influence of demand from one region will have an impact on demand in other areas that are interrelated (Rosni et al., 2018; Yatskiv et al., 2012).

The pattern of utilization of potential areas within the scope of influence on the development of transportation in certain areas has an impact and changes. Changes in positive and negative levels will be the pattern of transportation trips from adjacent environments. A real approach in utilizing space can be done using the concept that some areas contribute to the progress of their transportation. This assumption is realized by regional cooperation with each other with a clear pattern. Followed by rules that provide free movement of transportation development in accordance with agreed regulations (Cristobal et al., 2017a; Jacobs et al., 2018).

A sustainable form of cooperation between regions will get better results than providing policies in one or more policies within the framework of one region. Utilization of this collaboration that has not been touched on regional level arrangements in overcoming transportation problems in the Bogor area. Researchers try to provide the best solution that can be applied in structuring this area. The arrangement of the area in question is the arrangement of transportation infrastructure and facilities, the arrangement of public routes and transportation as well as the transportation of goods (Eboli et al., 2017b; Harun et al., 2017).

The indicators of poor traffic services can be seen from the low travel speed, the average length of the queue, the length of travel time and the high traffic barriers along the roads in the Bogor City area. If these conditions are not anticipated in advance, then it is feared that sooner or later the city of Bogor will become an unattractive city and be avoided by road users and there will be a burden on the people of Bogor city who are spent on travel needs.

Transportation problems in the city of Bogor and Bogor district are very complex and varied. This diversity is supported by the increasingly uncontrolled growth in the number of motorized vehicles. Because the control is getting out of control and there are social factors that follow, including the ease of getting motorized vehicles, both cash and credit, types of motorcycles or cars. In the problem

of transportation, it can answer various conditions both infrastructure, facilities and service systems that provide population mobility services, expedite the movement of goods and open access to all areas. Aside from being transportation accessibility, in principle the most important function in transportation matters is as a driving force for development (the promoting function) and serving real activities, especially the running economy (the servicing function) (Ruske et al., 2018; Tolujevs et al., 2018; Widodo, 2014).

Several studies state that transportation problems revolve around the number of vehicles, congestion caused, roads that are less supportive and comfort in driving (Tini et al., 2018; Zhao et al., 2018). Observing the facts and phenomena above, the author seeks to compile studies and model the problems that exist around transportation with the concept of regionalism as a solution.

Transportation in Indonesia is very diverse, this diversity of transportation is very unique when viewed from its type. Most land transportation is dominated by two-wheeled motorized vehicles. This motorbike is the most complete form of transportation and is widely found, both in urban areas including big cities and in rural or suburban areas (Ganda CF et.al, 2019; Kariman N, Akbardin J, 2019; Syaiful S et.al, 2022; Syaiful S et.al, 2022). This is because land transportation ownership is very easy to get. With credit or cash purchases, you can own a motorbike. Especially credit with a down payment of 500,000 IDR, you can already own a motorbike. However, it should also be considered that the impact of this easy ownership makes densely populated areas narrow and noisy with the sound of motorbikes. Because every house has a narrow alley even though it has a motorbike. This will make cities with dense populations will be burdened with the existence of this motorbike (Syaiful S, Rusfana H, 2022; Syaiful S, Pratama Y, 2019; Syaiful S, Hariyadi D, 2019).

Apart from that, it is also necessary to have government policy in regulating regulations on the existence of motorcycles, as well as private cars not to have more than one vehicle, namely one car and one motorbike for 1 family. This will reduce the impact of congestion, especially on densely populated highways and main roads where congestion is a common sight every day. The population density in big cities makes it possible to increase transportation activities in the city. Anticipation has been carried out by outreach to residents to take public transportation, mass rapid transit, intermodal transportation, feeder transportation and other public transportation. This activity is carried out to avoid traffic jams, air pollution and noise pollution, the city becomes beautiful, green and environmentally friendly Syaiful S et.al, 2020; Syaiful S Fadly A, 2020; Syaiful S et.al, 2021; Syaiful S et.al, 2023).

Based on some of the problems that arise, the author seeks to find problem points and solutions that can be proposed regarding the policies taken by the government in the study area later. From the description of the background, the identification of the problem above, the author seeks to provide a recommendation regarding the model of sustainability of transportation facilities and infrastructure in the management of public transportation with the concept of inter-regional cooperation. The formulation of the problem that the author suggests is as follows:

a. How is the condition of the transportation infrastructure in supporting the concept of adequate traffic?
b. How big is the influence of the performance of public transport in serving passengers as a concept of good traffic?
c. What is the strategic model for decision making regarding public transportation facilities in the study area?
d. What is the model of sustainable management of public transport with inter-district and city cooperation patterns?

The purpose of this study is to obtain a model for the sustainability of public transportation facilities and infrastructure that is well managed, so that the model for applying this concept in other regions and in other countries is in accordance with good public transport services.

The main objective of this study is to formulate a model for the sustainability of transportation facilities and infrastructure in the management of public transport with the concept of inter-regional cooperation. The research has 4 (four) derivative objectives, namely:

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a. Evaluating the concept of existing transportation facilities in the study area,
b. Formulate the facilities of public transportation operating in the study area,
c. Modeling decision making on the sustainability of public transportation facilities in the study area,
d. Obtain a strategic model for decision-making regarding public transportation facilities with the concept of cooperation between districts and cities.

The model of sustainability of transportation facilities and infrastructure in the management of public transport with the concept of inter-regional cooperation is good and is widely carried out by experts and academics in Indonesia. Sustainable arrangements and management in terms of various aspects with a review of the cooperation model have never been carried out.
Originality/novelty in research is showing:

a. Handling the model of sustainability of transportation facilities and public transport transportation infrastructure in the two areas of Bogor district and Bogor city,
b. Sustainability of the public transport management model with the concept of inter-regional cooperation, namely Bogor district and Bogor city in reducing congestion between the two buffer cities.

Theory about traffic

Traffic is a system consisting of components. The first main component or a head way system (time between two successive vehicles when passing a point on a road) includes all types of infrastructure and facilities of all types of existing transportation, namely: road networks, road complements, road facilities, transportation public and private, and other types of vehicles that carry out the transportation process, namely moving people or materials from one place to another which is limited to a certain distance. Traffic in the 2009 Law defines the movement of vehicles and people in the road traffic space. Road traffic space is an infrastructure intended for the movement of vehicles, people and/or goods in the form of roads and passenger facilities.

Theory about the transportation system

The transportation system is an attachment and link between humans, vehicles, goods, infrastructure and facilities in the context of moving people or goods, both naturally and artificially/engineered. While the transportation system is an integral part of the functions and activities of society, where there is a very close relationship with the range and location of production activities and the fulfillment of goods and services available for consumption (Law, 2009). Furthermore, it is also explained about the five main elements of transportation, namely: 1) humans who need transportation, 2) goods needed by humans, 3). vehicles as means of transportation, 4) roads as transportation infrastructure and 5) Organizations as transportation managers.

Theory about public transport stops

The definition of public transportation stopping facilities is a location where passengers can get on and off public transportation, and also locations where public transportation can stop to pick up and drop off passengers. The operational policy of public transport stops usually depends on two main factors, namely: a) Level of Travel Demand. The point is the level of travel demand, namely the number of passenger movements that need to be anticipated by public transport operators on their route trajectories, b) walking distances that are still acceptable. This means that the walking distance is still acceptable, namely the distance that is still considered comfortable from the place of residence of the prospective passenger to the nearest stop (Decision of the Director General of Land Transportation, 1996)

Road capacity

Road capacity is the maximum flow of vehicles through the road, under certain conditions. This depends on the number and width of traffic lanes and the amount of disturbance to traffic flow. Ideal capacity conditions are determined, among others: 1) smooth, undisturbed traffic flow, free from disturbances by vehicles and pedestrians, 2) only passenger cars are available, 3) standard width of traffic lanes is 3.65 meters, 4) there is no barrier to overtaking visibility. Road capacity is the

maximum number of vehicles that can be accommodated by a road segment at a certain time period based on the geometric, pattern and composition of traffic flow/volume and factors around the road. The amount of the conversion value for converting vehicle data into passenger car units (pcu) is as stipulated in the Indonesian Highway Capacity Manual (IHCM). Passenger car unit conversion values (pcu) for roads and intersections are as shown in table 1 below.

Table 1. SMP conversion values for vehicle types

Transportation type	Conversion Value (pmp)
Light vehicle	1,00
Heavy vehicle	1,20
Motorcycle	0,25
Non-motorized vehicles	0,80

Source: IHCM, 1997

Calculation of road capacity

Based on the Indonesian Highway Capacity Manual (IHCM), the road capacity for inner-city roads is formulated as follows:

$$C = Co \times Fw \times Fks \times Fsp \times Fsf \times Fcs$$

Which:
Co : base capacity
Fw : width of the road benefit
Fks : road shoulder
Fsp : median
Fsf : friction factor
Fcs : total population of the city

Road service level

Road sections can be assessed by knowing the level of service that exists in the IHCM guidelines and is based on the range of V/C ratio values for road segments.

Theories about transportation sustainability

Characteristics of the movement of people and goods (travel flows) is a concept with the characteristics of the movement of people and goods with infrastructure and means of transportation. The implementation of a transportation system with these characteristics is supported by four interrelated concepts and will lead to an integrated system. The four concepts are multimodal, multidimensional, multistakeholder and multiagency.

Similar previous research

Previous research that is similar to the concept of public transport management can be described in this section with reinforcement for each concept.

a. Journal of Land Transportation Research, Vol. 21, No. 1, 2019, Pgs 1-12. Evaluation of the sustainability of public transportation accessibility in the city of Sukabumi, I Made Arka Hermawan, Santun R.P Sitorus, Machfud, IF. Poernomosidhi, Umar Mansyur. Transportation College of the Ministry of Transportation of the Republic of Indonesia. The concept in this study is a key factor in the economic dimension. The key to sustainability is not discussed in detail so that it is not maximized because the calculation model is not measured precisely by involving 4 dimensions. In the right study there must be 5 or more dimensions to achieve all aspects of the sustainability of public transport in a good and structured manner. The gap analysis in this research needs to consider dimensions to support the strength of research studies, especially public transport in urban areas.

b. Journal of Land Transportation Research, Vol. 21, No. 1, 2019, Pgs 75-90. Analysis of the sustainability of road-based passenger public transport (a case study in the city of Bogor). Author

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Moh. Nurul Iman, Polite R.P Sitorus, Machfud, IF. Poernomosidhi, Widiatmaka. Study Program of Natural Resources and Environmental Management at the Bogor Agricultural University Postgraduate School. The concept of the level of sustainability of public transport is studied using 4 dimensions, namely, economic, social, environmental and service performance. In researching the sustainability of public transport, at least 5 dimensions or more must be determined so that the sustainability of public transport is more focused. The gap analysis obtained from this study is used as a consideration for continuing the research pattern with a targeted and measurable model.

c. Journal of Land Transportation Research, Vol. 23, No. 2, 2021, Pgs 122-134. Evaluation of public transportation in Surakarta through Fuzzy Quality function Deployment. Writers Septin Puji Astuti, Taufik Ismail Alhakim, Eko Setiawan. IAIN Surakarta Islamic Business Management Study Program, Industrial Engineering Study Program, Muhammadiyah University of Surakarta. The performance studied was only 1 route with Batik Solo Trans (BST) corridor 1 for Adisumarmo Boyolali Airport-Palur Karanganyar Terminal. Methods with FGDs, interviews, questionnaires, then with the application of Fuzzy-QFD in improving public transportation services, especially BST. The reliability of QFD is still very doubtful considering the suggestions of previous authors (Schockert et al, 2013) because the respondents are diverse, so the level of accuracy is lacking. The results discuss driver skills, service quality, and level of safety. Another thing is the minimal facilities for persons with disabilities. The gap analysis obtained from this study is used as a consideration for continuing the research pattern with a targeted and measurable model.

d. Indonesian Journal of Public Policy and Management Review, Vo. 1 No. 1, 2012, Pgs 1-10. Management Strategy for Highway Public Transport in Semarang City. Writers Agatha Debby, Herbasuki Nurcahyo, Mariyam Musawa, Department of Public Administration, Faculty of Social and Political Sciences, Diponegoro University, Semarang. The study in this study uses the power of SWOT analysis in determining public transport handling policies. One strategy in managing public transport is not enough. The results of the study are 1) monitoring public transport when carrying out KIR tests, 2) evaluating routes once a year, 3) optimizing public transport in improving its services to passengers. The gap analysis from this study is the lack of control in terms of stabilizing and strengthening the management of public transport in accordance with a clear concept so that both policy makers, operators and users as parties benefit as a win-win solution.

e. Dissertation of the Postgraduate School of the Bogor Agricultural Institute, 2008, Management Model of sustainable non-bus passenger public transport for the city of Makassar, Umar Mansyur. The study in this research is to improve the performance of non-bus passenger public transport route patterns which are influenced by high population movements due to the influence of the socio-economic level of the community, land use, level of transportation service, transportation comfort, load factors and road conditions, and the integration of non-public transport management models. -the bus model of assistance for the development of geographic information system areas, namely with social, environmental, institutional and economic aspects. This concept has actually answered with a public transport management model, but not all aspects have been reviewed. The gap analysis in this research occurs when the technology aspect has not been included, the aspect of transportation facilities and infrastructure also does not exist.

f. Transportation Research Interdisciplinary Perspec, 11 (2022) Pg. 123-136. Evaluating the potential of online review data for augmenting traditional transportation planning performance management. Golnaz Sarram writer, Stephanie S. Ivey. Intermodal Freight Transportation Institute (IFTI), Herff College of Engineering, University of Memphis, Memphis, TN, 38152, USA. The purpose of this paper is to investigate and discuss how cities are managed in the anti-pandemic new normal. and this in light of unexpected phenomena such as: the ongoing modal shift from public transport to private modes vs. the new momentum gained by walking, and social lifestyles that were and are now confined by unregulated behavior, also affecting land use. added to the unpreparedness of pre-pandemic transport policies and new opportunities that emerged; fresh directions for research and development, for example in the field of urban

mobility management. With the added aim of contributing to advancing further research, this paper also clearly demonstrates that crises can be overcome simply by considering different areas of action and by considering our shared past.

Based on the literacy above, the concept offered in each study is only limited to forming a forum according to the needs of each region, so that it is still possible not to implement it with various obstacles at every level. Decisions taken must also be supported by the readiness of personnel in carrying out any existing decisions so that the concept offered will be more targeted to the public who use public service facilities. This research offers a different concept and becomes the basis for application in various regions in Indonesia, as well as abroad. Management of the transportation system with this concept is offered so that each region can carry it out well even though it is across different administrative areas.

RESEARCH METHODS

Reasearch Data

This research was carried out by collecting data from December 2023 to March 2023. There are 6 (six) locations to support public transportation activities and the road network on the border of Bogor city and Bogor district. The amount and volume of city transport traffic is a model of public transportation with existing facilities and infrastructure along the route and its journeys. So that a model of transportation infrastructure will be obtained as a form that will represent the results of the research as a complete mindset of every decision making in the management of public transportation. Identify the number of public transportation that passes through the route with the number of nodes/modes of intersection of the lines as evaluation material. The need for public transportation, mode-integrating transportation, para-transit transportation will be seen from the routes that are passed. So that both transportation facilities and infrastructure are more supported by the concept offered will produce the expected public transport routes. Supporting government programs as regulators and private/organizations as operators for the provision of public transport services. Big cities that represent the use of public transport have launched BRT as an alternative to support integrated public transport services. This concept is the result of an in-depth study of the BRT program to support the existence of public transportation and other paratransits, including online motorcycle taxis, which began to grow in the early 2020s.

When viewed from passenger demand and the recovery of operating costs for public transport, it is classified as low when viewed from competition between angkots, route intersections, public transport supporting facilities and infrastructure. With regard to public transport facilities and infrastructure, it is evident that this sector is the most difficult to manage and manage properly. The operation of public transport and the management of public transport facilities and infrastructure is very attractive and more profitable if the management is in accordance with the policy.

A brief description of the method of research

This study carried out procedures for collecting primary data by identifying 6 existing locations in the study area. After the study location is determined, the location determination point will be identified which will be the focus of the research. Existing data concerns the area, land ownership/land use and facilities that can be recommended as policy proposals taken. Use of GPS (Garmin 2108) for 10 days including camera use, Vertex rental for 6 days, use of a roll meter to measure location for 10 days which will be studied. Also used to measure the noise level generated by motorized vehicles using a Sound Level Meter / SLM for 10 days of data collection and to map the research area using the Phantom 3 Pro Drone for 5 days. To determine the exact location in placing the results of the recommendations using the theodolite as the accuracy of the research results for 5 days. Furthermore, the speed, volume and density of vehicles in the study area are calculated as supporting data recommendations for the development of research proposals.

Location and time of research

The location has been determined by mapping the existing conditions of public transport facilities and infrastructure in the city of Bogor, which borders the Bogor district. The reason is that the synergy of progress between cities and regencies can be followed up with inter-regional cooperation

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programs in improving the public transport services that have been created. While the research time was set from March 2023 to June 2023. Furthermore, in determining the research points, 6 (six) locations were determined, all of which were on the border of the Bogor Regency and the city of Bogor with details as shown in Figure 1 below.

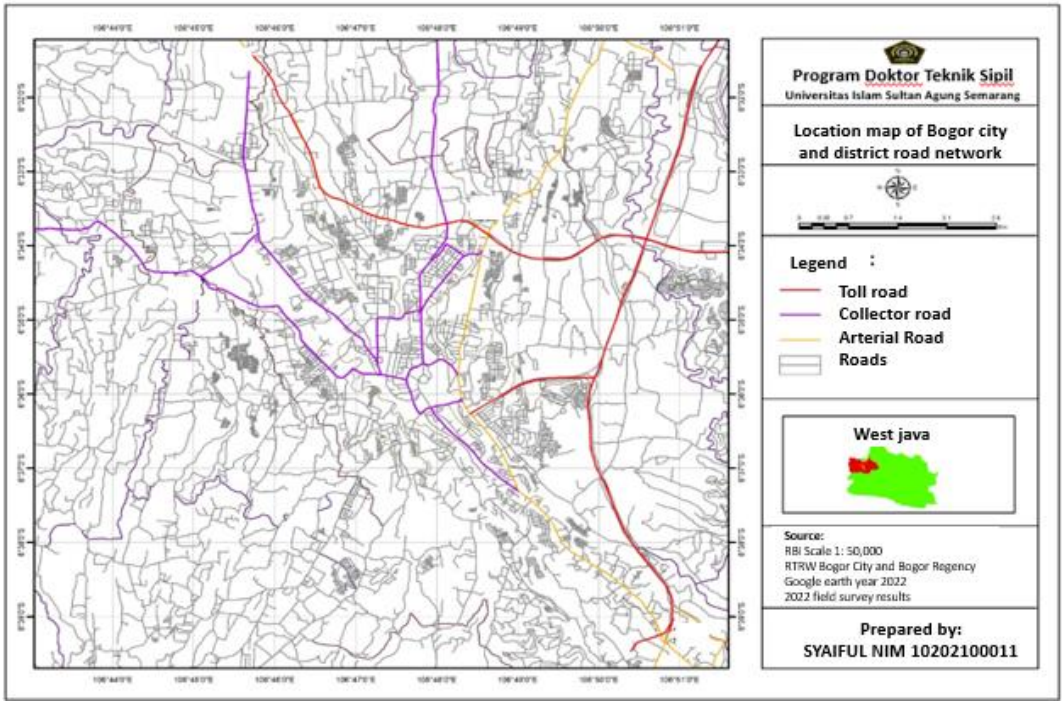

Figure 1. Map of the location of the Bogor regency and Bogor city road networks

Object, population and sample

The object of research is the means of transportation in the form of motorized vehicles such as cars, bicycles, motorcycles, rickshaws and bicycles which are vehicles used as a means of transportation. The population used in this study is as stated earlier in the research background, namely residents of the city of Bogor and residents of Bogor district so that after calculating the total population and the number of samples used, there are 326 samples consisting of public vehicle operators and public transport users and users public transport infrastructure. It is divided into 3 parts and added by the number of experts as many as 5 experts, as described above. So the total sample is 331 samples.

In determining the sample, the number of samples is determined based on purposive sampling. Data with this sample includes respondents who use motorized vehicles, users of public transportation, operators of public transportation. The number of samples used as research targets was 326 samples consisting of study locations in the district and city of Bogor. The questionnaire method was developed in taking data samples for its determination based on the Slovin formula (Sevilla et al., 1960), namely:

$$n = \frac{N}{1+Ne^2}.$$

Description: n = Number of samples
N = Total population
e = Fault tolerance limit

The Slovin formula can be used to determine sample size in research using the survey method, with the assumption that the population has homogeneous and random characteristics. Slovin's formula is as follows:

N = N / (1 + N(e)^2)

Where:

n = sample size
N = total population
e = allowable error rate (bias), usually around 5% (0.05)

The population of Bogor in 2022 is 1,097,000 people (BPS Kota Bogor, 2022) and the allowed error rate is 5%, so the number of samples required can be calculated as follows:

n = 1.097.000 / (1 + (1.097.000 x 0,05)^2)
n = 1.097.000 / (1 + 3.365.225)
n = 1.097.000 / 3.366.225
n = 326

So, according to Slovin's formula, the number of samples needed for this study is around 399. However, this is only an initial estimate and must be reconsidered with other considerations such as the research objectives and research methods used.

Meanwhile data collection uses an expert system/expert by taking several criteria included in it. 1) expertise/expertise at the academic/researcher level as many as two people, 2) expertise/expertise as decision makers as many as two people, 3) expertise/special skills such as experts in the field of transportation in this case the Indonesian Transportation Society/MTI one person. So the number of respondents in this expert system is set at 5 (five) people with the assumption that the range of experts and experts is between 3-7 experts/respondents (Hora, 2004).

Research data collection methods

Research data collection methods are divided into several parts. Each method uses a different method depending on the data to be processed and the data to be used in each form that has been defined. Collecting data in the form of a questionnaire by conducting interviews for each activity carried out by public transportation operators as many as 100 (one hundred) respondents, users of public transportation including the use of transportation infrastructure used while traveling as many as 176 (one hundred seventy six) respondents.

Furthermore, respondents who only used intersections but did not use public transportation as a means of transportation were 50 (fifty) respondents. To complement the power of decision making, 2 (two) experts came from Academics, 1 (one) expert came from the Bogor District Transportation and Highways Service and 1 (one) expert came from the Traffic and Road Transportation Service Raya city of Bogor, as well as 1 (one) expert from the Indonesian Transportation Society. The type of questionnaire can be seen in the attachment which is displayed separately from this proposal.

Instruments and research process

In determining the research instrument, it can be described based on 4 (four) objectives that will be developed into subsequent activities.

a. Evaluating the concept of transportation facilities and public transportation infrastructure in the study area.

   This concept uses an instrument based on the evaluation of public transportation facilities and infrastructure in the study area by treating the choice of strategies equally, namely determining the one strategy that has the greatest impact. Emphasis on implementation that has a high priority weight with the SWOT factor. Use within the SWOT framework to evaluate SWOT factors in a systematic and measurable manner. This combination will produce a quantitative measure of the importance of decision-making factors (Kurtila et al., 2000). There are 4 SWOT stages, namely (Strengths, weaknesses, opportunities and threats). Factors that influence this are by identifying strengths, weaknesses, opportunities and threats. In the internal environment there are strengths and weaknesses and external are opportunities and threats that are relevant in identifying each group. Then construct a pairwise comparison matrix for each related hierarchical level. The results of the calculation of the pairwise comparison matrix will obtain the eigenvector value as the priority weight value for each SWOT group, the SWOT factor by determining the choice of strategy. The results of pairwise comparisons for the SWOT analysis are described in the form of a strength group comparison matrix, a weakness group comparison matrix, an opportunity

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group comparison matrix and finally a threat group comparison matrix. Next, the global priority value is calculated. This stage is to calculate the global priority value for each SWOT factor. The global priority value is obtained by multiplying the group priority value with the factor/local priority value (Gallego-Ayala and Juizo, 2011). Identification of SWOT factors based on the results of field surveys, desk studies, structured interviews with experts.

b. Formulate the facilities of public transportation operating in the study area.

   This calculation model is the real condition of operating public transport by looking at the conditions in the field, the possibility of rerouting and the form of operational improvement of the operating public transport. The patterns studied are convenience, security, punctuality followed by an increase in service quality. There are two components to assess this public transport facility. The first is using the concept of Ministerial regulations regarding service levels and the second is using the SATURN model, with an analysis of public transport capacity calculations.

c. Modeling decision making on the sustainability of public transport facilities and infrastructure in the study area

   In determining the sustainability model is to describe the level/status of sustainability for each model form of public transportation facilities and infrastructure in each study area at 11 (eleven) study plan points in the city and district of Bogor. The model for the sustainability of public transport facilities and infrastructure using the Multidimensional Scaling (MDS) analysis approach uses software from Rapid Appraisal for Fisheries (Rapfish) with the concept of a Non-Parametric Multidimensional Scalling approach (Kruskal and Wish 1978; Preikshot et al., 1998). The stages of operation using the Rapid Appraisal for Settlements (Rap-Settlement) process software are as follows:

Determination of the topic/theme of the model of public transport facilities and infrastructure with a pattern of cooperation between regions, both Bogor district and Bogor city.

a. Determination of the study dimensions and attributes of each study dimension, namely 12 technological attributes, 12 service level attributes, 10 economic attributes, 8 ecological attributes, 8 social attributes and 10 institutional attributes.
b. Determined score for each attribute
c. Determine the value of the score in the process using predefined software
d. Next determine the sustainability index for each dimension by assigning sustainability (%)
e. Me-run leverage analysis in obtaining the leverage of attribute is an attribute lever of sustainability in each dimension.
f. After that Monte Carlo analysis to see the effect of error (error) to increase the level of validity of the model analysis.
g. Get an R2 value in the accuracy assessment
h. Calculation of the stress value in determining the level of mismatch in the basic concept.
i. Calculation of the Root Mean Square (RMS) value for each dimension
j. Determination of kite-diagrams for the dimensions of model sustainability.

In compiling the index on the sustainability status of the models of public transport facilities and infrastructure with inter-regional collaboration patterns, both Bogor district and Bogor city for each dimension and their attributes. So that the assessment score for each dimension is obtained with the worst (bad) scale of 0% to the best (good) 100%. Next, table 2 shows the relationship between the assessment index categories below.

Table 2. Rating index categories

No	Index Value	Sustainability category
1	0 – 25	Bad; Not sustainability
2	26 – 50	Not enough; Less sustainable
3	51 – 75	Enough; Sufficiently sustainable
4	76 - 100	Good; Very sustainable

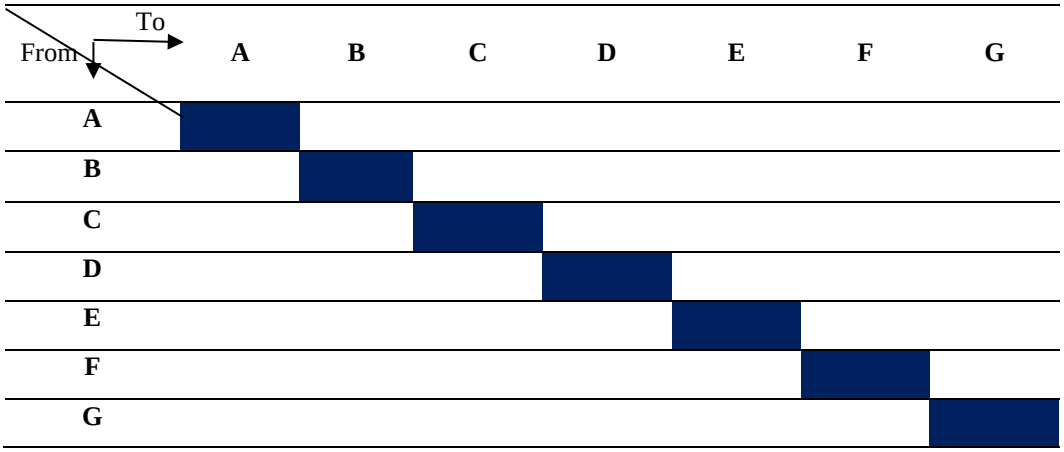
(Source: Pitcher, 1999).

In determining the key factors for the traffic engineering model and transportation system in the study area, a prospective analysis approach was used by analyzing problems using an expert system by rearranging decision designs using a different approach (Bourgeois and Jesus, 2004). Meanwhile, to realize this prospective with 2 stages of prospective analysis as follows:

a. Determination of key factors by identifying all key factors using the criteria in Multidimensional Scaling (MDS) analysis.
b. Determine the strategic goals and interests of the main actors in the sustainability model.

The direct influence between factors in the determined system is a form of a matrix system based on table 3 below.

Table 3. Effect and dependency matrix



(Source: Bourgeois and Jesus, 2004).

At this level, we identify that the key elements can change in determining the state (state) for each factor, examine changes together and describe scenarios that pair changes by discussing scenarios and their implications for the system to be determined.

Primary data includes, structured interviews with experts/experts including 2 (two) people from academics with expertise in transportation, 2 (two) people from related institutions/agencies and 1 (one) person from the Indonesian Transportation Society/MTI.

Secondary data includes:

a. Existing data related to public transportation facilities,
b. Existing data related to public transport infrastructure,
c. Existing data on public transport route permits passing through the study location,
d. Real data on the number of publictransportation operating in the study location,
e. The level of public transport services in the study location.

Furthermore, after determining the secondary data and primary data, the steps taken are data processing using a predetermined and planned model.

A strategic model for making decisions about public transportation facilities and infrastructure with the concept of cooperation between districts and cities.

Building a model for determining decisions based on alternative policies in determining models of public transportation facilities and infrastructure with the concept of inter-regional cooperation using the Analycal Hierarchy Process (AHP) approach. There are several stages in determining alternative policies to construct a functional hierarchy, namely human perception. AHP in determining using a comparison scale is shown according to table 4 below.

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Table 4. Analytical Hierarchy Process (AHP) comparison scale

No	Value	Information
1	1	Equally important (Equal)
2	3	A little more important (Moderate)
3	5	Obviously more important (Strong)
4	7	Very clearly important (Very strong)
5	9	Absolute is more important (Extreme)
6	2,4,6,8	When in doubt between 2 adjacent values
7	1/(1-9)	The opposite of the value of the level of importance from Scale 1-9

(Source: Saaty, 2008).

The data needed for this purpose includes: Structured interviews with experts/experts including 2 (two) people from Academics, 2 (two) people from related institutions and 1 (one) person from the Indonesian Transportation Society/MTI. Additional data from related agencies as well as data from reference books, as well as study reports on transportation facilities and infrastructure and journals on public transport and the level of public transport services such as.

a. Conditions of operating public transport,
b. Conditions of the surrounding environment including traffic signs, APILL, school-free area markers,
c. Public transportation that operates according to a predetermined schedule,
d. Forms of questions to be asked to experts/experts.

Analysis Methods

The analytical method applied for each destination is different treatment, but in general it can be described in study 3.6 above, namely for the first objective using SWOT analysis, while for the second objective using the SATURN calculation based on the matrix of origin and destination and service levels of public transport and service levels of facilities and infrastructure transportation in silalah study. The third objective uses data analysis using the Multidimensional Scaling (MDS) method and the last one uses Hierarchy Process Analysis (AHP) analysis. These four objectives have been briefly discussed in the research instrument section.

Research flow chart

Furthermore, the author will display a research flowchart which is used as a reference for determining each attribute in this study. Based on the display below, the author will display the research flowchart in accordance with the concepts that the author has arranged properly, which can be seen in Figure 2 below.

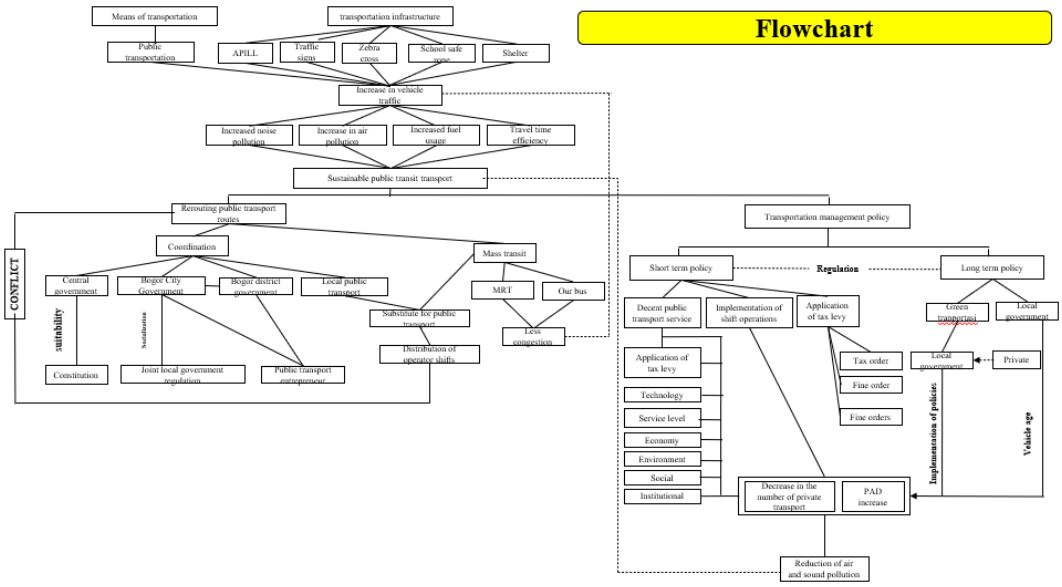

Figure 2. Research flowchart

RESULTS AND DISCUSSION

Description of critically reviewed relevant and up-to-date literature

Studies on the transportation sustainability model have started since 2022 so that it can become a reference for the integrated transportation concept. Continuing the research program from Syaiful, 2022 concerning the traffic engineering model in the transportation system with a pattern of sustainable inter-regional cooperation in the city of Bogor. This research is a dissertation in the IPB University Natural Resources and Environmental Management study program in 2022. This study focuses on the performance of signalized intersections in the buffer zones of the city and district of Bogor. The pattern of traffic engineering modeling in the Bogor area concluded that the LOS level for the 5 (five) intersections still needed further treatment, especially treatment at peak hours. Including sustainable activities in the transportation system and traffic engineering at every intersection as a multimodal concept by maximizing the function of mass public transport. Factors affecting the technological dimension that put pressure on policy as decision makers. The concepts and patterns offered in this study are PARUNGSEMPLAK and CIAWIBARANANGSIANG as regional transportation system development concepts.

According to Francesco Censori et.al, 2022 in a study entitled Sustainable and resistant Road Infrastructures: The Role of the Envision Framework as a Guide to a New Design Approach, focuses on 3 components of the model, namely the first scenario of procuring bicycle lane infrastructure to reduce noise, scenario the second is structuring green areas and the third scenario is by planting shade trees on either side of the road to reduce noise and air pollution. The sustainable concept in this study is an added value in creating a sustainable world as a future infrastructure design concept.

According to Golnaz Sarram and Stephanie S. Ivey, 2022. Evaluating the potential of online review data for augmenting traditional transportation planning performance management. The study focuses on conventional transportation planning decision making. There are five concepts examined in this condition, namely safety/security, mobility/mobility, cultural/cultural, environment/environmental, facilities/amenities and socio-economic. This research was conducted in two cities, namely Memphis and San Francisco. The two cities place the highest crime and accidents, then mobility with traffic and modal shifts, the third culture is like racism and the lowest socio-economic. Aspect-based outcomes are compatible with placing culture or lifestyle next. This new environmental attribute is not recommended, but from the results of this study the environment is closely related to the socio-economic characteristics of the two cities.

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Furthermore, according to Ofyar Z Tamin, 2007 in his paper entitled Towards the creation of a sustainable transportation system in big cities in Indonesia concluded that: policies for developing urban transportation systems in Indonesia that use conventional approaches, namely predict and provide or forecast and provide, must be abandoned and replaced with a new approach, namely predict and prevent, namely by carrying out management or management efforts on the transportation demand side, known as Transport Demand Management (TDM) or Transportation Demand Management (MKT). The concept of Transportation Needs Management (MKT) and several strategies that can be implemented in big cities in Indonesia. Policies that can be implemented in implementing the MKT concept must be able to lead to the occurrence of several effects of shifts in space and time, such as, 1) the impact of shifts in time; the movement process occurs at the same location, but at a different time, 2) the impact of a shift in route/location; movement processes occur at the same time, but on different routes or locations, 3) the impact of modal shifts; the movement process occurs at the same location and at the same time, but with different modes of transportation, 4) the impact of a shift in the destination location; the movement process occurs at the same location, the same time, and the same mode of transportation, but with a different destination. There is no one policy (single solution) that can directly solve the urban transportation problem completely. The policy that must be taken must be a combination of several policies or strategies that synergistically will be able to solve existing transportation problems. Several other supporting policies must be carried out jointly in order to support the success of the MKT concept. Furthermore, the concept of sustainable transportation is described in a form like Figure 3 below:

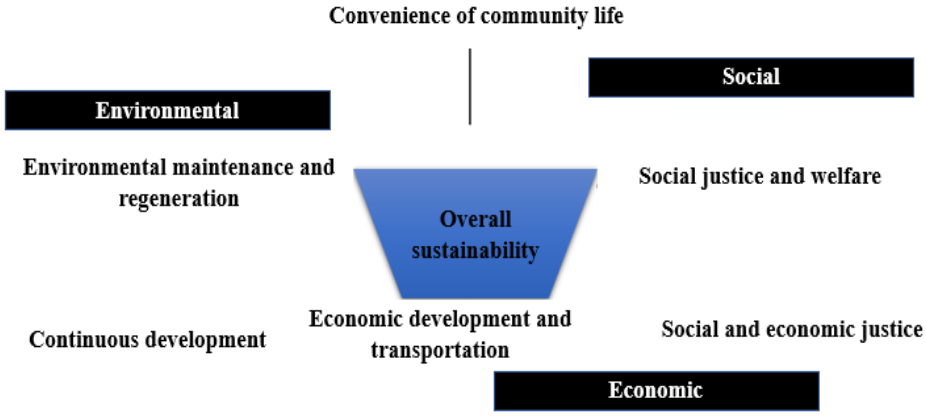

Figure 3. Interaction between elements in a sustainable transportation system (Center for Sustainable Development, 1997 in Ofyar Z Tamin)

A sustainable transportation system is defined as one that provides access to the basic needs of individuals or communities safely and in a manner consistent with human and ecosystem health, with present and future societal equity.

According to Jiin Yoo and Yooncheong Cho, 2022 in their paper entitled Investigating the Factors on Public Transportation System for Citizen Relationship and Sustainability argue about public transportation in the concept of sustainability. His opinion is to investigate the key factors influencing public transport users' dissatisfaction with the transportation system by highlighting the need for community participation and increased sustainable management of advanced technology. The research questions applied in this study include; 1) how is the dissatisfaction factor related to the type of transportation mode; 2) how the proposed factors influence citizen dissatisfaction; 3) how the improvement of public transport services affects the level of expected satisfaction; and how expected satisfaction affects policy agreements and government confidence. Research design, data and methodology: For qualitative research, civic opinion was collected and chi-square analysis was applied using keywords. in quantitative research, online surveys were collected from factor analysis and multiple regression was applied. The efficiency of the operating system and safety against dissatisfaction is significant for the three modes of public transportation. This study found that

perceptions of government policies and trust in the government will increase as expected satisfaction increases. Furthermore, it describes the managerial and policy implications for the community in policy makers addressing the needs and strategies for improving the public transportation system with consideration of public relations management in sustainable development. In this study a theory of sustainability regarding public transportation will be raised with the name MODEL SUSTAIN_SARPRASKOKABO_2023. This model refers to the management of public transportation that is friendly to the environment, friendly to users and friendly to managers. So that the sustainability of public transportation management supported by reliable infrastructure like those in foreign countries will soon be realized.

CONCLUSION

The conclusion from a literature review on transportation facilities, namely cars, buses, motorcycles, bicycles and road transportation infrastructure, traffic signs, bridges, terminals in the study area places that a thorough study of research activities on the sustainability model is needed in order to obtain a clear concept. This concept is called MODEL SUSTAIN-SARPRASKOKABO_2023. This model will continue to be developed along with the concept of transportation development in Indonesia in general. By referring to this initial concept, it is hoped that a balanced and sustainable traffic pattern in Indonesia will soon be realized.

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DAFTAR PUSTAKA

Abubakar I, Agung TGSP, Widyatmoko, Subroto JS, Judiza RZ, Ernani B, Subastian J, Djasinga N, Ginting R, Surti BH, Sembiring N, Haribowo C, Supono T, Hutabarat T, Susanto S, Yani A, Sutiono E, Muttaqin, Carolina N, 1998, Sistem Transportasi Kota, Direktorat Jenderal Perhubungan Darat, Direktorat Bina Sistem Lalu lintas dan Angkutan Kota, Departemen Perhubungan, Jakarta.

Acharya SR, Parumog-Pernia M, Morichi S. 2013. Evolving Concepts in Urban transport, transport Development in Asian Megacities, *Transportation Research, Economic and Policy*, doi:10.1007/978-3-642-29743-4-2, Springer-Verlag Berlin Heidelberg 2013, pp. 15-31.

Ahferon MT, Svensson MGE. 2009. Sustainablity Assesment of a Bus Rapid Transit (BRT) System: The Case of Dar es Salam, Tanzania, *A Thesis Submitted in Partial Fulfillment of the Degree Mater of Science in Environmental Studies and Sustainability Science*, Lund University, Sweden.

Agatha Debby, Herbasuki Nurcahyo, Mariyam Musawa, 2012. "Strategi Pengelolaan Angkutan Umum Jalan Raya Di Kota Semarang." Indonesian Journal of Public Policy and Management Review, vol. 1, no. 1, 2012, pp. 1-10.

Atallah RF, Assi CM, Khabbaz MJ. 2018. Scheduling the Operation of a Connected Vehicular Network Using Deep Reinforcement Learning. *IEEE Transactions on Intelligent Transportation Systems*, Hongkong.

BPS kota Bogor, 2018

BPS kabupaten Bogor, 2020

Banerjee A, Duflo E, Qian N. 2012. Acces to Transportation Infrastructure and Economic Growth in China. *The 2004 MacArthur Network for Inequality Conference in Beijing, the China Summer Institute, and the 2011 IGC Conference in London*, England.

pISSN 2302-4240
eISSN 2655-2086
Volume 12, Issue 2, June 2023, pp.613-634
DOI: http://dx.doi.org/10.32832/astonjadro.v12i2 http://ejournal.uika-bogor.ac.id/index.php/ASTONJADRO

Baum-Snow N, Brandt L, Henderson V, Turner M, Zheng Q. 2014. Urban Transportation, Land Use, and Growth Evidence from China 1990-2010. *International Growth Centre. Ideas for Growth*. www.theigc.org. Policy Brief 3013.

Bourgeois R, Jesus F, 2004. Participatory Prospective Analysis. Exploring and Anticipating Challanges with Stakeholders. Center for Alleviation of Poverty though Secondary Crops Development in Asia and the Pacific and French Agricultural Research Center for International Development. Monograph 46: 1-29

Buehler R. 2018. Can Public Transportation Compete with Automated and Connected Cars? *Journal of Public Transportation*, Vol. 21, No. 1, 2018 pp. 7-18.

Cavoli C, Christie N, Mindell J, Titheridge H. 2015. Lingking Transport, Health and Sustainability: Better Data Sets for Better Policy-Making. Journal of Transportation & Health, 2, 2015, pp. 111-119.

Censorii, F.; Cotignoli, L.; Vignali, V.; Bartoli, A. 2022. Sustainable and Resistant Road Infrastructures: The Role of the Envision Framework as a Guide to a New Design Approach. Coatings 2022, 12, 236. https://doi.org/10.3390/coatings 12020236.

Coyle D, Rosewell B. 2014. Investing in City Regions: How does London Interact with the UK System of Cities and what are the Implications of this Relationship? *This Essay has been Commissioned as Part of the UK Government's Foresight Future of Cities Project*, England, UK.

Cristobal T, Padron G, Quesada-Arencibia A, Alayon F, Garcia CR. 2017. Systematic Approach to Analyze Travel Time in Road-Based Mass Transit Systems Based on Data Mining. *IEEE Acces*. Vol. XX, 2017.

Cristobal T, Padron G, Quesada A, Alayon F, Garcia CR. 2017a. Using Data Mining to Analyze Dwell Time and Nonstop Running Time in Road-Based Mass Transit System. *Prceedings at the 12th International Conference on Ubiquitous Computing and Ambient Intelligence (UCAmI 2018)*, Puna Cana, Dominician Republic, 4-7 December 2018.

Direktorat Jenderal Bina Marga, 1997, Panduan Survey dan Perhitungan Waktu Perjalanan Lalu lintas, Departemen Pekerjaan Umum, Jakarta.

Direktorat Jenderal Perhubungan Darat, 1996. Tentang tata letak halte, Departemen Perhubungan Republik Indonesia, Jakarta.

Eboli L, Mazzulla G, Pungillo G. 2017b. Measureing the Driver's Perception Error in the Traffic Accident Risk Evaluation. *IET Intelligent Transport Systems*. 2017, Vol. 11 Iss. 10, pp. 659-666.

Esmaelzadeh E and Nakhaie-Jazar G. 1997. Vibration of Road Vehicles with Non-Linier. *Journal of Engineering, Islamic Republic of Iran*, Vol. 10, No. 4 November 1997, pp 209-217.

Jordi Gallego-Ayala, 2011. Strategic implementation of integrated water resources management in Mozambique: An A'WOT analysis. Physics and Chemistry of the Earth, Parts A/B/C Volume 36 Issues 14-15, pp 1103-1111.

Fellner M, Tenart J, Vierling J. 2018. Barriers and Best Practices to the Use of Public Transportation: A Case Study of the South Baltic Sea Region. *Master's Degree Thesis. Blekinge Institute of Technology Karlskrona*, Sweden.

Garmin, 2018

Golnaz Sarram, Stephanie S. Ivey, 2022. Evaluating the potential of online review data for augmenting traditional transportation planning performance management. Journal of Urban Management, 11, pp123-136.

Goodbody Economic Consultants. 2017. Transport and Regional Development, *The Departement of Urban & Regional Planning UCD & Oscar Faber Transportation*, diakses 20 Januari 2018, Pukul 11.00 BBWI.

Gudmundsson H and Regmi MB. 2017. Developing the Sustainable Urban Transport Index. *Transport and Communication Bulletin for Asia and the Pacific*, No. 87, 2017.

Harun NZ, Zakariya K and Mansor M, 2017. Design Factors Contributing to the Succes of Business Premises at Urban Public Plaza Area, *Advanced Science Letters*, Vol. 23, 6127-6130, July 2017.

Hatefi SM, 2018. Strategic Planning of Urban Transportation System Based on Sustainable Development Dimensions Using an Integrated SWOT and Fuzzy COPRAS Approach, *Global Journal Environtmental Science Manager*, Vol. 4 (1): 99-112, Winter 2018.

Hora SC, 2004. Probabality Judgments for Continous Quantities: Linear Combinations and Calibration. Published Online: Management Science Hawaii (US) Volume 50: 597-604.

I Made Arka Hermawan, Santun R.P Sitorus, Machfud, IF. Poernomosidhi, Umar Mansyur, 2019. Evaluasi keberlanjutan aksesisbilitas angkutan Umum di kota Sukabumi, Jurnal Penelitian Transportasi Darat, Vol. 21, No. 1, 2019, Hal 1-12.

IHCM, 1997.

Jacobs B, Cunningham R, Boronyak L, 2018. Climate Adapted People Shelters: Field Assesment, UTS:ISF, Australia.

Jordi Gallego-Ayala, Dinis Juizo. 2011. Strategic implementation of integrated water resources management in Mozambique: An A'WOT analysis, Physics and Chemistry of the Earth Parts A/B/C 36(14):1103-1111.

Jittrapirom P, Marchau VAWJ, vander Heijden RECM, Meurs H. 2018. Future Implementation of Mobility as a Service (MaaS): Results of an International Delphi Study, *Working Paper*, Radboud University. June 2018.

Jii YOO, Yooncheong CHO, 2022. Investigating the Factors on Public Transportation System for Citizen Relationship and Sustainability. Journal of Industrial Disribution & Business Vol 13 No 3 (2022).

Jyrki Kangas, Mikko Kurttila, Miika Kajanus, Annika Susanna Kangas, 2003. Evaluating the management strategies of a forestland estate - The S-O-S approach.

Jung S, Xiao Q, Yoon Y. 2013. Evaluation of Motorcycle Safety Strategies Using the Severity of Injuiries. *Accident Analysis and Prevention Journal* 59 (2013) 357-364.

Kamla J, Parry T and Dawson A, 2017. Aplication of Random Parameters Models to Estimate Truck Accidents at Roundabouts, *A Paper Submitted for Presentation at the 2017 Annual Meeting of the Transportation Research Board*, Submission Date 15/November/2016.

Kementerian Perhubungan Republik Indonesia, 2015. Modul Bahan Ajar Diklat Teknis Transportasi Tingkat III, Badan Pengembangan Sumber Daya Manusia Perhubungan, Pusat Pengembangan Sumber Daya Manusia Aparatur Perhubungan, Bogor.

Keputusan Direktur Jenderal Perhubungan Darat, 1996, Pedoman Teknis Perekayasaan Tempat Perhentian Kendaraan Penumpang Umum No. 271/HK.105/DRJD/96, Jakarta.

Keputusan Menteri Perhubungan, 1995, Tata Cara Pelaksanaan Survey Perhitungan Manual, Jakarta.

Koglin T and Varhelyi A, 2018. What does Maintenance of Infrastructure Mean for Pedestrian A Knowledge Summary, *Bulletin 309, Transport and Roads, Departement of Technology and Society*, Lund University, Lund.

Kruskal JB, Wish M, 1978. Multidimensional Scalling. Beverley Hills, CA (USA): Sage Publications.

Mikko Kurttila, Mauno Pesonen, Jyrki Kangas, Miika Kajamus, 2000. Utilizing the analytic hierarchy process (AHP) in SWOT analysis — a hybrid method and its application to a forest-certification case. Forest Policy and Econimics 1 (2000) 41-52.

pISSN 2302-4240
eISSN 2655-2086
Volume 12, Issue 2, June 2023, pp.613-634
DOI: http://dx.doi.org/10.32832/astonjadro.v12i2 http://ejournal.uika-bogor.ac.id/index.php/ASTONJADRO

Li Q, Qiao F, Wang X, Yu L. 2017. Drivers' Smart Advisory System Improves Driving Performance at STOP sign Intersections. *Journal of Traffic and Transportation Engineering (English Edition)* 2017; 4 (3) pp 262-271.

Mampearcachchi WK, Masakorala SR. 2018. Analytical Model for Passing Sight Distance Design Criteria of Two-Lane Roads in Srilanka. *Transport and Telecomunication,* 2018, Vol. 19. No. 1, pp. 10-20.

Manual Kapasitas Jalan Indonesia, 1997. MKJI, Jakarta.

Melia S, 2018. Does Transport Investment Really Boost Economic Growth? *World Transport Policy and Practise,* 23 (3&4). Pp. 118-128.

Miika Kajanus, Jyrki Kangas, Mikko Kurttila, 2004. The use of value focused thinking and the A'WOT hybrid method in tourism management. Tourism Management 25(4):499-506.

Mikko Kurttila, Mauno Pesonen, Jyrki Kangas, Miika Kajanus, 2000. Utilizing the analytic hierarchy process (AHP) in SWOT analysis - A hybrid method and its application to a forest-certification case, Forest Policy and Economics 1(1):41-52.

Moh. Nurul Iman, Santun R.P Sitorus, Machfud, IF. Poernomosidhi, Widiatmaka, 2019. Analisis keberlanjutan angkutan umum penumpang berbasis jalan (studi kasus di kota Bogor). Jurnal Penelitian Transportasi Darat, Vol. 21, No. 1, 2019, Hal 75-90.

Morlok and Edward K, 1985. Introduction to Transportation Engineering and Planning, Mc Graw-Hill, New York.

Munawar, Ahmad. 2011. Speed and Capacity for Urban Roads, Indonesian Experience, Sweden. 6th International Symposium on Highway Capacity and Quality of Service Stockholm, Sweden June 28-July 1, 2011. *Social and Behavioral Sciences* 16 (2011) pp. 382-387.

Mwebesa ME, Yoh K, Inoi H, Doi K. 2018. A New Approach to Cross-Sector Cooperation in Road Safety Through a Comparison of Policies in Selected Countries, *IATSS Research, 2018.*

Ofyar Z. Tamin, 2007. Menuju Terciptanya Sistem Transportasi Berkelanjutan Di Kota-Kota Besar Di Indonesia, Jurnal Transportasi, 7 (2), pp 87-104.

Okraszewska R, Jamroz K, Michalski L, Zukowska J, Grzelec K and Birr K, 2019. Analysis Ways to Achieve a New Urban Agenda-Based Sustainable Metropolitan Transport, *Sustainability Journal*,11,813; pp. 2-23.

Pemerintah Kota Bogor Dinas Lalu lintas dan Angkutan Jalan, 2012. Evaluasi Kinerja Jaringan Jalan dan Simpang di Wilayah Kota Bogor, Laporan Akhir PT. Oxalis Subur, Bogor.

Peraturan Menteri Perhubungan Republik Indonesia, 2006, No. 14 tahun 2006 tentang Manajemen dan Rekayasa Lalu lintas, Jakarta.

Pfaffenbichler PC and Shepherd SP, 2002. A Dynamic Model to Appraise Strategic Land-use and Transport Policies, *European Journal of Transportation and Infrastucture Research*, 2 No. ¾ (2002), pp. 255-283.

Pitcher TJ, 1999. Rapfish, A Rapid Appraisal Technique for Fisheries, and Its Application to the Code of Conduct for Responsible Fisheries. FAO Fisheries Circular No. FIRM/C: No. 947: 47p.

Preikshot Db, Nsiku E, Pitcher TJ, Pauly D, 1998. An Interdisciplinary Evaluation of the Status and Health of African Lake Fisheries Using a Rapid Appraisal Technique. Journal Fish Biology. 53 (Suppl A): 382-393).

Rahman MS-U. 2012. Public Transport in a Small Island of a Developing Country. *Brazilian Journal of Urban Management*, v. 4, n. 1, p.61-72.

Rakkesh ST, Weerasinghe AR, Ranasinghe RAC. 2017. Equipoising Multi-Modal Traffic Environments using Vehicular Ad-hoc Networks. *International Journal on Advances in ICT for Emerging* Regions 2017 10 (2).

Rassafi AA. 2004. Benchmarking Sustainability with Respect to Transportation Supply and Demand. *IJE Transactions B: Applications*, Vol. 17, No. 4, December 2004, pp 357-368.

Roshandeh AM, Li Z, Zhang S, Levinson HS and Lu X. 2016. Vehicle and Pedestrian Safety Impacts of Signal Timing Optimization in a Dense Urban Street Network, *Journal of Traffic and Transportation Engineering (English Edition)* 2016; 3 (1) pp 16-27.

Rosni NA, Ponrahono Z and Noor NM, 2018. Integrated Land-Use-Transportation Approach in Controlling the Growth of Urban Sprawl Using Remote Sensing and GIS Application, *IOP Conf.Series: Earth and Environtmental Science* 169 (2018)

Rymarz J, Niewczas A, Stoklosa J. 2015. Reliability Evaluation of the City Transport Buses Under Actual Conditions. *Transport and Telecomunication*, 2015, Vol. 16. No. 4, pp. 259-266.

Saaty TL, 2008. Decision Making with The Analytic Hierarchy Process. International Journal Services Sciences. 1 (1): 83-98.

Sadeghi J and Askarinejad H. 2007. Influences of Track Structure, Geometry and Traffic Parameters on Railway Deterioration. *IJE Transactions B: Applications*, Vol. 20, No. 3, December 2007, pp 291-301.

Septin Puji Astuti, Taufik Ismail Alhakim, Eko Setiawan. 2021. Evaluasi transportasi public di Surakarta melalui Fuzzy Quality function Deployment. Jurnal Penelitian Transportasi Darat, Vol. 23, No. 2, 2021. Hal 122-134. Program Studi Manajemen Bisnis Syariah IAIN Surakarta, Program Studi Teknik Industri Universitas Muhammadiyah Surakarta.

Sevilla CG, Ochave JA, Punsalan TG, Regala BP, Uriarte GG, 1960. Research Methods. Quezon City (PH): Rex Printing Company.

Shafabakhsh G, Motamedi M. 2016. Sensitivity Analysis of Road Actual Conditions to Evaluate the Optimal Positioning of Geogrid Using Finite Elements and Dynamic Methods. *IJE Transactions C: Aspects*, Vol. 29, No. 9, September 2016, pp 1235-1241.

Sloop KI, Adams S, Hill R, Arrington GB, Hencke J, Hull E, Liden K, Mar C, Viggiano S. 2013. A Primer for Planning, Sitting, and Designing Transit Fascilitie in Oregon, *Transit in Small Cities, Oregon Transportation and Growth Management Program*, State of Oregon. United States, pp. 1-82.

Stogios C. 2018. Investigating the Effects of Automated Vehicles Driving Operations on Road Emissions and Traffic Performance. *A thesis submitted in conformity with the requirements for the degree of Mater of Applied Science*, Departement of Civil Engineering, University of Toronto, Canada.

Sun Y, Moshfeghi Y and Liu A, 2017. Exploiting Crowdsourced Geographic Information and GIS for Assessment of Air Pollution Exposure During Active Travel. *Journal of Transport and Health* 6 (2017) 93-104.

Syaiful, Hermanto Siregar, Ernan Rustiadi, Eri Susanto Hariyadi, 2022. Model rekayasa lalu lintas dalam system transportasi dengan opla Kerjasama antar wilayah berkelanjutan di kota Bogor, Disertasi. Repository IPB University. https://repository.ipb.ac.id/handle/123456789/111676

Swierstra AB, vanNEs R, Molin EJE. 2017. Modelling Travel Time Reliability in Public Transport Route Choice Behaviour. *EJTIR Issue* 17, (2), 2017, pp 263-278.

Tini NH, Shah MZ and Sultan Z, 2018. Impact of Road Transportation Network on Socio-Economic Well-Being: AN Overview of Global Perspective, IJSRSET, Vol. 4(9), pp. 282-296.

Tolujevs J, Shedenov O, Askarov G. 2018. Investigation of Road Transport Enterprise Functioning the Basis of System Dynamics. *Transport and Telecomunication*, 2018, Vol. 19. No. 1, pp. 1-9.

Torrisi V, Ignaccolo M and Inturri G, 2017. Estimating Travel Time Reliability in Urban Areas Through a Dynamic Simulation Model, Transportation Research Procedia 27 (2017) 857-864.

Undang-undang Republik Indonesia, 1992. Undang-undang No 14 tahun 1992 tentang Lalu lintas dan Angkutan Jalan, Jakarta.

Undang-undang Republik Indonesia, 2009. Undang-undang No 22 tahun 2009 tentang Lalu lintas dan Angkutan Jalan, Jakarta.

Umar Mansyur, 2008. Model Pengelolaan transportasi angkutan umum penumpang NonBus berkelanjutan kota Makassar, Disertasi, Sekolah Pascasarjana Institut Pertanian Bogor.

Vayalamkuzhi P, Amirthalingam V. 2016. Influence of Geometric Design Characteristics on Safety under Heterogeneous Traffic Flow. Journal of Traffic and Transportation Engineering (English Edition) 2016; 3 (6) pp 559-570.

Wang Z, Goodchild AV and McCormack E, 2016. Freeway Truck Travel Time Prediction for Freight Planning Using Truck Probe GPS Data, *EJTIR* 16 (1), 2016 pp. 76-94.

Wasike WSK. 2001. Road Infrastructure Policies in Kenya: Historical Trends and Current Challenges. *Infrastructure and Economic Services Division, Kenya Institute for Public Policy Research and Analysis*, Kenya.

Widodo B, 2014, Kebijakan Rencana Tata Ruang Wilayah Perbatasan Kota dengan Kabupaten, Sekolah Tinggi Ilmu Administrasi Asuh Mitra Solo, Surakarta.

Wismans J, Granstrom M, Skogmo I and Kronberg P, 2019. Global Road Traffic Safety Scenarios: A State of the Art Review of Global Policy Targets and Strategies, *SAFER Vehicle and Traffic Safety Centre at Chalmers University*, February 2019, Gothenburg, Sweden.

Wright S. 2015. A European Model for Public Transport Authorities in Small and Medium Urban Areas, *Journal of Public Transportation*, vol. 18, No. 2, 2015, pp. 45-60.

Yatskiv I, Pticina I, Savrasovs M. 2012. Urban Public Transport System's Reliability Estimation Using Microscopic Simulation. *Transport and Telecomunication*, 2012, Vol. 13. No. 3, pp. 219-288.

Zhao L, Yu Y and Zhou C, 2018. Comparative Research on Optimal Damping Matching of Seat System for an off-Highway Dump Truck. *International Journal of Engineering Transactions B:Aplications* Vol. 31, No. 2, February 2018, pp 204-211.

Cicilia Fransisca Ganda, Hary Moetriono, Sri Wiwoho Mudjanarko, (2019). Analisis Alternatif Pembiayaan Penyeberangan Asdp Ujung-Kamal Akibat Dibangunnya Jembatan Surabaya-Madura. ASTONJADRO, 8(2),pp.103-109. http://ejournal.uika-bogor.ac.id/index.php/ASTONJADRO/article/view/2801/1681

Hana Karimah dan Juang Akbardin, (2019). Kajian Tentang Model Bangkitan Pergerakan Permukiman Kawasan Ciwastra Kota Bandung, ASTONJADRO, 8(2),pp.97-102. http://ejournal.uika-bogor.ac.id/index.php/ASTONJADRO/article/view/2799.

Syaiful Syaiful, Hermanto Siregar, Ernan Rustiadi, Eri Susanto Hariyadi. (2022). Performance Of Three Arms Signalized Intersection At Salabenda In Bogor Regency, ASTONJADRO, 11(1),pp.13-29.

S Syaiful, H Siregar, E Rustiadi, ES Hariyadi. (2022). Model Rekayasa Lalu lintas dalam Sistem Transportasi dengan Pola Kerjasama antar Wilayah Berkelanjutan di Kota Bogor. IPB University.

S Syaiful, H Rusfana. 2022. Rigid Pavement Planning In Traffic: Case Study In Ciherang Road And Pemuda Road, Bogor Regency, Indonesia. Journal of Applied Engineering Science, 1-13.

S Syaiful, Y Pratama. 2019. Sustainable Studies about General Public Transport Performance in the City Of Bogor, ARPN Journal of Engineering and Applied Sciences 14 (18), 3241-3247.

S Syaiful, D Hariyadi. 2019. Case Study on Sustainable T-Jungtion Cibinong City Mall (CCM) in Bogor Indonesia, ARPN Journal of Engineering and Applied Sciences 14 (17), 2960-2971.

S Syaiful, H Prayoga, J Akbardin. 2020. Sustainable about the Need of Parking Systems at the Mall RDS Bogor, ARPN Journal of Engineering and Applied Sciences 15 (22), 2620-2626.

S Syaiful, A Fadly. 2020. Analysis of the Effectiveness of Bus Services Outside of Campus IPB Dramaga Bogor. ASTONJADRO, 9 (2), 173-186.

S Syaiful, H Siregar, E Rustiadi, ES Hariyadi. 2021. Traffic Improvement Strategy in Transportation System Using AHP Method. ARPN Journal of Engineering and Applied Sciences 16 (22), 2431-2439.

Syaiful Syaiful, Renea Shinta Aminda, Yuggo Afrianto, 2023. Influence motor cycle density on noise sound at the highway. ASTONJADRO, 12 (1), 304-313.