

Prospect of the Development of Makassar-Maros-Malino Alternative Road in Gowa Regency of South Sulawesi

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Abstract: Congestion arises due to the increasing volume of private vehicles which is not accompanied by rapid infrastructure development and the lack of discipline of drivers in using their vehicles. This study aims to (1) analyze the relationship between preferences individual and choose of alternative roads; (2) the variables that have a significant effect for choose of alternative roads and; (3) analyze the sensitivity of developing alternative roads. This study uses a survey method with data collection techniques using questionnaires and interviews, the number of samples used is 250 respondents, used is the conditional logit model with STATA software. The results of the study show that Travelers more likely to choose alternative 1"; the variable of time and costs are significant in the route selection model, route selection between alternative 2, alternative 3 and alternative 1 can have a significant effect if the cost variable is added to each of these alternatives.

Keywords: Mobility, Traffic Demand, Grou in Vehicle, Development of roads

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I. Introduction

The transportation system in general involves the movement of goods/people from one place to the destination, the movement must be supported by adequate space and facilities so that the transportation process can be achieved optimally in a certain space and time taking into account the factors of safety, comfort, smoothness, and time and cost efficiency. Problems then arise in several countries, especially developing countries such as Indonesia. Indonesia's increasing economic growth has a positive effect on people's ability to travel from one place to another. On the other hand, the availability of transportation facilities and infrastructure in Indonesia is still inadequate in terms of quantity and quality. As is the case with urban transportation conditions which are always characterized by uncontrolled traffic jams, this is a very complex problem which is the resultant of the interaction and combination of many aspects of life and the life of a city. City transportation which is physically seen in the form of very chaotic traffic of vehicles and people is a logical result of economic development[1].

Makassar is one of five metropolitan cities in Indonesia with a recorded population of 1,338,663 people in 2010[2]and 2020 as many as 1,423,877 people [3]. With the increase in population, it will encourage an increase in the level of movement of the population in Makassar city. This congestion arises due to the increasing volume of private vehicles which is not accompanied by rapid infrastructure development and the lack of discipline of drivers in using their vehicles. In Makassar City the number of 2-wheeled vehicles increases by 13-14% per year and 4-wheels increases by 8-10% per year. The number of two-wheeled and four-wheeled vehicles reached 2.4 million (1.1 million motorcycles and 1.3 million cars) which is higher than the population of Makassar City of 1.7 million people. If there is no effort to improve transportation patterns, in 2018 there will be total congestion [4]

One of the traffic infrastructure that will be developed and built by the government in general in the Mamminasata area, especially in the Gowa Regency, the Makassar City Government and the Maros Regency Government, in particular the Road Development Planning in Gowa Regency, one of which is the construction of an alternative Makassar-Maros-Malino road, where the prospect of the road connects of BTP-Antang axis road, Maros Regency axis road, and GowaRegency - Pattalassang and Malino, the construction of this road segment in the future is expected to reduce congestion at several main points on the PerintisKemerdekaan road and Malino axis road which have a fairly high traffic density.

This study aims to analyze the pattern of the relationship between individual characteristics and the opening of alternative roads; determine the variables that have a significant effect on the opening of alternative roads and; analyze the level of sensitivity to the feasibility of developing alternative roads.

II. Methodology

This research was conducted at the intersection of four BTP-MarosMoncongloe – GowaParangloe – Malino roads as shown in Figure 1. The location of this research does not fully cover the Makassar, Maros and Gowa areas; the delineation of the research location boundaries is based on focusing on the downtown area, developmental ‘sub-urban’ and regional areas traversed by alternative route planning corridors. The type of research used is a survey. The data collection method used in this study was a survey method using a questionnaire with stated preference techniques. Data collection focused on public places, government offices, private offices, campuses, schools and from house to house located around the alternative route planning routes of Makassar, Maros and Gowa.

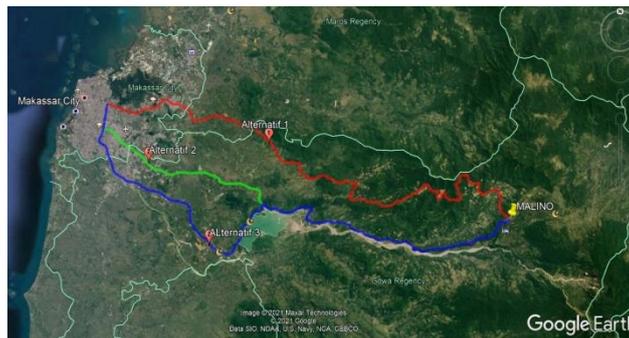


Figure 1. Research location (Google Maps, 2020)

The population is all road users around the alternative route planning routes of Makassar, Maros and Gowa. The sampling technique used is cluster random sampling while the minimum sample determination technique uses the Lameshow formula so that the minimum number of samples is 10 respondents and the number of samples used is 250 respondents.

The analytical technique used to analyze the data is the Conditional logit model with the help of STATA 16 software.

The data obtained from the survey results are quantitative and qualitative data. Quantitative data includes: age, distance and travel time, income and transportation costs. Meanwhile, the qualitative data includes: gender, occupation, education, purpose of travel, the main reasons and reasons residents choose the alternative route of Makassar, Maros and Gowa. The existence of different levels of service from each alternative and differences in socio-economic conditions will affect the selection.

III. Result And Discussion

Characteristics of Respondents

The characteristics of respondents who travel from Makassar City to Gowa (Malino) are reviewed based on age, travel frequency; travel destination, occupation and income can be seen in Table 1.

Table 1. Characteristics of Respondents

No.	Variables	categories	Percentage (%)
1	Age	20 to 24 yeras	25,5
		25 to 29 years	28,5
		30 to 34 years	20,5
		35 to 39 years	14,5
		40 to 44 years	12,0
		45 to 49 years	16,0
		50 to 54 years	3,5
		55 to 59 years	3
2	Travel frequency	60 to 64 years	1,5
		1. (1 time/day)	8
		2. (5 times/week)	18
		3. (3 times/week)	23
		4. (1 time/day)	21
		5. (4 times/month)	17
		6. (2 times/month)	9

		7. (1 time/month)	5
3	Travel destination	Work/Business	24
		Recreation visit family, etc	38 29 9
4	Profession	Fisheries/Agriculture/Forestry	3
		Mining	4
		Industry/Manufacture	4
		Construction	10
		Communication and Transportation	4
		Bank/Finance/Insurance	20
		Trading Business/Entrepreneur	16
		Electricity/Gas/Water Supply	2
		Central Government Services	3
		Local Government Services	4
		Rentals/Rentals	1
		Service Industry	2
		Military/Police teacher	2 10
Etc	14		
5	Income	<IDR 2.000.000	3
		IDR 2.000.000 – IDR 3.000.000	6
		IDR 3.000.000 – IDR 5.000.000	16
		IDR 5.000.000 – IDR 7.000.000	29
		IR 7.500.000 – IDR 10.000.000	30
		IDR 10.000.000 – IDR 15.000.000 >IDR 15.000.000	12 4

Route Choice

Character analysis of respondents based on route selection can be seen in Table 2. Based on table 2 it can be seen that respondents 58% who traveled from Makassar City to Gowa (Malino) were dominated by respondents who chose alternative route 1, respondents who chose alternative route 3 about (29%) and the respondents who chose alternative route 2 were 13%. One of the attractions of respondents tends to choose alternative 1 rather than alternative 2 and 3 because alternative 1 there are several tourist attractions that are passed, namely Parangloe waterfall and Manrusu waterfall which are located in Belapungranga village, Gowa Regency.

Table 2. Distribution of respondents using

No.	Respondent User Route	Percentage(%)
1	Alternative 1	58%
2	Alternative2	13%
3	Alternative 3	29%

Relationship between Route Selection and Scenario

From respondents surveyed to 8 scenarios, in year 2000 observation data from stated preference techniques were obtained with 6 levels of choice, namely; (1) definitely alternative 1; (2) possible alternative 1; (3) definitely alternative 2; (4) possible alternative 2; (5) definitely alternative 3; (6) possible alternative 3. Based on the stated preference technique, the most data obtained in scenario 1 must have chosen alternative 1 with 98 respondents (40%) as shown in Figure 2.

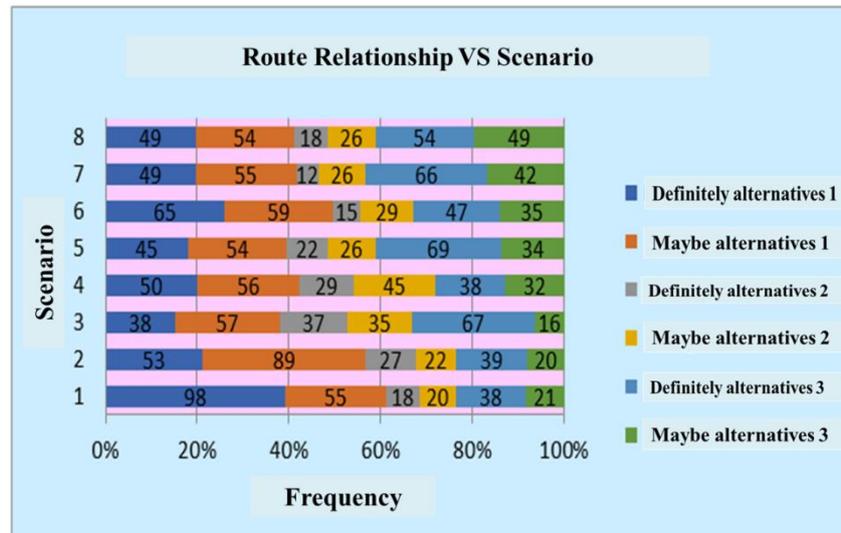


Figure 2. The relationship between route choice and scenario

Preference Model for Route Selection

Furthermore, to determine the route selection model, first look at the terms and significance of the model. The output results of the STATA program, then look at the value of Prob> chi2 and the value of the logical test (sign test) for the condition of the variable under review. The logic test value (sign test) also indicates that the results obtained are logical or not. In the logical test there are 2 signs that are reviewed, namely the positive (+) and negative (-) signs. If the variables being reviewed have signs that are in accordance with the selection logic, then the model built can be said to be good. In this study, stated preference variables consist of travel costs and travel time variables. travel time variable in the group of respondents who travel on a travel route that will travel from Makassar City to Gowa (Malino) with the type of civil servant job showing a negative sign (-), this indicates that the longer the travel time, the fewer people who choose that route.

Table 3 shows the results of data processing for the values of constants and variable coefficients which will then be built into a preference model for choosing a route between alternative 2 and alternative 3 with alternative 1 based on the type of work of civil servants. From table 3 it can be concluded that the stated preference variables that have a strong influence on route selection are the fare (travel costs) and travel time variables.

Table 3. Preference Model for Route Selection for Civil Servants.

Set Options	Type of Work (Civil Servant)			
	Variables	Coef.	P> Z	
Independent				
Rate (X1)		-0.0879798	0.260	
Travel time (X2)		0.0218946	0.364	
Variable	Coef.	P> Z 	Coef.	P> Z
Base Category	Alternative 1			
Category	Alternative 2		Alternative 3	
Dependent				
Age(X3)	-0.375739	0.011*	0.0853015	0.000*
Travel frequency (X4)	0.1916959	0.006*	0.2677829	0.000*
Work/Business Purpose (X6)	-0.4902851	0.147	-1.190538	0.000*
Recreational Destinations & more (X7)	.2446965	0.392	-0.4854605	0.000*
_Cons	-0.7065525	0.648	-4.481945	0.012
LR chi²	= 97.80			
Prob >chi²	= 0.0000			
Jumlah Obs	= 1704			
Jumlah Case	= 568			

Remarks: *Significance level at 90% level

After the requirements and significance of the model are reviewed, then the coefficients of each variable derived from the results of the STATA program processing are built into a route selection preference model. Table 4 shows the results of data processing for the values of constants and variable coefficients which will then be built into a preference model for choosing a route between alternative 2 and alternative 3 with alternative 1 based on the type of work of private employees. From table 4 it can be concluded that the stated

preference variables that have a strong influence on route selection are the fare (travel costs) and travel time variables.

Table 4. Processing preference model for route selection for private employees

Set options		Type of Job (Private Employee)			
Variable	Coef.	P> Z			
Independent					
Rate (X1)	-0.0760079	0.109			
Travel time (X2)	0.0223791	0.149			
Variabel	Coef.	P> Z	Coef.	P> Z	
Base Category					
Alternative 1					
Kategori					
Alternative2		Alternative3			
Dependent					
Age(X3)	-0.0278665	0.001*	0.0155015	0.012*	
Travel Frequency(X4)	0.3796455	0.000*	0.0919607	0.034*	
Total Income(X5)	0.0978151	0.086*	0.0720969	0.126	
Recreational Destinations and More (X7)	-0.4005979	0.023*	-0.2730794	0.058*	
_Cons	-2.856447	0.004	-2.646589	0.021	
LR χ^2	=	103.59			
Prob > χ^2	=	0.0000			
Total Obs	=	4296			
Total Case	=	1432			

Remarks: *Significance level at 90% level

Probability Estimation of Route Selection

Next is the probability of choosing a route between alternative 2, alternative 3 and alternative 1 for route selection conditions based on category: type of work (public servants and private employees). Based on the results of data processing, it shows the probability value of choosing a transportation route between alternative 2, alternative 3 and alternative 1. From Figure 3 it can be concluded that for both conditions, the characteristics of respondents who travel from Makassar City to Gowa (Malino) respondents are more likely to choose alternative routes 1. This is due to the consideration of travel costs and faster travel times.

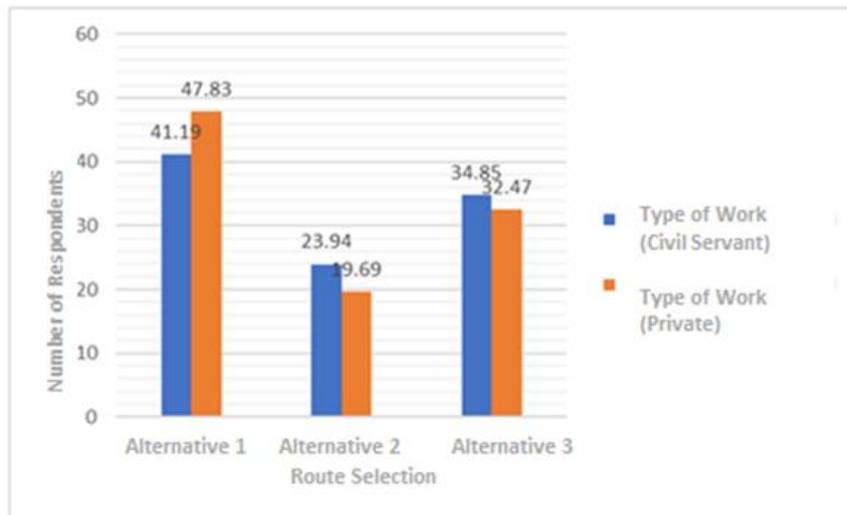


Figure 3. Probability of choosing a route

The Sensitivity of the Route Selection Model

For sensitivity results, 50% additional costs are used from the existing total costs. The sensitivity results of the route selection model are presented in tables 5 and 6. The sensitivity results of the model in tables 5 and 6 show that the values of the sensitivity model parameters that have been given an additional cost of 50% of the total cost. Table 5 shows the results of the sensitivity of the general transportation route selection model between alternative 2, alternative 3 for the type of work of civil servants. From table 5 it can be concluded that if there is an additional cost of 50% of the total cost, in alternative 1, respondents tend to choose alternative 3, whereas if alternatives 2 and 3 experience additional costs, respondents tend to choose alternative 1.

While in table 6 shows the results of the sensitivity of the model for selecting transportation routes in general between alternative 2, alternative 3 for the type of work of private employees. From table 6 it is concluded that if there is an additional cost of 50% of the total cost, in alternative 1, the respondent tends to

choose alternative 3, whereas if alternatives 2 and 3 experience additional costs, the respondent tends to choose alternative 1.

Table 5.Sensitivity of route selection model

Route selection type	Margins		
	1	2	3
Alternative1	0.96	55.84	64.21
Alternative 2	42.76	0.43	34.90
Alternative 3	56.27	43.71	0.87

Table 6.Sensitivity results of the general transportation route selection model

Route selection type	Margins		
	1	2	3
Alternative1	2.13	59.06	70.43
Alternative 2	35.79	0.59	28.46
Alternative3	62.07	40.34	1.09

IV. Conclusions And Recommendations

The results of the study show that travelers who will travel from Makassar City to Malino City more likely to choose alternative 1; the variable of time and costs are significant variables in the route selection model; route selection between alternative isa significant effect if the cost variable is added to each of these alternatives.

The recommendations for further research are the selection of other transportation routes in Makassar City will be carried out; It is necessary to conduct further research by including other factors that have not been analyzed in this study; For the government to pay more attention to the feasibility of the policies taken in solving the congestion problem in Makassar City, so that the policies taken can be more effective and efficient.

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