American Journal of Engineering Research (AJER)
e-ISSN: 2320-0847 p-ISSN : 2320-0936
Volume-8, Issue-6, pp-27-33
www.ajer.org
Research Paper Open Access

The Influential Factors in Development Sustainable Road Infrastructure (A Case Study in Buol Regency of Central Sulawesi Province)

Ricardo Sugiarta Ridwan[1], Muhammad Yamin Jinca[2], Armin Lawi[3]
[1]*Postgraduate Student, Master Degree of Transportation Planning, Hasanuddin University*
[2]*Professor for Transportation Planning, Urban and Regional Planning, Hasanuddin University,*
[3]*Department of Computer Science, Faculty of Mathematics and Natural Science, Hasanuddin University, Makassar - Indonesia*
Corresponding Author: Ricardo Sugiarta Ridwan

ABSTRACT: *The concept of sustainable road infrastructure development can be assessed from economic, social and environmental criteria. Sustainable road is a process of balancing the three criteria in its implementation. This study aims to determine the influence factors in developing sustainable road infrastructure in Buol Regency and formulate directions sustainable road infrastructure development. This research is a descriptive study, using qualitative methods and capturing the opinions of stakeholders using the Analytical Hierarchy Process (AHP), a quantitative method used to formulate the direction of sustainable road infrastructure development. The results showed that the factors of influence were social and economic factors such as safety, construction guarantees, maintaining quality, health, reforestation and flood mitigation, so the recommended direction of development was to optimize these priority factors.*
KEYWORDS: *Road infrastructure, Social, Economy, Environment.*

Date of Submission: 20-05-2019 Date of acceptance: 03-06-2019

I. INTRODUCTION

Infrastructure plays an important role in the development and progress of a region. One aspect that has received attention in encouraging the development of a region is the provision of infrastructure in the transportation sector, especially the availability of road infrastructure. Road infrastructure is a regional need and serves as a driver for the development of other sectors in development and the economy is cross-sectoral [1,2].

Road infrastructure has an impact on the economic growth of a region [3]. The road functions to open access from one region to another, to increase GRDP and reduce lagging areas, provide services in the process of product distribution, marketing or other community and economic activities, and provide services for long-distance community transportation and delivery city or region [4,5]. Other impacts on social life include the interaction between residents of an area with other regions, the convenience of the community in regulating their lives, the ease of meeting education and health needs, improving the quality of life and human welfare, which includes increasing consumption values, labor productivity and access to the field work, as well as prosperity and real welfare that can reduce poverty [6,7].

The road construction has increased rapidly has an impact on the use of natural resources as a form of pavement structure. The extraction of C excavated material in the river; mountain and coastal areas used in the road construction can cause landslides, erosion and abrasion so that it has a considerable role in decreasing the quality of the environment [8].

The concept of sustainable road infrastructure development can be assessed from economic, social and environmental criteria [9,10]. Sustainable roads are the process of balancing these three criteria in their implementation [11,12]. At the local level sustainable development requires that economic and social development can sustain people's lives through the use of resources locally. If the results of the economic and social development are to be distributed in the long term, then environmental protection to prevent ecological damage is one of the paths to be taken [13].

The sustainable concept that can be applied in Buol Regency is important to do research on how the influential factors in the development of sustainable road infrastructure, in order to know the opinions of stakeholders and the direction of sustainable development. The results of this study are expected to be useful as reference material for the Buol Regency Government in the formulation of development plans and sustainable road development programs.

II. RESEARCH METHODS

Location and Design of Research

This research was carried out on the district road sections, namely collector roads and the environment in the capital of Buol Regency, Central Sulawesi Province. The time of the study was conducted in December 2018 until January 2019. This type of research is descriptive, using quantitative and qualitative methods.

Population and Samples

The population is the stakeholder respondents related to the field of public works, spatial planning, residential and settlements, namely heads of regional apparatus organizations (RAO), echelon III and IV officials, auditors, ULP working groups, commitment makers (CM) to agencies related to the Government of Buol Regency, the consultant consists of site engineers, experts and inspectors, contractors consisting of directors, site managers, technical personnel and field supervisors, as well as academics, vocational teachers, journalists, drivers and the public.

A sample of 85 respondents from the government, implementers, academics and related communities were selected by purposive sampling, namely the characteristic sampling technique or special selection determined by researchers on the target population elements based on background and certain knowledge related to the research objectives.

Data collection

The data used are primary data, namely capturing stakeholder opinions through observation and dissemination of questionnaires to respondents and secondary data sourced from relevant agencies.

Data Analysis Techniques

The data were analyzed qualitatively and quantitatively, using the MS Excel Analytical Hierarchy Process (AHP) application to answer the first objective of the study. Whereas for the purpose of the second research, quantitative descriptive analysis was used to look at the problems, potentials, and other factors that influence the development of sustainable road infrastructure in Buol Regency, which then will lead to the development of these factors.

III. RESULTS AND DISCUSSION

Characteristics of Respondents

The respondent's profession is shown in Figure 1. Respondents' professions are Government (51%), Implementers (34%), Academics (4%) and Associated Societies (11%).

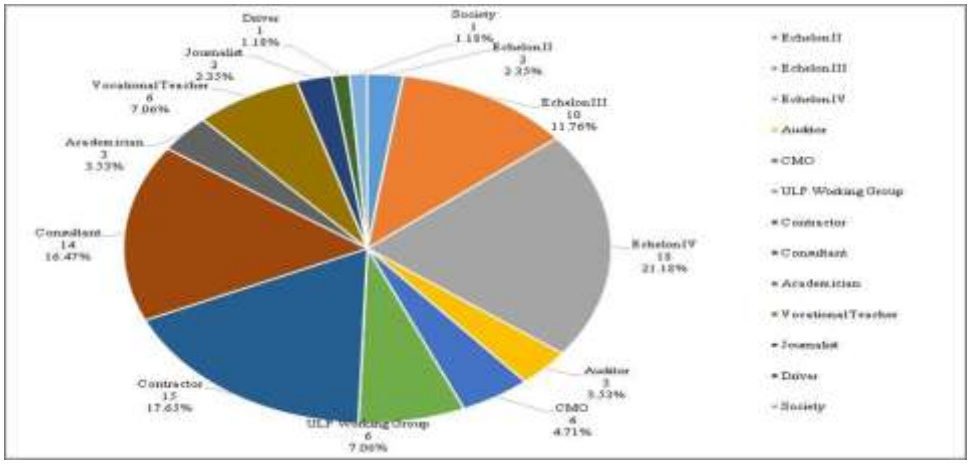

Figure 1. Respondents based on profession

Source: Analysis Results, 2019

The education level of the respondents is shown in Figure 2. This indicates that the respondents had sufficient education and knowledge to answer the questions asked.

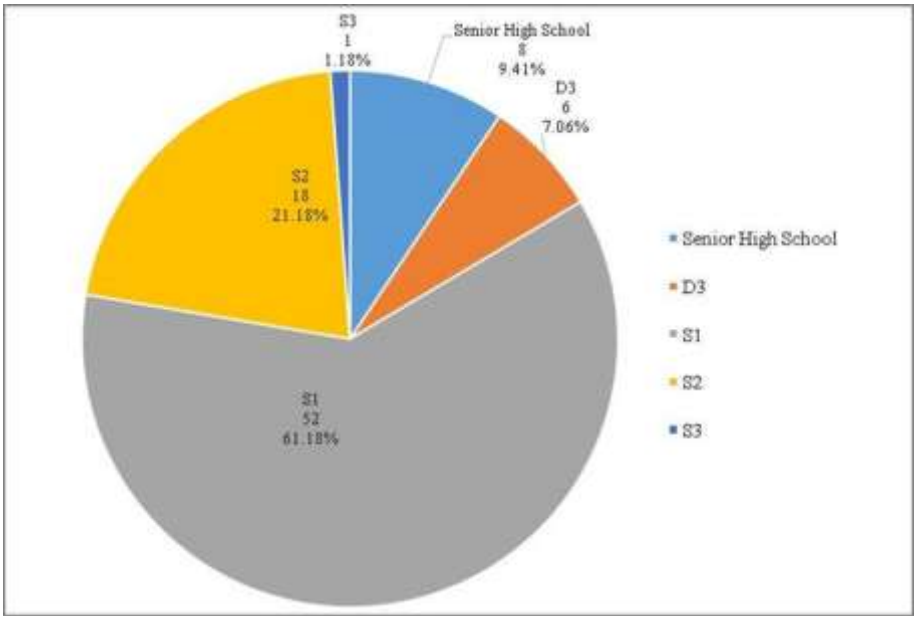

Figure 2. Respondents based on education level

Source: Analysis Results, 2019

The Influential Factors in Sustainable Infrastructure Development

Based on the results of data processing it is known that the priority factors influencing sustainable road development in Buol Regency are social and economic criteria. Priority factors for social and economic criteria have a high priority value of 0.40 and an environment with a priority value of 0.20.

Respondents tended to give priority assessments to criteria that were considered to have a direct impact on the community, such as social and economic criteria where these criteria included health, safety, accessibility, cost efficiency, road design and so on. This criterion also fulfills most criteria in the Norms, Standards, Guidelines and Criteria (NSGaC) that exist and are considered to have been able to support community needs in carrying out social and economic activities.

The description of respondents' perceptions of the influence of road infrastructure with the criteria of the surrounding environment is still low, due to taking pavement material for the construction and development of road construction, especially in the district capital only for basic embankment and choice work, while for broken stone material imported from other regions such as Donggala and sand from Tolitoli. Pavement material is brought in because the location of taking local materials is far away with the road conditions still partially land and availability, and the quality of the existing material does not meet the standards.

Factors that have a high priority level on social sub-criteria are safety factors with a priority value of 0.28. This shows the awareness of stakeholders in Buol Regency about the importance of safety. The high priority value of safety is caused by respondents' perceptions of the occurrence of accidents when infrastructure development in Indonesia and traffic accidents in the area have resulted in injuries and lives so that road infrastructure development in Buol Regency should prioritize safety factors in carrying out infrastructure work and operations. Factors that have a low priority level are road landscape factors with a priority value of 0.03. The low priority value is due to lack of understanding and knowledge of respondents to these factors. This is made possible by the respondents' perceptions of the condition of the road which is still 37.53% of the surface of the gravel and 45.68% is the land which often experiences damage due to the burden of traffic and rainfall [14]. For details, see Figure 3.

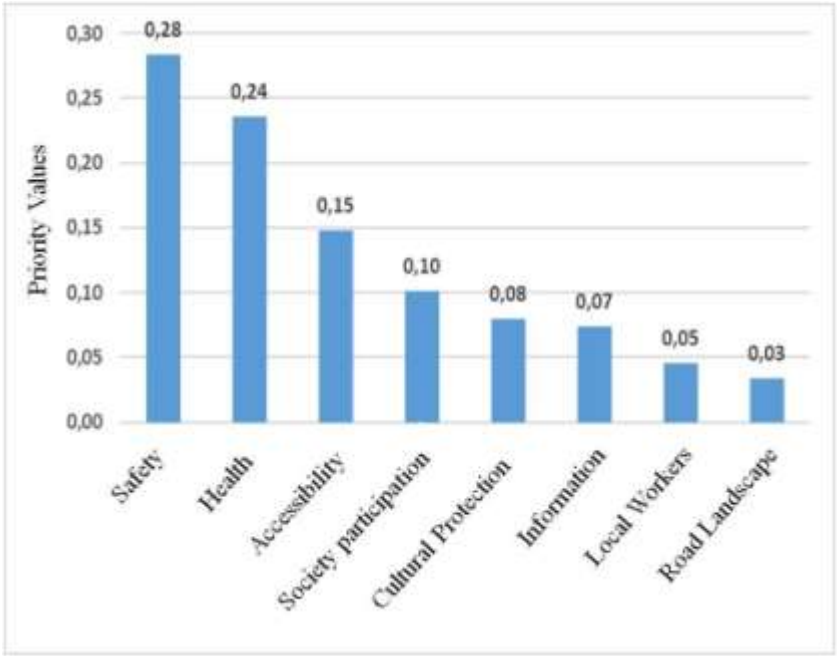

Figure 3. Priority factors for influence on social sub-criteria
Source: Analysis Results, 2019

The economic sub-criteria for developing road infrastructure in Buol Regency which have a high priority level are guaranteed construction with a priority value of 0.28. Construction guarantee factors play a role in the results of the work carried out, where providers provide guarantees that they will carry out work according to the specifications stated in the contract so that construction failures can be avoided and quality can be guaranteed. While the factors that have a low priority level in this aspect are cost efficiency factors with a priority value of 0.04. The low priority of cost efficiency shows that respondents' perceptions are currently difficult to implement cost efficiency. This is due to the fact that some of the road pavement structure material is still imported from outside the area due to not being available and having poor quality, and the lack of skilled and experienced human resources implementing activities that are not qualified as experts and technicians due to education and lack of experience in carrying out construction work the way so that cost efficiency is difficult to achieve, as in Figure 4.

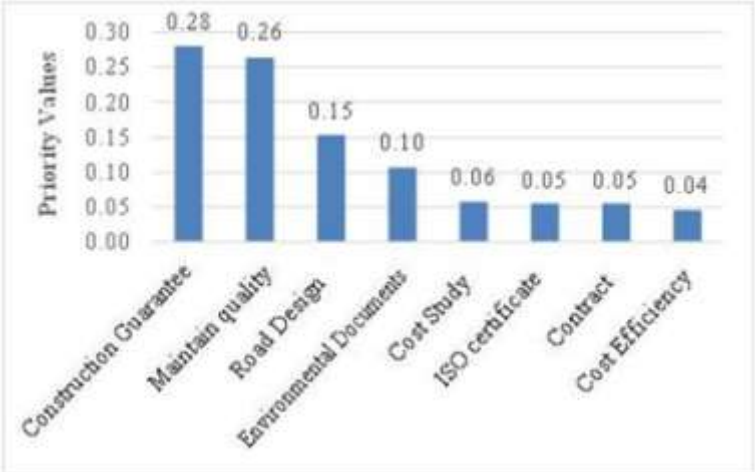

Figure 4. Priority factors for influence on economic sub-criteria
Source: Analysis Results, 2019

Factors that have priority levels in the environmental sub criteria are greening factors and flood and noise mitigation with priority values of 0.23. The high greening priority value indicates the respondent's perception of the desire for comfort on the road. The condition of Buol Regency is partly in the tropical coastal region, especially the capital of the regency. It requires reforestation, namely planting trees on the roadside and

vegetation on the road, while the priority value of flood mitigation and noise has a high priority, due to the topographic condition of Buol Regency which is around 553.97 km2 or around 13.70% between 1 to 100 meters above sea level is a lowland, so that if there is high intensity rain, and sea tides will experience puddles and cause flooding [15]. While the factor that has a low priority value on the environmental aspect is the reduction of emissions with a priority value of 0.02. The low priority value is due to the lack of understanding of respondents who think that air emissions produced by construction vehicles and equipment still have no impact on road users and the environment. This is possible because the number of vehicles and equipment used on the road is still small. The air emissions generated from the operation of road construction equipment such as heavy equipment, stone crusher, dump truck, Aspalt Mixing Plant (AMP), finisher are wrong one of the biggest contributors to air pollution, moreover the average age of vehicles and heavy equipment is over 10 years old and still uses gasoline and diesel fuel and coal in its operation. Coal is imported from Kalimantan to be used in AMP because it is more economical than diesel. Priority factors in the environmental sub criteria are presented in Figure 5.

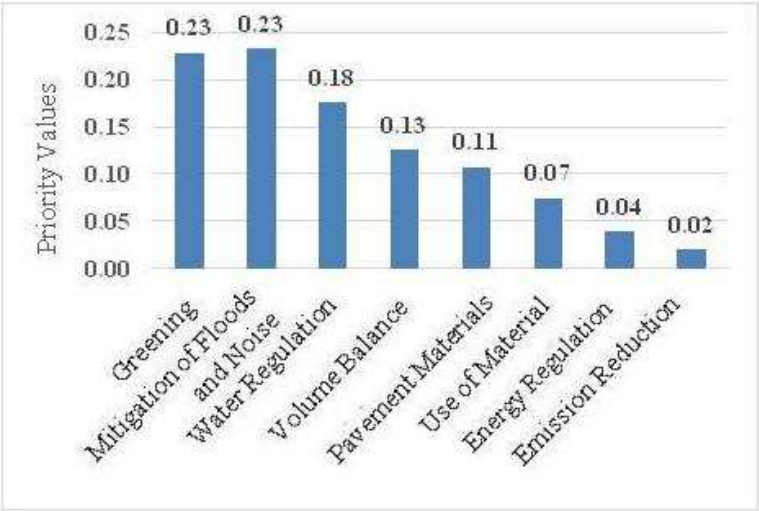

Figure 5. Priority factors for influence on environmental sub-criteria
Source: Analysis Results, 2019

Based on the aspects described above, priority factors can be sorted into 4 priority levels, as in Table 1.

Table 1. Inter-Factor Priority Levels

No.	Aspect	Factors	Value	Priority Order
1	Social	Safety	0,28	1
		Health	0,24	1
		Accesbility	0,15	2
		Society participation	0,10	3
		Cultural Protection	0,08	3
		Information	0,07	3
		Local workers	0,05	4
		Road landscape	0,03	4
2	Economy	Construction Guarantee	0,28	1
		Maintain quality	0,26	1
		Road Design	0,15	2
		Environmental Documents	0,10	3
		Cost Study	0,06	4
		ISO certificate	0,05	4
		Contract	0,05	4

No.	Aspect	Factors	Value	Priority Order
		Cost efficient	0,04	4
3	Environment	Greening	0,23	1
		Mitigation of Floods and Noise	0,23	1
		Water Regulation	0,18	2
		Volume balance	0,13	3
		Pavement Materials	0,11	3
		Use of Material	0,07	3
		Energy Management	0,04	4
		Emission Reduction	0,02	4

Source: Analysis Results, 2019

In Table 1 it is known that the main priority factors that influence the development of sustainable road infrastructure in Buol Regency are safety, construction guarantees, maintaining quality, health, reforestation, flood mitigation and noise. So the development of road infrastructure in Buol Regency has the first 2 priority factors for every aspect, both social, economic and environmental. While factors that have low priority values are local workers, road landscape, cost studies, ISO certificates, contracts, cost efficiency, energy regulation and emission reduction.

Directions for Sustainable Infrastructure Development

Based on the priority level and problems found in the field, the recommendations for road development directions in Buol Regency are as follows;

1. Improve the quality of occupational safety and health quality standards with guaranteed construction proven by ISO certificates and equipped with environmental assessment documents.
2. Increasing the involvement of the community by conducting activities such as exhibitions, open discussions and opinions on the importance of sustainable road infrastructure.
3. Improve interconnection between regions with the construction and repair of roads that meet the rules of sustainable road infrastructure and prioritize local cultural sustainability
4. Increase budget costs to improve the geometric road to improve road accessibility which will have an impact on regional economic growth.
5. Increasing the human resources of local workers in accordance with the standards set by service users.
6. Take into account the operational and maintenance costs of roads in each road infrastructure development and development
7. Increase innovation in the use of renewable energy
8. Increasing knowledge of processing local materials that are environmentally friendly
9. Conducting sustainable infrastructure planning that prioritizes disaster mitigation, especially floods.
10. Minimizing the operation of construction equipment over the age of 10 years and included in the construction contract.
11. Increase knowledge of local workers to minimize the impact of air emissions
12. Optimizing the drainage network system in the streets to avoid inundation

IV. CONCLUSION

The influential factors in developing sustainable road infrastructure in Buol Regency are social and economic criteria. Especially the aspects of safety, guarantee of construction, maintaining quality, health, reforestation, flood mitigation and noise. The recommendation for the direction of sustainable road infrastructure development is to improve the quality of quality standards of occupational safety and health with guaranteed construction proven by ISO certificates and equipped with environmental assessment documents, increasing local workers' human resources in accordance with the standard requirements set by service users and increasing knowledge of processing environmentally friendly local materials.

REFERENCES

[1]. Adisasmita R. 2005. Location Theory and Regional Development. Hasanuddin University Publishing Institute, Makassar.
[2]. Jinca, M.Y., 2015. Transportation Planning, Course Module Master Program in Transportation Engineering, Hasanuddin University, Makassar
[3]. Winanda AA. 2016. Analysis of the Influence of Infrastructure on Economic Growth in Bandar Lampung City. Essay. University of Lampung, Bandar Lampung

[4]. Arifuddin, M.Yamin Jinca, and Jamaluddin Rahim, 2017. An Analysis of the Functional Roadworthy on Perintis Kemerdekaan in Makassar South Sulawesi Province. American Journal of Engineering Research(AJER),e-ISSN: 2320-0847 p-ISSN : 2320-0936, Volume-6, Issue-3, pp-140-145.
[5]. Muhammad Samri, Muhammad Yamin Jinca, and Jamaluddin Rahim, 2018. Performance of Primary Rural Road Transport(A Case Study in North Luwu, South Sulawesi Indonesia). InternationalJournal of Engineering & Technology IJET-IJENS Vol:18 No:02
[6]. Haris A, 2007. Effect of Land Stewardship on Infrastructure Success, Directorate of Spatial Planning Bappenas, Jakarta
[7]. ArliNindita, M. YaminJinca, and TaufiqurRachman, 2019. IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE),e-ISSN: 2278-1684,p-ISSN: 2320-334X, Volume 16, Issue 2 Ser. IV (Mar. - Apr. 2019), PP 13-19
[8]. Sri Jaurianty, Muhammad Yamin Jinca, and Esther Sanda Manapa, 2018. Stakeholder Knowledge of Sustainable Road Implementation In Buru Regency. IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE),e-ISSN: 2278-1684,p-ISSN: 2320-334X, Volume 15, Issue 2 Ver. I (Mar. - Apr. 2018), PP 38-42.
[9]. Agri Kusumaningrum, ShirlyWunas, and M. Yamin Jinca, Sustainable Road Concepts InThe Dense Settlementsof Makassar City. IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE), e-ISSN: 2278-1684,p-ISSN: 2320-334X, Volume 16, Issue 2 Ser. III (Mar. - Apr. 2019), PP 37-42
[10]. MY Jinca. 2009. Integration of the Intermodal Transportation Network System on Sulawesi Island. Transportation Journal, FSTPT, Vol. 9 No. 3/2010, ISSN 1411-2422. (last accessed on 23rd August, 2018)
[11]. [I-LAST] Illinois Departemen of Transportation. 2010. Illinois-Livable and Sustainable Transportation Rating System and Guide. (http://www.cte.ncsu.edu/accountability/ documents/literature/ILAST.pdf, diakses tanggal 31 Agustus 2018).
[12]. Muench ST, Anderson JL. 2009. Greenroads: A sustainable performance metric for roadway design and construction. University of Washington, Washington, (https://www.wsdot.wa.gov/research/reports/fullreports/ 725.1.pdf, (last accessed ong 31st Agust 2018)
[13]. Setiadi R, Jawoto S, Sophianingrum M, Rosalia D. 2008, Indicators of Sustainable Development in Semarang City, Research and Technology Journal, vol.2, No.2, p. 1-6. (http://bappeda.semarangkota.go.id/v2/wpcontent/uploads/2013/12/1.-INDIKATOR_ PEMBANGUNAN-RUKUH_dkk. pdf), (last accessed on 31st August 2018).
[14]. Buol Regency Statistic Center. 2018. Buol Regency in Figures 2018, Buol
[15]. Buol Regency Government, 2017. Preliminary Design of the Buol Regency Medium-Term Development Plan for 2017 to 2022, Buol

Ricardo Sugiarta Ridwan" The Influential Factors in Development Sustainable Road Infrastructure" American Journal of Engineering Research (AJER), vol.8, no.06, 2019, pp.27-33