International Journal on Advanced Technology, Engineering, and Information System
https://ojs.transpublika.com/index.php/IJATEIS
Online ISSN 2828-5425

https://doi.org/10.55047/ijateis.v4i1.1589

Original Article

Road Infrastructure Condition Analysis in Terms of Road Quality in Bengkulu City

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Received : 24 December - 2024
Accepted : 25 January - 2025
Published online : 29 January - 2025

Abstract

The purpose of this research is to explain the analysis of road infrastructure conditions, in terms of road quality in Bengkulu City. The research method uses descriptive with qualitative approach, Research Subjects, are people and government institutions, key informants are all people or officials related to road infrastructure policy makers, traffic density and road quality, such as traffic police, transportation department, PUPR department, BPS Bengkulu City. The results of the study explain that the level of traffic density in Bengkulu City is categorized as moderate (26 vehicles / km), the population density of Bengkulu City is known to be categorized as moderate, in accordance with the demographic situation (population density) calculated per square kilometer (Km^2) in 2024 is 2,600 people / km^2, the quality of roads in Bengkulu City is well qualified, although there are several road sections that experience cracking. The occurrence of road cracks is found on 15 (fifteen) road sections amounting to 2.340%. The data shows that cracking does not significantly reduce road quality as there are still 97.660% of roads with good quality.

Keywords: Road Infrastructure, Road Quality, Traffic Density, Population Density.

1. Introduction

Bengkulu City is the capital of Bengkulu Province and has a fairly busy traffic area. This is because Bengkulu City is the center of the economy and government, and as in many other cities in Sumatra and even more widely in Indonesia, road infrastructure needs face complex challenges. This is due to population growth, economic development, and urban dynamics that continue to improve and change both from road users, the types of vehicles that use the road, this situation is a serious concern to realize and provide safety and comfort in driving for road users in general (Ramadhani et al., 2022).

It is known that the traffic density and road quality in Bengkulu City are not good, so it is categorized that the roads in Bengkulu City have inadequate infrastructure. Bengkulu City should be categorized as having good road infrastructure because the population is not so dense, the number of vehicles operating is not too large and the mobility of road users is not so dense, but it turns out that Bengkulu City has a high level of traffic accidents, road facilities are also not fulfilled (Al Qurni, 2016; Triase, 2019).

To overcome and create traffic conditions that are orderly and safe so as to reduce the number of traffic accidents, the role of various related institutions is needed (Kurniati et al., 2017; Yunardhi, 2019), such as the Public Works Office, the Transportation Office, the Traffic and Road Transport Office, the police and road users and also the community in general (Stone, 1974), one of the roles and obligations carried out by the Bengkulu City Resort Police

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(POLRESTA) in collaboration with the Bengkulu Regional Police (POLDA) is responsible for enforcing traffic regulations in the jurisdiction of Bengkulu City. The Directorate of Traffic or commonly abbreviated as Ditlantas Polda Bengkulu in collaboration with SubDitlantas Polresta Bengkulu in an effort to overcome traffic violations carries out various efforts that are preventive and representative in order to realize the security, safety, order and smoothness of traffic, one of which is to install an electronic vehicle monitoring system by implementing ETLE (Electronic Traffic Law Enforcement) is a traffic law enforcement system that uses technology by utilizing electronic devices in the form of CCTV cameras (Closed Circuit Television).

The low awareness of traffic obedience for road users is because there is still an attitude of secularity in society, namely people tend to think that violating traffic rules is not a sin, even though the violations committed can cause harm to themselves and others (Fithra & Tantawi, 2018; Sumantri & Misbahudin, 2020). Public awareness needs to be intensively raised in various ways and approaches through institutions or community groups, so as to reduce the number of road accidents in Bengkulu City. The growth in the number of vehicles that is not proportional to the increase in road capacity has resulted in slowdowns and congestion on various roads, especially on Bengkulu City roads and provincial roads. The traffic congestion makes the travel time of vehicles from one place/point to another place/point uncertain (Lasut, 2015; Purnama & Aditya, 2022; Saidah et al., 2018).

This condition greatly affects the driving pattern or cycle of the drivers, where in this situation the vehicle sometimes makes behavior that is not in accordance with the road conditions (Prayoga & Susilowati, 2017; Saidah et al., 2018), for example, light vehicles and motorcycles perform zigzag maneuvers creeping slowly towards the front of the queue when the light is red, blocking the flow of traffic by disturbing other vehicles behind overtaking out of place (Fitri, 2017). In the end, there is irregularity in traffic both from the condition of accelerating the speed of the vehicle which results in traffic. According to the Directorate General of Highways (2014), several characteristics that influence the capacity value of road segments include road segments, side obstacles, and also the size of the city, activities on road segments occur due to the lack of parking facilities so that parking activities are carried out beside the road segment, besides that public awareness / drivers when exiting and entering from the side of the road, pedestrians, and vehicles running slowly are also factors that interfere with traffic flow (Suwandi, 2017; Tjendani et al., 2020).

The problem of side obstacles also often occurs and is found on several roads in Bengkulu City, especially around the area of shops, commerce, markets close to the terminal of city transportation vehicles, this is often the behavior of drivers of low-awareness goods vehicles by not paying attention to the surrounding location, by way of example unloading or loading goods in large quantities in the road area. This is a trigger for congestion coupled with narrow roads.

Table 1. Data on Traffic Accidents in Bengkulu City

2016-2018 | 2013-2015 | 2010-2012 | Cari data statistik

Freeze judul kolom

rincian korban	Banyaknya Kecelakaan Lalu Lintas dan Korban (Jiwa)		
	2016	2017	2018
Korban Meninggal	211	239	227
Korban Luka Berat	233	269	322
Korban Luka Ringan	896	664	640
Jumlah Kecelakaan	676	622	649

Source: https://bengkulu.bps.go.id/id/statistics-table/2/MjQwIzI=/banyaknya-kecelakaan-lalu-lintas-dan-korban.html

Table 2. Population data in Bengkulu City

Wilayah	Proyeksi Penduduk 2021-2023 (Jiwa)		
	2023	2022	2021
Provinsi Bengkulu	2.086.883	2.060.092	2.032.942
Bengkulu Selatan	172.162	170.093	167.989
Rejang Lebong	283.689	281.281	278.793
Bengkulu Utara	306.201	302.833	299.395
Kaur	131.345	129.661	127.953
Seluma	216.977	213.755	210.505
Mukomuko	199.932	196.571	193.196
Lebong	107.693	107.248	106.767
Kepahiang	156.330	153.995	151.640
Bengkulu Tengah	121.509	119.814	118.100
Kota Bengkulu	391.045	384.841	378.604

Source: https://bengkulu.bps.go./id/statistics-table/2/NDE2lzl=/proyeksi-penduduk-2021-2023.html

Table 3. Data on the number of motorized vehicles in Bengkulu City

Jumlah Kendaraan di Provinsi Bengkulu, 2023/The Number of Vehicles in Bengkulu Province, 2023

Kabupaten/ Kota	Jumlah Kendaraan (Unit)			
	Mobil Penumpang	Bus	Truk	Sepeda Motor
Bengkulu Selatan	7.840	68	3.953	81.068
Rejang Lebong	10.417	59	6.278	99.742
Bengkulu Utara	11.058	45	8.748	166.344
Kaur	2.954	21	1.910	41.519
Seluma	5.786	10	4.771	90.399
Mukomuko	8.209	89	6.014	120.088
Lebong	2.137	10	1.608	32.259
Kepahiang	4.636	35	3.213	53.051
Bengkulu Tengah	4.250	21	3.334	53.794
Kota Bengkulu	53.098	897	22.114	303.736

Catatan/Note:
Mobil Penumpang terdiri dari Sedan, Jeep, dan Minibus
Truck terdiri dari Pickup, Light Truck, Truck, dan kendaraan khusus
Jumlah kendaraan secara total merupakan penambahan jumlah Mobil Penumpang, Bus, Truck, dan Sepeda Motor
Sumber/Source:
Badan Pengelolaan Keuangan Daerah Provinsi Bengkulu

Source: https://bengkulu.bps.go.id/id/statistics-table/1/MTc1OCMx/jumlah-kendaraan-di-provinsi-bengkulu-2023.html

Table 4. Road Length by Level of Authority

Panjang Jalan Menurut Tingkat Kewenangan di Provinsi Bengkulu, 2023/Road Length According to Authority Level in Bengkulu Province, 2023

Kabupaten/ Kota	Panjang Jalan (km)			
	Negara	Provinsi	Kabupaten	Total
Bengkulu Selatan	107	123	1.281	1.511
Rejang Lebong	65	126	658	850
Bengkulu Utara	104	358	514	977
Kaur	72	111	579	761
Seluma	101	176	669	946
Mukomuko	170	96	687	953
Lebong	0	81	499	580
Kepahiang	30	120	530	680
Bengkulu Tengah	85	100	414	599
Kota Bengkulu	48	39	943	1.029
Provinsi Bengkulu	782	1.330	6.773	8.885

Sumber:
1. Satker Perencanaan dan Pengawasan Jalan Nasional (P2JN) Provinsi Bengkulu, Kementerian Pekerjaan Umum dan Perumahan Rakyat
2. Dinas Pekerjaan Umum dan Perumahan Rakyat (PUPR) Provinsi Bengkulu
3. Dinas Pekerjaan Umum dan Perumahan Rakyat (PUPR) Kabupaten/Kota di Provinsi Bengkulu

Source: https://bengkulu.bps.go.id/id/statistics-table/1/MTc1NyMx/panjang-jalan-menurut-tingkat-kewenangan-di-provinsi-bengkulu-2023.html.

Traffic density is a key indicator for evaluating road capacity and the effectiveness of the transportation system in addressing congestion. Meanwhile, optimal road quality plays an important role in ensuring road user safety and reducing long-term maintenance costs. The objective of this study is to provide a comprehensive overview of the road infrastructure condition in Bengkulu City, focusing on traffic density analysis and road quality evaluation.

2. Methods

This research methodology consists of two types of research, namely literature study and field study. The literature study was conducted by collecting references related to the process and implementation of good road infrastructure from various sources, such as literature, papers, regulations, books and journals, both national and international. This study aims to obtain a theoretical basis that supports the research as well as the basis for preparing a list of interview questions. Meanwhile, field studies were conducted through informal observations in the form of data collection on road infrastructure through direct interviews with officers, agency heads, road users, and experts in the field of road infrastructure.

The data collection procedure involved several methods, namely primary data and secondary data. Primary data was obtained directly from the original source through documentation and field surveys. Field surveys were conducted to determine the level of traffic density in Bengkulu City and the condition of road quality. The survey also included non-formal interviews to identify problems and factors affecting traffic congestion and road quality degradation. In addition, data in the form of drawings and photos of work progress at week 14 were also included to provide a visual representation of road conditions.

Secondary data included detailed traffic density data obtained from the Department of Highway Traffic and Transportation (DLLAJR), the Central Bureau of Statistics (BPS), and the Department of Transportation. In addition, road quality data includes road surface conditions, road materials, road design, drainage, lighting, pedestrian facilities, and accessibility of routine road maintenance.

This research used a descriptive method with a qualitative approach. The research subjects included people and government agencies/institutions related to road infrastructure. Informants consisted of officers in agencies such as the Public Works Agency, DLLAJR, BPS, and the Transportation Agency. Key informants were the heads of these institutions who were selected based on the research criteria. Triangulation was conducted by evaluating the answers from informants and key informants through the opinions of infrastructure lecturers, traffic observers, or road infrastructure experts. Data analysis was conducted using theories relevant to the data obtained. The analytical techniques used, such as descriptive statistical analysis or regression, were adjusted to the research needs to process and interpret the data in depth.

3. Results and Discussion

3.1. Demographics of Bengkulu City

Bengkulu City has a demographic (population density) calculated per square kilometer (Km2). in 2024 is 2,600 people / km2. Meanwhile, from the data obtained that the population of Bengkulu City in 2024 was 394,192 people, with an area of 152 Km2. Based on the population density category in a city, it is usually grouped based on the number of people per square kilometer (Km²). The following are general categories for population density levels:

1) Very Low:
- < 100 people/km²
- Mostly found in rural areas or regions with limited accessibility.

2) Low:
- 100–500 people/km²
- Commonly found in small towns, suburban areas, or regions with sparse land use.

3) Moderate:
- 500–1.500 people/km²
- Typically occurs in medium-sized cities with moderate infrastructure development.

4) High:
- 1.500–5.000 people/km²
- Mostly found in large cities or developing metropolitan areas.

5) Very High:
- 5.000 people/km²
- Found in major cities and megacities such as Jakarta, Mumbai, or Tokyo, where space is extremely limited.

Based on the population density criteria above, Bengkulu City is categorized as having a high population density. This population density is influenced by various factors, such as the size of the city, population, level of urbanization, level of education and employment opportunities, and land use patterns. The city government often uses this data to plan infrastructure, transportation and public services.

Table 5. Population of Bengkulu City (in Thousands), 2020–2022

Kecamatan	Jumlah Penduduk Kota Bengkulu (Ribu Jiwa)					
	Penduduk			Kepadatan Penduduk		
	2020	2021	2022	2020	2021	2022
SELEBAR	79,5	82,8	86,0	1,7	1,8	1,9
KAMPUNG MELAYU	44,0	45,4	46,5	1,9	2,0	2,0
GADING CEMPAKA	38,8	38,7	38,9	2,7	2,7	2,7
RATU AGUNG	50,6	50,2	50,1	4,6	4,6	4,6
RATU SAMBAN	21,3	21,3	21,2	7,5	7,5	7,5
SINGARAN PATI	41,3	41,0	41,0	2,9	2,8	2,8
TELUK SEGARA	22,0	22,0	22,0	8,0	8,0	8,0
SUNGAI SERUT	25,3	25,3	25,6	1,9	1,9	1,9
MUARA BANGKAHULU	50,7	51,9	53,5	2,2	2,2	2,3
Kota Bengkulu	373,6	378,6	384,8	2,5	2,5	2,5

Data Description: Data quoted from the publication Kota Bengkulu Dalam Angka Population Size and Population Density by Subdistrict in Kota Bengkulu

Bengkulu City, as the provincial capital, has a road network that forms the backbone of community mobility and logistics distribution. However, road conditions show significant variations, namely:

a) Main Road Quality: Main roads such as Jalan Ahmad Yani, Jalan Soekarno-Hatta, Jalan S. Parman, Jalan Sutoyo and Jalan Natadirja, Jalan Adam Malik are generally in good condition, with a fairly flat hotmix asphalt surface and equipped with directions and traffic signs and equipped with traffic lights at several intersections.
b) Residential Areas: In residential areas, some neighborhood roads and connecting roads still need improvement, such as repaving or widening the road body.
c) Supporting Facilities: Poorly maintained or poor drainage or sewerage systems often cause puddles that damage roads, especially during the rainy season. This can affect the lifespan of the road infrastructure.

3.2. Traffic Density

In general, the traffic density in Bengkulu City is in the medium category, namely 26 (twenty-six) vehicles/km, however, the population density of Bengkulu City is in the high category according to the demographic situation (population density) calculated per square kilometer (Km^2) in 2024 is 2,600 (two thousand six hundred) people/Km^2,

The population density in Bengkulu City is dominated by adults, or tends to be teenagers, which is 47%. This shows that the correlation with the level of mobility is moderate, because most adults and adolescents are active indoors either at school, campus, office or at home (in door) The data states that the population of Bengkulu City can be divided into 3 groups, namely young people aged between 0 - 24 years, 41% and the dominance of adults aged between 25 - 49 years, 47%, while old age aged 50 - 75 years and over is 12%.

With the condition of the comparison between population, the length of the road shows that the quality of the road is good, because traffic or road traffic that occurs density or load on vehicles passing through the road, the level of road damage will be low or the quality of the road remains good. Therefore, in order for the road quality to remain good, it is necessary to complete road infrastructure such as good drainage/ sewerage and traffic signs and road safety are equipped. However, from the results of observations in the field by researchers, there is

still a need for additional facilities needed in infrastructure, such as the absence of a Pedestrian Bridge (JPO) facility that crosses over the road, as well as road signs and markings and a crossing or zebra crossing equipped with Pelican Crossing with traffic lights, difabel buttons to cross and loudspeakers as a sign so that motorists know there are people who will cross the road.

The latest data on road sections in Bengkulu City is 2,723.40 km long, consisting of 2,636.40 km of city roads, 48.00 km of provincial roads and 48.00 km of national roads, compared to the number of vehicles in Bengkulu City of 429,507 vehicles consisting of 54 passenger cars.550 vehicles, 967 buses and similar vehicles, 22,114 transport vehicles/trucks and similar vehicles and 303,737 motorcycles, from the data above, it is reflected that the level of traffic density in Bengkulu City is categorized as 'medium'.

3.3. Relationship between Road Quality and Traffic Density

The quality of roads in Bengkulu City based on the results of the study found that in general the quality of the road is well qualified, although there are several road sections that experience cracking. Cracking data occurs on Jalan Danau from the direction of Simpang Empat Padang Harapan to Simpang Empat Danau Singaran Pati Subdistrict, the length of the road is 810 meters, the road sheet is 6.00 meters, the level of damage is cracked along 190 meters and a width of 4 meters by 0.156% The occurrence of road cracks is found on 15 (fifteen) other similar road sections, so it can be calculated that there are 15 (fifteen) road sections x 0.156% = 2,340%.

Based on this condition, road cracks do not significantly reduce the quality of the road because there are still roads with good quality of 97.660%, therefore it can be concluded in general that the condition of roads in Bengkulu City is of good quality and thus does not cause congestion and traffic density in the medium category.

Based on the results of the discussion, it is known that the traffic density in Bengkulu City is categorized as low because the traffic density is 26 (twenty-six) vehicles / km. Road quality in Bengkulu City is categorized as good, although there are several road sections that experience cracking of 2.340%. Road infrastructure in Bengkulu City is generally categorized as good, as the Bengkulu City government periodically conducts routine maintenance.

In the theory of Infrastructure Management proposed by Grigg (1988), it is stated that road infrastructure is good because it manages public assets well, this can be seen from the field of infrastructure management:

1) Transportation System (roads and bridges)

The transportation management system carried out by the Bengkulu City Government through the Public Works and Housing Agency (PUPR) and the Bengkulu City Transportation Agency together with the Bengkulu Police Traffic Unit (SATLANTAS) always conducts periodic amdalin (Traffic impact analysis) studies to maintain the quality of the transportation system. The Bengkulu City Public Works and Housing Department periodically evaluates and monitors roads and bridges to follow up on findings and immediately carry out maintenance and repairs if damaged.

2) Clean Water and Sanitation System

Based on the results of the discussion above, the Bengkulu City Government has carried out a closed and open drainage / channel sanitation system which is an important part of the road infrastructure in Bengkulu City. Closed drainage serves to drain rainwater, waste water, and water from sidewalks, roads, and yards. To meet the clean water needs of the city community, the Government has piped clean water from clean water sources to public facilities and households in Bengkulu City. The management of clean water and sanitation

management aims to meet the needs of the community while maintaining a clean and tidy environment and maintaining the aesthetics of the city.

3) Energy and other public facilities

As a result of the discussion above, it is known that the Bengkulu City Government has implemented the provision of public facilities such as clean water, electricity, waste disposal, transportation and services to facilitate social and economic objectives. The infrastructure includes transportation, irrigation, drainage, buildings, and public facilities such as government buildings, education, health, historical and tourism buildings, and various other facilities, such as shopping facilities, sports facilities, entertainment and recreation facilities, transportation facilities, places of worship, other public facilities such as regional libraries, city parks and cultural centers. Based on the theory of infrastructure management put forward by Grigg (1988), it is evident that the Analysis of Road Infrastructure Conditions in Bengkulu City is good, in accordance with the results of the analysis of transportation systems (roads and bridges), clean water systems and sanitation and energy and other public facilities.

4. Conclusion

Based on data and observations made by researchers in Bengkulu City, it is known that the level of traffic density is categorized as Medium (26 Vehicles/Km), this is in accordance with the number of vehicles and the length of roads in Bengkulu City. Quoting the theory of Morlok (1991), although the population density of Bengkulu City is known to be categorized as High in accordance with the demographic situation (population density) calculated per square kilometer (Km^2) in 2024 is 2,600 people/Km2. Bengkulu City has an area of 152.00 Km2 with a total population in 2024 recorded at 394,192 people consisting of 198,279 men and 195,915 women.

Referring to the theory of Road Quality using PEQI (Pedestrian Enviromental Quality Index) Criteria, Jan Gehl (1971). That the quality of roads in Bengkulu City is well qualified, although there are several road sections that experience cracking. The occurrence of road cracks is found on 15 (fifteen) road sections amounting to 2.340%. The data shows that cracking does not significantly reduce road quality.

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