

Analysis of Road Functionality on the Mount Bawakaraeng Road, Makassar City

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Abstract— Highways play an important role in people's lives as one of the most important transportation infrastructure. The main function of roads is to mobilize vehicles to secure the movement of people and goods. In this research, researchers examined whether the Mount Bawakaraeng road section met the requirements for roadworthiness and what technical requirements must be met for a road to be said to be functionally fit for purpose. Based on the research results of the functional feasibility test analysis on the Gunung Bawakaraeng Road section, it can be categorized as Conditionally Functional Eligible (LS), where the road fulfills some of the technical requirements for functional roadworthiness based on PP No. 5 of 2023, but can still provide safety for road users so that it is suitable for public operation..

Keywords— Road Functional Worthiness, Road Technical Requirements.

I. INTRODUCTION

Highways play an important role in people's lives as one of the most important transportation infrastructures. The main function of roadways is to mobilize traffic for the safe movement of people and goods. Public roads intended for traffic include district / city, village, national and provincial lines. For people who want to move places both inside and outside the city, they can thus use the highway. Directly, in this case, this results in increased traffic density, congestion, and even a high rate of traffic accidents. A road section is considered roadworthy if it meets the administrative and technical standards for roadworthiness, which ensures user safety, and legal clarity for road operators and users, allowing the road to be used by the general public.

If a section of public road meets the technical specifications for road geometry, traffic management and engineering, pavement structure, auxiliary structures, road section utilization, and road equipment, it is considered fit for road use. As such, it is anticipated that roadworthiness testing will improve road safety without first requiring an incident. To reduce the likelihood of accidents, which has become a problem in the transportation industry, road feasibility studies are necessary. One such road is Gunung Bawakaraeng Road in Makassar City, South Sulawesi. The national route of Jalan Gunung Bawakaraeng serves the national activity center (PKN) of Makassar City. As for the condition of the road section on Jalan Gunung Bawakaraeng, there are frequent vehicle conflicts at intersections and frequent congestion and lack of traffic signs. Previous research is important for guidelines in the research to be carried out, some of the previous studies that underlie this include:

The physical compliance of road elements with road technical criteria and road environmental conditions to prevent traffic accidents is known as road safety. Road functionality is another term for the state of a road section that complies with technical specifications. The purpose of this study is to examine the safety implications of road test findings. This research utilizes a qualitative research methodology, which is based on the protocol for conducting road functionality tests as stipulated in the Minister of Public Works Regulation No.

11/PRT/M/2010. Afterwards, the test results and field surveys were analyzed using six technical components - geometry, pavement structure, ancillary structures, road sections, traffic engineering management and road equipment - to determine the roadworthiness category. The province of Central Sulawesi's Tambu-Tompe national road segment was the site considered. Based on the data obtained, the segments were classified as Conditionally Eligible, with 44% and 56% of the segments falling into the Functional Eligibility and Conditional Eligibility categories, respectively. Road operators can utilize the findings of this study to prioritize how to handle tasks that fall under the area of roadworthiness." [1] One of the main roads that connects Aceh Province's national activity centers to each other is the Soekarno-Hatta National Road. Roads that serve the public interest are an important part of transportation infrastructure that is essential for daily operations as it helps maintain the security and safety of users. This research aims to identify the Road Function Feasibility category and ascertain whether Soekarno-Hatta Road has met the Road Function Feasibility requirements in order to fulfill the technical Feasibility requirements to ensure user safety. The research approach is based on the Minister of Public Works Regulation Number: 11/PRT/M/2010 on Road Functioning Procedures and Requirements. According to the results of the Road Function Feasibility Test survey, Segments I, II, IV, and V have a road status of Functional Feasibility (LF) category, while Segments III and VI have a road status of Conditional Function Feasibility (LS) category. Recommendations for Rehabilitation Maintenance are made for roads that are Conditionally Fit for Purpose, while recommendations for Routine Maintenance are made for roads that are Fit for Purpose [2]. Jalan A.H. Nasution often has accidents caused by its condition, which does not meet standards such as pavement, equipment, road appendages, and adjacent sections that require researchers to conduct a road functional analysis feasibility test. The purpose of this study is to analyze the feasibility threshold on a particular lane in accordance with the PUPR RI Regulation No. 11/PRT/M/2010 on Acta Carta and Road Functioning Requirements, PUPR RI Regulation No. 19/PRT/2011 on Road Technical Requirements and Road

Technical Planning Criteria as well as the 2018 Feasibility Road Functioning Implementation Schedule. It includes discussion, analysis, and conclusion along with data collection operations. In this study, a questionnaire conducted directly at the research site was used to collect data. Afterward, the data was evaluated to determine the roadworthiness level. This study utilized both primary and secondary data sources. Geometric data, pavement structure, auxiliary structures, road equipment, traffic management and engineering implementation, and road section utilization are the primary data used. Maps showing the location of the area were the secondary data used. Primary data will be collected using this study technique (6 components of the technical feasibility test). The level of functional viability of the road on Jalan A.H. Nasution is a finding of the study. Jalan A.H. Nasution Section 007 has a conditional viability (LS) of 56.75% and a functional viability category (L) of 43.25%, both with recommendations. Although the road section is adequate for normal operation, the necessary technical modifications should take precedence [3]. A road section meets the standards for road function when it is in a state that meets the technical and administrative requirements. In accordance with the Regulation of the Minister of Public Works No. 11/PRT/M/2010, this research utilizes a qualitative methodology based on the process of conducting road function fitness tests in order to assess road safety issues from the test findings. Road geometry, pavement structure, ancillary structures, road sections, traffic engineering management, and road equipment are the six technical components of roads that are considered when processing data derived from test results and field surveys to make roadworthiness classifications. The Manado-Tomohon National Road section was chosen as the research object. The aim of this study is to evaluate the level of technical capacity and improvement of the road to meet the test requirements for road performance. According to this analysis, the Manado-Tomohon City Limits road stretch falls into the conditional functional feasibility category, which means it needs certain technological advancements. In order for the Manado-Tomohon City Limits road section to truly become a functional road, a number of technical modifications must be completed, including routine maintenance and the purchase of new road components." [4]. One of the factors that brings road maintenance together is the proper purpose of the road. The relevant rules and regulations determine this. For the government to fulfill its obligation to ensure the safety of road users and the legal certainty of road operators, the legitimate function of roads must be carried out. Technical feasibility tests are oneway road operators try to ensure the safety of their customers by evaluating the technical features of the route. The lack of applicability of road functional due diligence forms and subjective evaluations made by individual members of the functional due diligence team are two of the many challenges that remain in conducting such tests. Therefore, innovation is needed to ensure that the test form can produce objective results. A method for classifying roadworthiness and airworthiness was the next innovation. The test results on the designated road sections show that the tested road sections still belong to the non-functional feasibility category, requiring

improvement before they can reach a better fungibility category and ensure the safety of road users [5]. One of Pekanbaru City's secondary collector highways, Jalan Lobak is 1322 kilometers long. In terms of technical standards and relevance of handling, this route still needs a lot of improvement. Therefore, to determine the feasibility category of the road section and provide alternative solutions to overcome current problems so that people can receive high-quality services, research is needed on the feasibility of road functions and the level of importance of handling Jalan Radish technically. The procedure used in the AHP quantitative approach technique. Determining the significance of road function feasibility test management is the objective of this study. Road professionals and related parties filled out a questionnaire to analyze the technical feasibility test of the road and assess how important it is to handle the road function feasibility test. According to the findings of the AHP study, managing the geometric structure of the road is very important [6]. Due to limitations with support staff, surveyors, and the current database system, the relevant Transportation Agency has not conducted the road functional feasibility test in Pati District to the best of its ability. Academia should work with us as a partner to support roadworthiness testing efforts. Road feasibility test assistance with the Pati Regency Transportation Office is the purpose of this service. Three (3) ways shaped the implementation of the Community Service activities: field assistance, lecture and discussion methods, and assistance with creating a road function feasibility test database. On the other hand, pre- and post-test findings were used to assess how well the activities were implemented. Based on the experience of the road function feasibility test participants-that is, as employees of the Pati Regency Transportation Office-the highest category performed well in the pre-test with a percentage of 40%, and performed very well in the post-test with a percentage of 60%. As a result, participants' understanding improved [7]. A number of variables can contribute to traffic accidents, such as problems with the capacity of the road to support the safety, security, and comfort of drivers as they drive on it, as well as problems with the viability of the road as a means of transportation. Pavement structure, auxiliary structures, road geometry, road section usage, application of traffic management and engineering, and road equipment are some of the issues addressed. Considering that the capital city of North Maluku Province, Sofifi City, is located in a special area designated for the center of government, it is necessary to analyze the feasibility of road functions by monitoring and evaluating technical standards. This can reduce the survival rate of road functions and improve access to land transportation. Road users must realize the importance of information about the feasibility of road functions so that it can serve as a driving guide. As a result, Sofifi City needs a regional information media that is able to act as a road system. To fulfill the requirements of road function feasibility, a road network map information system is needed. This system uses Geographic Information System (GIS) to facilitate administration and data search [8]. Based on the findings, Jalan Tumora (Bts. Kab. Parimo) - Tambarana Km.157+800 to Km.168+000 Central

Sulawesi Province is now in the following states: 1) Definitions of command, instruction, and prohibition are provided: Appropriate for function with conditions, nothing to be done yet. 2) Road status: The road has a legitimate purpose and national road status in accordance with the Public Works Decree on road section designation. 3) Road class: Class II, conditional function eligibility, Directorate of Engineering Development, General of Highways, Ministry of Public Works. 4) Rumija land ownership: No action required; this is a conditional function. 5) Leger Road: Nothing can be done yet, eligible for conditional operation. 6) Environment-related documents (AMDAL, UKL/UPL): Only SPPL document to be completed. 7) Completion of road administration documents is suggested by the Makassar National Road Implementation Center VI to occur no later than 2017. Some of the technical standards for the surrounding area that are visually assessed and monitored in order to analyze the road functional feasibility test are road geometry engineering, pavement structure engineering, auxiliary structure engineering, road section space utilization engineering, traffic management and engineering, and road equipment engineering, including with. [9]. Thus, the purpose of this study is to assess the road's functional feasibility and the changes needed to achieve it, as determined by the Roadworthiness Test (ULFJ) and the Minister of Public Works Regulation No. 11/PRT/M/2010. A road section passes the roadworthiness test if it meets the administrative and technical standards for roadworthiness, which ensure user safety, and legal certainty for road operators and users, allowing the road to be used by the general public. Road geometric technical, pavement structure technical, auxiliary structure technical, road section space utilization technical, traffic management and technical engineering, and road equipment technical are the technical standards that are visually evaluated and monitored to analyze the road technical function feasibility test. The research findings show that the lower Tumpa-an-kawangkoan road section is classified as Functionally Conditional (LS), which means that although it meets some technical requirements for road function, it still maintains a level of safety for users, making it suitable for public use. However, technical improvements related to the road section are required, including regular maintenance and repairs for any test components classified as Functional Conditional (LS). [10].

II. METHODOLOGY

A. Location and Time of Research

The research site is located on Gunung Bawakaraeng Road, Makassar City, South Sulawesi Province. The route used is the national route, which is the main route other than the toll road to reach the city center. The process of collecting data and taking photos was carried out from noon to evening. The survey time for data collection was conducted over two days, Saturday and Sunday.



Figure 1. Research Location

B. Data Retrieval

1. Primary Data

Primary data is collected directly by direct field observation to get the right data, data collection methods can include testing or observation. The following is the data that will be seen

- Road Geometric Technical Data is collected by measuring and observing traffic lanes, medians, road shoulders, side channels, and sidewalks of each section following the functional feasibility test format of the Directorate General of Highways.
- Information collected by monitoring road facilities, including traffic signal devices (APILL), road signs, markings, dividers, sidewalks, side channels, and crosswalks, is used
- to implement traffic management and engineering.

2. Secondary Data

Information collected indirectly through archives or records is referred to as secondary data. This data is collected through interviews or relevant viewpoints. Secondary data includes things like average daily traffic (LHR) and location maps. The Directorate General of Highways of South Sulawesi provides Daily Traffic Data (LHR).

III. ANALYSIS AND DISCUSSION

A. Analysis

1. Road Geometric Data

The research data for the segment of Gunung Bawakaraeng Road that meets the standard is only taken from the 664.8 meters that are the subject of this case study. Because it connects provincial capitals, Jalan Gunung Bawakaraeng qualifies as a national road. In order to function as an arterial corridor that connects national activity centers with regional activity centers. Jalan Gunung Bawakaraeng is classified as a class I road, meaning that motor vehicles weighing more than 10 tons and with dimensions no greater than 2500 mm can travel on it. The Highway class is included in the Road Infrastructure class for Gunung Bawakaraeng Road. Road body cross section, horizontal alignment, and vertical alignment are the three types of road geometry data used in this study. The road body cross-section is used to analyze traffic lanes, shoulders, side drains, and traffic safety measures. Horizontal alignment includes measurements of straight road segment length, visibility, and road environment. Longitudinal slope, visibility, and route climate were evaluated in an upward setting.

TABLE 1. Road Geometric Data

Geometric Data										
Segment	Number of Paths	Number of Lanes	Lane Width (m)				Separator Width (m)	Separator Height (m)	Shoulder Width (m)	Gutter Width (m)
1	1	4	3,84	3,64	3,82	3,94			1,9	1
	1	4	3,69	3,60	3,57	3,63	0,75	0,25	1,9	1
2	1	4	3,69	3,60	3,57	3,63	0,75	0,25	1,9	1
	1	4	3,84	3,64	3,82	3,94			1,9	1
	1	4	3,69	3,60	3,57	3,63	0,75	0,25	1,9	1
3	1	4	3,69	3,60	3,57	3,63	0,75	0,25	1,9	1
	1	4	3,84	3,64	3,82	3,94			1,9	1

2. Functionality and Segment Analysis Data

To conduct this case study, the stretch of Gunung Bawakareng Road was separated into three sections. The feasibility analysis for this function was conducted as a two-part evaluation as follows.

- A. Technical Geometrics of the road
- B. Technical Implementation of Traffic Management and Engineering



Figure 2. Data Plan for Fit-for-Purpose Analysis and Segment Division

3. Road Classification and Technical Criteria

Only 664.8 meters of Gunung Bawakaraeng Road were examined in this case study as research material for a portion of Gunung Bawakaraeng Road that met the following requirements:

1. Due to the inclusion of routes connecting provincial capitals, Jalan Gunung Bawakaraeng qualifies as a national road connecting national activity centers with regional activity centers by acting as an arterial route.
2. Class I roads, such as Gunung Bawakaraeng Road, allow motor vehicles weighing more than 10 tons, having a maximum size of 2500 mm, and a maximum length of 18000 mm to pass. Class of highway and Gunung Bawakaraeng Road for Class of Road Infrastructure.

4. Road Function Test Analysis Results

The Roadworthiness Test is a test conducted to see whether a road section meets the technical and administrative requirements to fulfill the laws and regulations in the field of roads and provide safety for its users. The procedures and requirements for roadworthiness are regulated in Minister of Public Works Regulation No. 11/PRT/M/2010. The Road Function Feasibility Test Team consists of elements of road

organizers, elements of traffic and road transport organizers, and elements of the police. The Road Function Test Team consists of experts in the fields of road engineering, road geotechnics, bridge engineering, traffic/transportation engineering, as well as environment and road administration. Furthermore, if necessary, the Roadworthiness Test Group may consist of universities, exploration foundation components, road expert relationships or other components that meet the criteria. The testing stage is the implementation of the tested components in accordance with technical and administrative requirements, this stage contains the preparation of recommendations for the fulfillment of the given time period. Field surveys are used to conduct direct observation or inspection, compare field conditions with technical requirements, and conduct assessments according to applicable regulations. After the test is carried out, the data that has been obtained is compiled to determine the status of road function feasibility, fulfillment recommendations and the time to fulfill the recommendations. In addition to manual form filling and data collection, the roadworthiness test is also carried out through physical inspection of the road. Field assessments are conducted to determine the level of road welfare and safety.

TABLE 2. Results of Road Function Analysis

No	Geometric elements	Data		Criteria	Description
1	Number of Lanes	4		Min. 2	L
2	Lane Width	Without Separator	With Separator		L
		3,84	3,69		L
		3,64	3,60		L
		3,82	3,57		L
		3,94	3,63		L
3	Road Shoulder Width	1,90		2,00	T
4	Gutter Width	1,00		1,00	L

The road geometric data in this study is divided into 3 segments, namely segment 1 starting from the intersection of Jl. Latimojong - intersection of Cerekang River Road with a road length of 222 m, segment 2 from the intersection of Jl. Cerekang River - intersection of Jl. G. Lompobattang with a road length of 221 m, and segment 3 from the intersection of Jl. G. Lompobattang - intersection of Jl. Jendal Sudirman with a road length of 221.8 mm.

The traffic lanes on these three segments after measurements were made in the field, with measurements made from the outer markings to the inner markings obtained 15.24 m, in PP/PU No.5 Article 6 of 2023 concerning PTJ stipulates the width of the traffic lane at 15.00 m.

The traffic lanes on these three segments after measurements were made in the field obtained different sizes in segments 1-3, for the lane width in accordance with PTJ in PP/PU No.5 Article 6 of 2023, namely 3x3.50 m, then in these three segments it is categorized as functionally feasible because it is in accordance with the size that has been set in PTJ, both in the width of the lane with separator and without separator.

The shoulders of the road on these three segments after measurements were made in the field only obtained the outer

shoulder size categorized as conditionally functionally feasible because it almost meets the size set in PP/PU No.5 Article 7 concerning PTJ, namely for the outer shoulder 2.00.

The median on these three segments after field measurements were obtained with a width of 0.75 m and a height of 0.25 and the separator on this road was categorized as not functionally feasible because it did not comply with the dimensions set in the PTJ, namely the minimum median width of 2.00 m.

The side channels on these three segments after field observations were obtained with a width of 1.00 and all channels were closed, so the side channels on these three segments were categorized as Functionally Eligible because they had met the PTJ.

So, in these three segments after looking at several components obtained in the field, namely road width, lane width, shoulder width, and separator, Jalan Gunung Bawakaraeng can be categorized as a Conditionally Functionally Eligible Road (Ls) because there are several components that have complied with the Technical Requirements for Roads but still require some handling to be able to rise to the Functionally Eligible Road (L) category.

Road markings, traffic signs, sidewalks, and traffic signal devices (APILL) are the data sources used in this study on the use of traffic engineering management. Data on the implementation of engineering and examples of traffic management are inspection of road section traffic signs and road markings;

- a. Markings: In segments 1-3 there are lane divider markings but some markings in this segment have faded, therefore this segment can be categorized as Conditional Functional Worthiness (Ls).
- b. Signs: In segments 1 and 2 there are several prohibition signs, namely no parking signs and no stopping signs and in segment 3 there are traffic warning signs, intersection warning signs, and guide signs with placement and conditions that are still good, and can be categorized as Functional Worthiness (L).
- c. Sidewalks: In segment 1 there is a sidewalk right in front of SMAN 1 and the Adidas store and in segment 3 right in front of the photocopy shop in good condition, and categorized as Functional Worthiness (L).
- d. Crossings (Zebra Crossing): Located in segments 2 and 3 in a color condition that is starting to fade.
- e. Traffic Signal Devices: In Segment 3 there is an APILL with a Functional Worthiness (L) condition.

TABLE 3. Traffic Engineering Management Observation Results

STA	MARK			Sign			Sidewalk	APILL	Crossing Place	
	Lane divider	Zebra cross	Stop Line	Warning	Prohibition	Instruction			Zebra Cross	Pedestrian bridge
1	✓				✓		✓			
2	✓	✓	✓		✓				✓	
3	✓	✓	✓	✓		✓	✓	✓	✓	

This component consists of 7 (seven) sub-components, namely markings, signs, separators, road islands, sidewalks, traffic signal devices (APILL), and crossings. Two sub-

components that were not assessed because they were not available in the field were medians and road islands. The road marking sub-component was assessed as conditionally functional because along this road section the markings had faded. The road sign sub-component was assessed as functionally feasible because there were several prohibition signs on the road section and they were in good condition. The APILL in the form of three-color lights (red, yellow, green) was stated as functionally feasible because it was placed at an intersection with the aim of avoiding obstacles due to differences in road flow for vehicle movement. The crossing was assessed as functionally feasible because there was a zebra crossing.

B. Discussion

Based on the results of the geometric engineering analysis of Gunung Bawakaraeng road. The values obtained for the basic number, lane width, lane width, lane width and gutter width meet PP/PU No. 5 article 6 and the width of the road shoulder does not meet PP/PU No. 5 article 6, so that the road shoulder located adjacent to the traffic lane used for stopping broken down vehicles and space to avoid emergency situations needs to be widened by looking at the specification standards for the width of the road shoulder. The results of the analysis for traffic engineering management in this study in the form of signs, markings, separators, road islands, sidewalks, traffic signal devices (APILL) were obtained. In the section of the crossing (zebra crossing) and markings, the color began to fade and required handling in the form of repainting. The sub-components of road markings are considered conditional. Since there are many functioning and well-maintained prohibition signs on the road, the subcomponents of road signs are considered functional. Since they are placed at intersections to prevent difficulties caused by variations in road flow for vehicle movement, the APILL, which consists of three-color lights (red, yellow, and green), is considered feasible to operate.

IV. CONCLUSION

The results of the functional feasibility test analysis of the Gunung Bawakaraeng Road section show that the road is included in the Conditional Functional Feasibility (LS) category, which means that even though the road meets several technical requirements for road feasibility based on PP No. 5 of 2023, the road can still provide safety for road users and be used by the general public. Technical improvements to the road segment are needed, including routine maintenance and repair of each test component included in the Conditional Functional Feasibility (LS) category.

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