

## An Analysis of the Functional Roadworthy on Perintis Kemerdekaan in Makassar South Sulawesi Province

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**Abstract:** The Infrastructure of Perintis Kemerdekaan Road in Makassar is only conditional feasibilities technically and administratively. In this case, there are parts of the road that have not fulfilled the minimum standards but remain safe. This research aims to explain the feasibility of road functions and formulate efforts to achieve the conditions of functional worthy. It uses a feasibility test method with 5W+1H analysis. The results of the analysis indicate that the road is categorized as a conditional function.

**Keywords:** Roadworthy, Engineering and administrative Requirements, Road Safety

### I. INTRODUCTION

Human and logistic mobility in the economy is still highly dependent on the reliability and level of road transport network services, as most are still transported through existing road transport<sup>[1]</sup>. The low level of road services greatly affects the smooth movement of the economy and causes a high social cost to road users. Currently, road infrastructure still has many sub-standard specifications that are at risk to road users' safety.

Perintis Kemerdekaan road in Makassar is a national road, including the primary road network, serves as an arterial road. Type of road segment is the first class highway category, serves as a liaison between regions and or in urban areas<sup>[2]</sup>. This road is structured according to the spatial plan and the service of distribution of logistics and services to support the development of the region by connecting all the distribution service nodes in the form of centers of activities such as Makassar City to Parepare, Bone and continuing to Kolaka or Kendari and so on. The problem of this research is how to explain the status of the feasibility of road function and strategy of improvement or achievement of road function in optimizing service to road users.

This research is based on current conditions and survey activity on the road of Perintis Kemerdekaan in Makassar South Sulawesi. The data collection consists of geometric, construction, management of traffic engineering, and road equipment<sup>[1,3]</sup>. The road infrastructure is increasingly demanded to respond to user needs and not just skip vehicles, but factors such as convenience, travelling time, and forgiving roads must be answered and realized. Roadworthy is an instrument to test and measure the viability of a road by assessing the components or parts of the road comprehensively with benchmarks of Norms, Standards, Guidelines and Criteria (NSGC).

The analysis techniques are used: the roadworthy test method, namely comparing the Norms, Standards, Guidelines and Criteria (NSGC) and method of 5W+1H (what, when, where, when, why and how) to determination of road categories (FF=Feasible Function, CF=Conditional Functional, and NF=Not Functioning) is looking at the whole of the assessed or tested aspects, and road function feasibility is a descriptive analysis according to the aspects of economy, technique and safety.

### II. RESULTS AND DISCUSSION

#### Geometric cross sections of the road

In the traffic lane section, Perintis Kemerdekaan road of Makassar has not fulfilled the NSGC standard seen from the width of the lane only 2.55 - 3.2 meters. The Road Technical Requirements (RTR) and some other rules for the primary artery road function of the road width should be 3.5 meters (11-13 feet)<sup>[3,4,5,6,7]</sup>. Similarly, the transverse slope, not along the segment having a slope of 2 - 3%<sup>[8]</sup>, in some parts is flat so that surface drainage (drainage on the surface of asphalt) is not maximal. Shoulder width, elevation to the face of the road, pavement and transverse slope, no one has qualified or only on certain segments that fulfill.

The median width of the road, type, and pavements had an eligible which has a width of between 3.3 - 3.8 meters, with elevated type and vegetation therein, some median openings are not yet eligible because they

are not equipped with a deceleration lane, not sufficient according to the class of road and lane acceleration. Thus, ideally openings in the median can only be performed for roads with a median lowered<sup>[1]</sup>.

The channels have trapezium form with inadequate slope. The safety threshold at some segments is less than 1 meters required. As for the safety rail is not required on this road segment.

**Table 1.** Technically test of geometric cross sections

	Focus Of Testing	Feasibility Status	Fact Field	Suitability With Nsgc (Recommendations)
		(FF/CF)		
Lane of traffic	Functionality	FF	Linked the region in stages	ok
	Compatibility with traffic lines served	CF	Dominated by urban transport with short routes and frequent slowing/congestion (VCR = 0.7)	Need for traffic engineering management
	Number of lanes	FF	6 lane-2-way lanes divided (6 / 2B)	ok
	The width of each lane	CF	Width lanes 2.55 m, 3.2 m and 2.9 m	Need to increase the width of the lane
	Cross-slope	CF	The straight section has a slope of 0 - 3%, while the super elevated bend 3 - 8%	It needs to improve the transverse slope.
Shoulder	Shoulder width	CF	The shoulder width varies, between 0.8 m - 4 m	Need to increase shoulder width
	Position of shoulder against front pavement	CF	Elevation of shoulder against the face road varies from 0 - 26 cm	It is necessary to improve shoulder elevation with suitable material
	Shoulder pavement	CF	Aggregate class A (broken stone), Sand-Stone class C, round cubes with diameter up to 15 cm, muddy ground or muddy.	It is necessary to repair the shoulder material with suitable material
	Cross-slope	CF	Slope 2% - 10%	Need to improve slope 4% - 6%
Median Street	Wide median	FF	The median width meets between 3.3 - 3.8 m.	ok
	Type of Median Road	CF	Median type is elevated with curb <18 cm	Need to increase kerb height
	Median Pavement Type	CF	Garden (grass and bush) with height <1.2 m	Need high increase
	Aperture on median	CF	There is an opening distance of < 0.5 km	Need to reset the median aperture distance
Drainage side	Width of Drainage side	CF	There is a drainage width <1.0 m	Need to improve channel dimensions
	Shape of drainage side	FF	Forms trapeziums	ok
	The function of running water	CF	There are puddles, the water does not flow maximally, there is sedimentation / blockage > 10% etc.	It needs to improve the slope and cleaning the channel regularly
Safety threshold	Safety threshold width	CF	There is a safety threshold <1.0 m	Require addition of threshold width
	Safety of road construction	CF	The position of the retaining wall is not positioned > 1 m from the outer edge of the drainage	Needs improvement to ensure that the safety threshold to meet the minimum standard of > 1 meter
Traffic safety devices	Safety guardrails	FF	Not required	ok
	Concrete barrier	FF	Not required	ok

**Notes:** Stages of handling:      :1-5 years,      : 6-,10 years,      :11-15 years,      : > 15 years

**Source:** Data, March 2017,

**Geometric alignment of the horizontal and vertical**

Overview of horizontal alignment includes up straight sections, curves, intersections and access in. For straight and bend sections, road segments qualify, unless the road environment is a commercial area (crowded activity). The cross section and access is not eligible, the distance ranges from 0.05 - 1 km less than required, i.e. must be greater than 500 meters<sup>[9]</sup>. Similarly, plot line access is available along the road.

The vertical alignment of Perintis Kemerdekaan Road of Makassar on the straight, the climbing lane and the vertical arch fulfills the requirement that there is no a climbing or decrease beyond the provisions. At km 12+350 there is an overlapping between the horizontal and vertical alignments, but it's still within the limits corresponding to the RTR.

**Table 2.** Elements of technical functions of horizontal and vertical alignment

	Focus of Testing	Feasibility Status	Fact Field	Suitability With Nsgc (Recommendations)
		(FF/CF)		
<b>Horizontal Alignments</b>				
Straight section	The length of the straight part of the road	FF	The length of the straight road is <3,000 m	ok
	Distance viewing	FF	Viewing distance to stop > 75m and Viewing distance to precede >350m	ok
	The road environment	CF	No access restrictions	Require restricted login access to reduce conflict
Bending section	Radius bend	FF	Radius bend > 110 m	ok
	Super elevation	FF	Super elevation < 10%	ok
	Distance viewing	FF	Distance viewing > 5 m (side interference)	ok
Intersections in the same level	Number of the intersections per Km	CF	Distance on the junction is 0.05 - 1.00 km	Need to restrict access by making frontage or slow lane
	How to access to the main road	CF	Can be accessed along the road and does not have a hierarchy.	Need to restrict access to the main line or the addition of signs
Parcel Access	Total access to plots	CF	There is more than 1 parcel access within 1 km	Require restrictions on the access of plots or the manufacture of frontage or slow lane
	Access to the main road	CF	Can be accessed along the road and does not have a hierarchy.	Require restrictions on the access of plots or the manufacture of frontage or slow lane
	Access form	CF	Form of direct access to the main line, no transition path	Require restrictions on the access of plots or the manufacture of frontage or slow lane
<b>Vertical Alignment</b>				
Straight section	Slope elongated	FF	There is no incline > 8%, or convex radius $\geq 2,000$ m and concave $\geq 1,500$ m	ok
	Distance viewing	FF	No vertical curved condition has visibility below the minimum distance	ok
	The road environment	CF	Road environment is a commercial area without safety	Need a safety fence
Climbing lane	The necessity of its existence	FF	Not required	ok
	Width and length of lane	FF	As above	ok
	Transition areas in and out of the lane.	FF	As above	ok
Vertical arch	Sharpness of the arch	FF	The maximum ramp is only 3% with convex radius > 2000 m while for concave > 1500 m.	ok
	Distance viewing	FF	Viewing distance to stop > 75m and Viewing distance to precede >350m	ok
	The direction of the road behind the arch	FF	There is no sharp bend in the arch (2 vertical arches on 1 horizontal arch)	ok
	The combination of vertical and horizontal arch	FF	There is a combination of vertical and horizontal arcs with a skill of <3% and radius of bend > 400 m	ok

Notes: Stages of handling:   :1-5 years,   : 6-,10 years,   :11-15 years,   : > 15 years

Source: Data, March 2017

**Pavement structure**

The type of road pavement used the condition and the strength of the construction is categorized Function Feasible (FF) that is using rigid and flexible pavement or combination between both of them. The type of pavement structure is corresponds to the traffic served, the class of road function and the class of road usage. The condition of the pavement road is categorized steady with the value of International Roughness Index (IRI) averaging 4.93 (cm/100 m). Another measure for measuring road surface stability is to use the Surface Distress Index (SDI) value, i.e. surface damage index by looking at the type and amount of damage per 100 meters or per

kilometer. Strength of road construction is relatively able to withstand the road plan life, can drain the water and there is no puddle in the hole. These conditions are categorized as Function-Worthy (FW).

#### **Complementary building structure and utilization of road parts**

The equipment building on Perintis Kemerdekaan road like the culvert has not fulfill the RTR i.e. flat terrain is required at least one every 200 meters distance. In fact, there are only 2 building of culvert within 5.5 km. The equipment building such as cross-over or lower bridges and pontoon are not required on this road. Parking spaces, retaining walls and roadside drainages, they have not fulfilled the requirement, namely there is not enough parking space (specifically for parking). In fact, the shoulder of the road is used as a parking area. The retaining wall is the condition it's broken. While the roadside drainages is not entirely has a width greater than or equal to 1 meter, as well as the inclination of puddles are some point without waterways and the drainage floor that have been peeled or even a buildup of waste or material.

Utilization of road area like the road space benefits section has not fulfilled the requirement that the width of it only 25-29 meters measured from the existing building on the left-right side of the road. If it is accumulated starting from the safety threshold, channel, shoulder, pavement and median, the minimum width should be 32.5 meters<sup>[3]</sup>. The shoulder is not used as a function, but it uses for vehicles parking and greening trees. For the road belonging space, besides the width that does not fulfill it is also used by the traveling trader. Thus, it's not optimal utilization for utility placement.

The road monitoring space on some parts of the road found dozens of buildings located not only, but it's also in the shoulder of the road that disrupts the traffic flow. As the rules of the minimum width of the road monitoring space 15 meters measured from the road space benefits section peg.

#### **Implementation of management and traffic engineering**

Management and traffic engineering on Perintis Kemerdekaan road has been equipped with road markings, signs, traffic alert and crossing lines, but it's not yet optimal, at some point of intersection should be equipped with guide markers, dividing markers and zebra cross. Likewise with signs and traffic lights, at some point found signs that are installed but less functioning optimally, obstructed by trees. Conversely, there are also locations that require sign or traffic lights, but it's not paired.

Separators, roads and sidewalks do not exist on this road, but base on the traffic conditions and other road users (pedestrians), sidewalks are a necessity of this road. At certain points, found the number of pedestrians with the intensity reaching tens of people every hour. For the crossing lines in the form of zebra cross is not equipped with a crossing sign or traffic light so endanger pedestrians against the possibility of getting hit by a vehicle.

#### **Road equipment and road users**

Road equipment that is directly linked to road users such as separator, Road Island and sidewalk is not available on this road. Marks, signs, traffic light and road transport support facilities only categories Conditional Functional (CF) i.e., there is, but only fulfill a part of the technical requirements.

Non-direct road equipment with road users include guidance pegs, kilometer pegs, hectometer pegs, the road belonging space pegs, boundary pegs, road fences, rest areas and road equipment facilities. Some equipments are such as guidance pegs are not needed because there are no sharp curves that coincide with the abyss, as does the boundary pegs, so in this section it is categorized as Conditional Function (CF).

The hectometer pegs are not installed at all, the road belonging space peg is only at a distance greater than 50 meters. Kilometer pegs, from its dimensions, shapes and writing are appropriate, but the placement of it, there are positioned on the road shoulders.

High pedestrian intensity on Perintis Kemerdekaan road can lead accidents so that it's required a fence between pedestrians and vehicles. This fence to avoid pedestrian crossing the road. In this section, there is no fence separator at all. Another disadvantage is the facility of safety equipment for road users such as the median curb road less than 18 cm with vegetation or a roadblock that is not high enough to block the glare of the lights at night. While for the rest areas are available almost along the way.

#### **Administrative requirements**

Administrative requirements are necessary because it relates to legal aspects in handling and managing of roads. Fulfillment of administration requirements look as in Table 3.

Table 3. Fulfillment of administrative requirements

Item	Explanation	Status of Worthy	Suitability With NSGC
		(LF/CF)	(Recommendations)
Determination of the Instructions, and Prohibitions	Not available	CF	Need to be equipped
Status of the Road	Status of National Road based on the decree of Ministry of Public Works and People's Housing of the Republic of Indonesia Number: 248/KPTS/M/2015 On the Road Determination In Primary Road Network According to Its Function As Artery Road and Collector Road-1	FF	ok
Road Class	There has been no stipulation of the Minister of Transportation Decree on Class Road Classification	CF	There needs to be a determination from the relevant ministries
Ownership of Rumija Land	No land ownership certificate yet, still in process	CF	Need to be equipped
Leger Road	There is already a street legend	FF	ok
Environmental Documents (EIA, EMaE / EMoE, SEEMS)	There is already a DELH document in 2015, Environmental Permit No: 0019/P2T-BKPM/9.14.P/VII/11/2015 from the Governor of South Sulawesi	FF	ok

Notes: Stages of handling: ■ :1-5 years, ■ : 6-,10 years, ■ :11-15 years, ■ : > 15 years

Source: Data, March 2017

### III. STRATEGY OF ACHIEVING ROAD FUNCTION

Strategy in achieving the feasibility of road function is done with the following efforts:

- For Conditional Function (CF) road parts, priority handling is made, by prioritizing of vital (important) parts or components of the road or related to the safety aspects. The next priority, handling can be optimized on the parts of the road that is easy and inexpensive to be implemented.
- Existing conditions are difficult to fulfill the technical aspects of road functionality because of the road parts such as safety thresholds, shoulders and lane roads still do not fulfill minimum standards (additional land required). So strategy to handle this case can be done by swapping the road with roads that can be upgraded to functional functions such as the ring road, or downgrading the road to become a district road.
- Road safety is an integral part of road functionality. Parts of road equipment such as guiding pegs, guardrails, signs and others have to adopt the concept of forgiving road that is the way to forgive the road users from fatal accidents. In this case, the road equipments do not become a point hazard<sup>[10]</sup>.
- The achievement of road functional is a process carried out jointly not only by the performance of Directorate General of Highways and Transportation but also from the police, municipal or district government and the whole community either as a road user or resident who lives in the region<sup>[7]</sup>.

### IV. CONCLUSION AND RECOMMENDATION

#### Conclusion

The technically and administratively aspects, Perintis Kemerdekaan road of Makassar can only be categorized as Conditional Function (CF) i.e. a condition in which the road segment only fulfills part of the technical requirements of feasibility but still provides safety for its users, and so also the administrative requirements have only a portion of the document as required.

#### Recommendation

Achievement the road functions-worthy should be done consistently (planned and phased) by prioritizing the important component but cheap and easy to be implemented. This plan is made in the form of a master plan that is drafted together by involving related elements (Directorate General of Highways, Transportation Department, Police, Local Government and Society).

All elements should coordinate and cooperate continuously in order to enforce the rules in returning the function of the road parts. Gradually, this can be directed to a larger goal of looking possibility the road widening to provide frontage, pedestrian safety and facilities for people with disabilities etc.

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