Journal of Engineering and Applied Sciences 13 (14): 5731-5737, 2018
ISSN: 1816-949X

Modeling the Effect of Perception of Goods Transport Driver on Route Selection in Manado City, Indonesia

Bambang Widodo, Harnen Sulistio, Achmad Wicaksono and Ludfi Djakfar
Department of Civil Engineering, Universitas Brawijaya, Malang, Indonesia

Abstract: There are problems concerning the movement of freight in Manado City which uses the highway, i.e., traffic jams. The main cause of traffic congestion in Manado City is the mixing of all types of vehicles both transporting goods and people on the role of artery, collector and local roads, so that, the road network is not functioning efficiently. The number of streets in the Manado City area allows the user to choose the best route based on his personal perception in order to avoid congestion in reaching his travel destination. The purpose of this study is to model the influence of the perception of freight drivers on traffic jams against route selection and handling recommendations and strategies for the selection of freight routes. This study uses purposive sampling where the sample in this study is a freight transporter which amounts to 250 drivers of goods transport spread over 5 access in and out of Manado City. This primary data collection tool is a questionnaire distributed through a road survey interview (road site interview). Instruments to identify the dimensions of perception of traffic congestion in the selection of freight routes are the distance, VCR, travel time and composition of goods transportation. The result of research shows that based on multiple regression analysis with forward method, there are two variables that have significant effect on the selection of freight route in Manado City, namely: short distance variable and low freight composition with model Y = 0.325+0.534X1+0.406X4. This model gives the meaning that every driver of goods transport in all access in and out of Manado City that in choosing the routes to be passed they only consider two dominant factors, namely the closest mileage to pass and the low composition of freight transport.

Key words: Traffic congestion perception, selection of freight, transportation route, composition, model, transport

INTRODUCTION

The economic strength of a region is largely determined by how the distribution system of goods and services is provided and operated. The efficiency of the distribution will be determined by the cost of production, the price level and the competitiveness of a commodity in the market. Thus, the importance of this distribution process, the usual business of strengthening the economy of a region is always associated with the provision of transportation facilities and infrastructure as a distribution medium and traffic operating system (Sismono *et al*., 2016; Rao and Rao, 2012).

Direct transportation will affect the retail sale price of production and consumption goods from the range of 40% of the sale price (source: freight cost of transportation, regulation and road fee in Indonesia, The Asia Foundation), depending on the type of product being transported. So, the efficiency of distribution through land transportation will greatly affect the economy in a broad sense. The current condition of freight transportation in Indonesia is still dominated by regions with strong economic structure, especially in Java Island. This condition is very possible because development development in Indonesia is still not evenly distributed.

There are problems concerning the movement of freight transport in Manado City using highway mode, i.e., traffic congestion, parking, environmental pollution caused by exhaust gases from exhaust vehicles and order problems and intas. The problem of traffic congestion has begun to increase at an alarming rate, so, it needs to be addressed immediately. The main cause of traffic congestion in Manado City is the mixing of all types of vehicles both transporting goods and people on the role of artery, collector and local roads, so that, the road network is not functioning efficiently. Implementation of route rules and time of operation will be able to reduce VCR traffic. The number of streets in the Manado City area allows the user to choose the best route based on his personal perception in order to avoid congestion in reaching his travel destination.

Corresponding Author: Bambang Widodo, Department of Civil Engineering, Universitas Brawijaya, Malang, Indonesia

Manado City can be regarded as the city of destination and transit city among the surrounding area, so, there is a continuous traffic passing access to one entrance and exit through the access of other entrance and exit. Access in and out of Manado City if by land there are 5 doors namely; From and towards Malalayang (Jln Wolter Monginsidi); From and towards Molas/Tuminting (Molas-Tongkaina Street); From and to the airport-Maumbi/Kairagi (Jln A. A Maramis); From and to Kembes/Teling (Jln Tololiu Supit); From and towards Pineleng/Winangun (Jln Sam Ratulangi 2).

The main cause of congestion in Manado City is the mixing of all types of vehicles, both transporting goods and people in one route of origin and destination and in the same time operation. Perceptions of traffic congestion may affect the selection of traffic movement routes including freight transport (Fitrianingsih, 2008; Bekhor *et al*., 2006). A well-functioning and optimized transport and distribution system for transporting goods/logistics is an important condition for the beginning to achieve sustainable urban economic development. The purpose of this study is to build a model of the influence of the perception of the driver of goods transport on the congestion on the selection of freight routes and provide recommendations for handling and strategy of the selection of freight routes in the future.

MATERIALS AND METHODS

Theory of perception: Humans are essentially individual beings. In looking at a problem every human being has a different view according to his level of knowledge and understanding. This also causes the perceptions of each individual have differences not least the community's perception of freight driver.

One human perception is not necessarily the same as other human perceptions because of the differences in the experience and the surroundings of the human being.

Kimball Young in states that perception is an activity that shows, feels, interprets and understands both physical objects and objects.

The main thing in the route selection process is to estimate the road usage assumptions about the best choice. There are several factors that influence the route selection when we travel. Some of them are travel time, mileage, cost (fuel and other), congestion and queue, type of maneuver required, type of highway (toll road, artery), landscape, completeness of traffic signs and road markings and customs.

The main cause of traffic congestion in Manado City is the mixing of all types of vehicles both transporting goods and people on the role of arterial road, collector and local roads are not optimal, so that, the road network is not functioning efficiently. The number of streets along the road in the City of Manado area of high traffic density is quite high and has begun to feel the impact for the smooth flow of freight distribution.

The route selection model can be classified based on several consideration factors based on the observation that not every rider from the origin zone to the destination zone will choose the exact same route, especially in urban areas. The route selection analysis consists of several main parts: the reason the road user chooses a route is compared to the other route; build a model with the perception of the driver of goods transport as respondents research in choosing a particular route. The possibility of different riders perceptions on the "best route" some riders may assume as the route with the shortest distance, the route with a small VCR level, the route with the shortest travel time, the route with the composition of the smallest freight or maybe a combination of the four.

In this research, the perception of the freight driver is defined as the knowledge to see, understand and interpret the traffic congestion indicated by: distance, VCR, travel time and goods transport composition which will then make the route selection process by estimating the assumption that the road to be chosen is the best way for him.

Goods transportation network road: Traffic transport is one of the causes of urban transportation problems. The congestion that occurs as a result of freight transport depends on how the freight is organized. Especially when there is a condition without parking and a good loading and unloading system, the distribution of goods can be a major source of congestion in urban business centers. The reasons for this are as follows: the size of the vehicle is not in accordance with the geometric way of making the vehicle difficult to maneuver. Overload, slowing traffic flow, especially, on inclines. Unloading-loading in second lane, done carelessly. Mix traffic and large vehicle size.

In many cases, freight transport is one of the causes of congestion at peak hour. Traffic congestion caused by freight transport can be observed as a fundamental problem in the distribution of goods also greatly affecting other issues such as environmental impacts and land use.

The economic development of a city depends heavily on the functioning of the distribution system of goods and transportation in general (Juneman, 2010; Gliebe *et al*., 2009). If the supply of goods into the city can not proceed efficiently and reliably, commercial

activities may move to more accessible locations. The economic structure that has flourished and evolved over the decades will be lost and its vitality in the city center will drop dramatically.

Modeling selection of freight transportation routes road mode: In modeling route selection of freight transport of road in this research using mathematical model. A mathematical model is a model that uses mathematical equations or functions as a media that has characteristics; Can represent a reality can provide information needed, model in the form of simple, cheap and easy.

Transport modeling can be classified into trip-based modeling and comodity-based transportation modeling (Prato, 2009). Travel-based modeling focuses more on tracking the number and route of the vehicle. While commodity-based transportation modeling focuses on modeling the quantity of transported commodities. The method that will be studied in this research is trip-based modeling.

In this research, one of the objectives is to make a mathematical model about the selection of freight routes influenced by the perception of the freight driver about the congestion. The indicators of congestion include: distance, VCR, travel time and composition of goods transportation. Based on this it will be studied the relationship between the selection of freight transport routes as Y and as X that is X1 as the closest distance, X2 as the smallest VCR, X3 is the fastest travel time as X4 is the composition of the smallest freight.

Stages of research preparation: This research is a kind of survey research and observation in the field directly. The study was designed with several stages from the preliminary compilation stage, field data collection and compilation, data analysis to the preparation of research reports.

After conducting preliminary surveys and literature studies, field surveys were conducted for site selection. In determining the location of research needs to be reviewed some field conditions to obtain roads in accordance with site selection criteria. The criteria are as follows: arterial road segment as well as access road segment in and out of Manado City which is reviewed must have adequate pavement width and assumed to represent a fairly crowded and strategic traffic for sustainable urban development.

The condition of the pavement on the arterial roads and access roads in and out of Manado City in good condition. The sampling location of the research sample data is the entrance points-Manado City exit as shown in the following Fig. 1:

- Access entrance-exit Manado City in Kairagi (Jln A. A Maramis)
- Access entrance-exit Manado City in Teling (Jln Tololiu Supit)
- Access entrance-exit Manado City in Winangun (Jln Sam Ratulangi 2)
- Access entrance-exit Manado City in Malalayang (Jln Wolter Monginsidi) and
- Access entrance-exit Manado City in Tuminting (Jln Molas-Tongkaina)

Model formation process with regression analysis: In analyzing the impact of the perception modeling traffic congestion on the selection of freight service in Manado City first conducted the survey

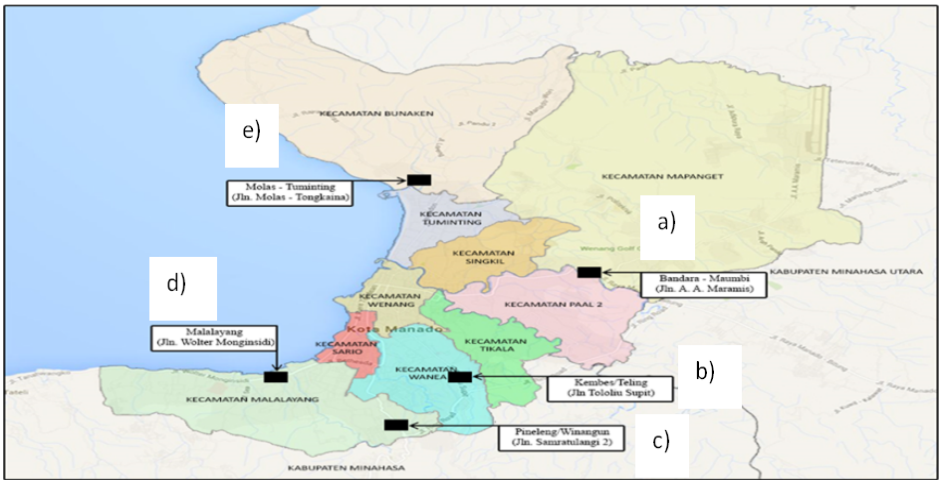

Fig. 1: Map of research data retrieval locations in Manado City

with the survey method curbside (road side interview) with target respondents were drivers freight vehicles.

Beginning with formulation of research hypothesis that is: the magnitude of the effect of traffic congestion perception on the selection of freight routes in Manado City is determined by the distance. The magnitude of the effect of traffic congestion perception on the selection of freight routes in Manado City is determined by VCR. The magnitude of the effect of traffic congestion perception on the selection of freight routes in Manado City is determined by time travel. The magnitude of the effect of traffic congestion perception on the selection of freight routes in Manado City is determined by the composition of goods transportation. The magnitude of the effect of traffic congestion perception on the selection of freight routes in Manado City is determined by are determined jointly or simultaneously by distance, VCR, travel time and composition freight.

From a series of interviews perception survey data driver freight transport in these elections will be conducted regression analysis using a computer-based application program statistics.

Statistical analysis used in the study modeling influence perception of goods transport driver selection rute is a linear regression analysis method. The linear regression analysis method will be used to study the relationship between two variables under investigation. While to prove a hypothesis required F test.

Linear regression analysis is a statistical method that can be used to study the relationship between the nature of the problem under investigation. Linear regression analysis method can model the relationship between 2 variables or more. In this model there are no free or bound variable (Y) that have a functional relationship with one or more independent variables (X). In the simplest case, the relationship can generally be expressed in the following equation:

$$Y = A+BX$$

Where:

Y = Variable is not free/dependent (dependent)
X = Independent variable (independent)
A = Intercept or regression constant
B = Regression coefficient

RESULTS AND DISCUSSION

Characteristics of respondents: In constructing the model of the effect of the perception of the driver of the freight to the route selection in this study the characteristics of the respondent of the freight driver include: sex, marital status, long working, age of respondents and last education. The number of respondents was taken each access entrance-exit Manado City (there were 5 access entrance-exit Manado City) as much as 50 respondents, so, the total respondents totaled 250 people.

Gender: The survey results found the gender of male amounted to 250 (100%) and female amounted to 0 (0%) (Table 1 and Fig. 2).

Marital status: The survey results of marriage status of respondents include: unmarried, married and divorced. Of the 250 respondents, there were 58 respondents (23%), married 184 respondents (74%) and divorced 83% (Table 2 and Fig. 3).

Duration of work: The results of the survey duration of work respondents are categorized as follows: <5, 5-10, 11-15, 16-20 and >20 years. Of the

Table 1: Gender respondents

Gender	Amount	Percentage
Male	250	100
Female	0	0
Total	250	100

Table 2: Marital status respondents

Marital status	Amount	Percentage
Not married	58	23
Marriages	184	74
Divorce	8	3
Total	250	100

Processed data results

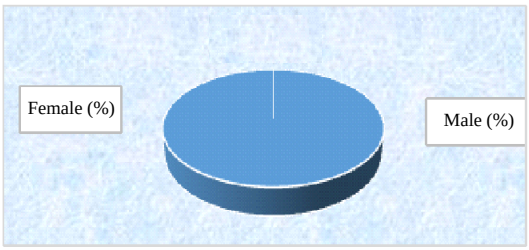

Fig. 2: Graph of percentage of respondent gender

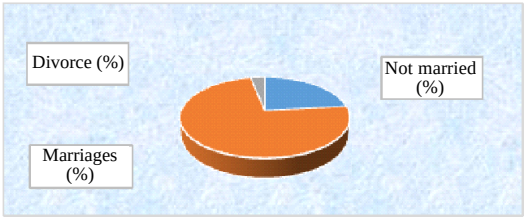

Fig. 3: Graph of percentage of marriage status of respondents

Table 3: Duration of work respondents

Category duration of work (years)	Amount	Percentage
<5	18	7
5-10	102	41
11-15	106	42
16-20	15	6
>20	9	4
Total	250	100

Table 4: Age respondents

Category age (years)	Amount	Percentage
Under 20	2	1
21-30	112	45
31-40	115	46
41-50	11	4
Above 50	10	4
Total	250	100

Processed data results

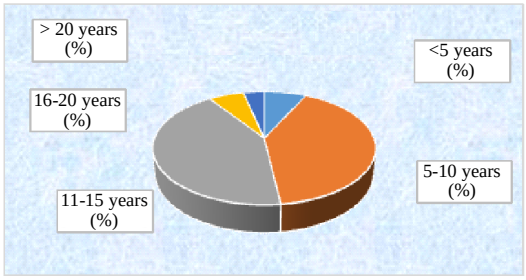

Fig. 4: Graph of percentage of duration of work respondents

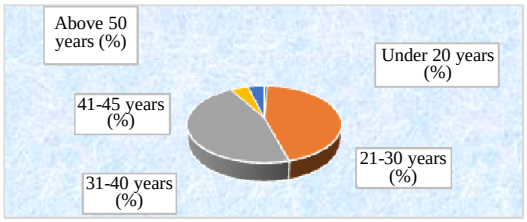

Fig. 5: Graph of percentage of age respondents

250 respondents, the data of working duration for the category of <5 years were 18 respondents 7%, 5-10 years, 102 respondents 41%, 11-15 years, 106 respondents 42%, 16-20 years 15 respondents 6% and >20 years were 9 respondents 4% (Table 3 and Fig. 4).

Age: Respondent's age survey results are categorized as follows: Under 20, 21-30, 31-40, 41-50 and above 50 years. From 250 respondents, the age data for the category under 20 years were 2 respondents 7%, 5-10 years, 102 respondents 41%, 11-15 years, 106 respondents 42%, 16-20 years 15 respondents 6% and >20 years were 9 respondents 4% (Table 4 and Fig. 5).

Last education: The level of a person's last education will affect the mindset, how to behave and even the perspective especially about the route selection caused by traffic jams. The last educational survey of respondents included: elementary, junior high school, D1, D2, D3, S1 and others. Of the 250 respondents, the latest education data obtained from elementary school are 11 respondents 4%, junior high school 187 respondents 75%, D1 is 0 respondents 0%, D2 is 8 respondents 3%, D3 is 2 respondents, S1 amounted to 0 respondents and others amounted to 0 respondents 0%. As shown in Table 5 and Fig. 6 the following.

Table 5: Respondent's last education

Last education	Amount	Percentage
Primary school	11	4
Junior high school	187	75
Senior high school	42	17
Diploma 1	0	0
Diploma 2	8	3
Diploma 3	2	1
Bachelor	0	0
Others	0	0
Total	250	100

Processed data results

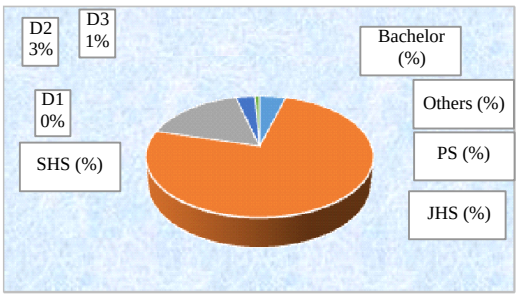

Fig. 6: Graph of percentage of last education respondents

From the data of respondent characteristic of freight driver covering the factors of gender, marital status, duration of work, age of respondent and last education above, found that: all drivers of goods transport vehicles are male 100%. The marital status of the driver of the goods transport vehicle is generally a marriage status (74%). Duration of working as a driver of goods transport because the data found duration working between the range of categories 5-10 and 11-15 years approached the same percentage or 1% disputes, it can be said that the old data worked as a driver of goods transport in general between 5-15 years of 83%. The age data of the respondent of the freight transporter found that between the ages of 21-30 and 31-40 years approached the same percentage or 1% dispute it can be said that the respondent's age data as the driver of goods transport in general between 21-40 years of 91%. The last education data of the respondents of public transport drivers in junior high school is 75%. From the summary of data characteristic of the respondents of the freight driver can

Table 6: Multiple linear regression analysis results

Variable	B	SE	t-arithmetic	Sig.	Information
(Constant)	0.226	0.215	1.049	0.295	No Sig.
Mileage (X1)	0.455	0.074	6.113	0,000	Significant
VCR (X2)	0.141	0.077	1.827	0.069	Sig. 10%
Travel time (X3)	0.009	0.063	-0.144	0.885	No Sig.
Composition of goods transport (X4)	0.386	0.052	7.482	0.000	Significant

R = 0.734; Sig. F = 0.000; Number of sample = 50; R^2 = 0.539; F count = 71.589; α = 0.05; Adj R^2 = 0.531; k = 4; N-k-1 = 250-4-1 = 245; Selection of freight transport route (Y) = 0.226+0.455X1+ 0.141X2+0.009X3+0.386X4; Processed data results

be concluded that the human resources in the transport sector, especially, the carrier operator of freight transport is still relatively low.

The results of multiple linear regression analysis of the variables studied, independent variables, namely the perception of freight driver (X) consisting of four sub-variables, then referred to as free variables, namely: variable mileage (X1), VCR variables (X2), variable time travel (X3); variable of goods transport composition (X4) and one dependent variable, i.e., route election (Y) variable as presented in Table 6.

Referring to the results of multiple regression analysis in Table 6 found that through one-way variance analysis (ANOVA) indicated that the regression was statistically very significant with the value of F = 71.589 for the degrees of freedom k = 4 and nk-1 = 250-4-1 = 245. and p = 0.000 is smaller than α = 0.05. The equations of multiple linear regression lines for the least squares method are:

$$Y = 0.226+0.455X1+0.141X2+0.009X3+0.386X4$$

Where:
Y = Choice of freight transportation
X1 = Distance
X2 = VCR
X3 = Travel time
X4 = Composition of goods transportation

The value of α constant is 0.226 where it means that if all the independent variables are 0, then the transport route selection (Y) is 0.226 or 22.6%.

Regression coefficient b1 of 0.455 states that any addition or increase of +1 from the distance of goods transport will increase the accuracy of the choice of freight route of 0.455 or 45.5%.

The regression coefficient b2 of 0.141 states that every addition of +1 times VCR will improve the accuracy of the choice of goods transport route of 0.141 or 14.1%.

The regression coefficient b3 of 0.009 states that every addition of +1 times the freight time of freight will increase the accuracy of the choice of freight route by 0.009 or 0.9%.

The regression coefficient b4 of 0.386 states that every addition of +1 times the goods transport composition will increase the accuracy of the choice of goods transport route of 0.386 or 38.6 %.

Referring to the result of data analysis in Table 6, it is known that p-value for distance variables (X1) and goods transport composition (X4) is smaller than 0.05 (<0.05), so, the two independent variables individual or partial influence on the selection of freight routes. The mileage variable has a significance value of 0.000 or <0.05 and the variable of goods transport composition has a significance of 0.000 or <0.05 while the other two variables ie VCR and time move variables have a significance value of 0.069 and 0.885, respectively >0.05, so that, two independent variables (variables and variable travel time VCR) has no effect individually or partially on the selection of freight service. These results indicate that on the one hand the variables of travel and composition of goods transport individually or partially have a significant influence on the selection of freight routes in Manado City while the other two variables do not significantly affect the selection of freight routes.

The result of statistic test found that the variables of travel and composition of goods freight have simultaneous and very real effect to the selection of freight transport route in Manado City to the other two factors, namely VCR and travel time have no significant effect on the selection of freight transportation. This result means that the drivers of goods transport in choosing alternative routes to be passed, it is more consider the factors of distance and the amount of composition of goods transport through the routes to be selected while VCR and travel time precisely less taken into account because the VCR related directly with the level of congestion while the distance has relation with time travel and vice versa travel time has a dependence on road capacity compared to vehicle volume (VCR) itself. Clearly can be listened through the results of multiple regression analysis with forward method (forward method is a method that incorporates predictors gradually based on the largest partial correlation) in Table 7.

With short mileage (nearest mileage) and supported by low goods transport composition through selected routes chosen by the freight driver, it will accelerate the freight to reach the destination.

Thus, the results of this study find more effective, efficient and timely transport route model, namely:

$$\hat{Y} = 0.325+0.534X1+0.406X_4$$

This model gives confidence to every freight driver in all Manado entrance-exit zones, that in choosing the

Table 7: Multiple regression analysis with forwad method (coefficients[a])

Models	Unstandardized coefficients		Standardized coefficients (β)	t-values	Sig.	Collinearity statistics	
	B	SE				Tolerance	VIF
(Constant)	1.093	0.191	0.635	5.722	0.000	1.000	1.000
Mileage	0.716	0.055		12.933	0.000		
(Constant)	0.325	0.193		1.687	0.093		
Mileage	0.534	0.054	0.474	9.939	0.000	0.833	1.200
Composition of goods transport	0.406	0.049	0.395	8.283		0.833	1.200

Dependent variable: choice of freight transportation

routes they have to pass only consider the two dominant factors, i.e., the distance or the shortest distance to travel and the low composition of goods passing through the route chosen, thus further accelerating to the destination while saving resources, both time, cost and effort.

To ensure the road users, especially, the freight drivers about which routes of the 5 entrance-exit zones of Manado City that have certain characteristics that will be passed, it is necessary a policy of Manado City government in the addition of the past signs cross-digital nature in order to photograph the latest condition of road traffic that must be passed by the driver of goods transport. Another policy is to establish a storage zone of nine basic commodities distributed into the 5 zones which are then transmitted through freight mode with a smaller capacity to distribute to the seller, both in traditional markets and in modern markets. Both of these policies can at least reduce traffic congestion in the City of Manado which lately more solid.

CONCLUSION

The result of statistical analysis is built that partially, there are two variables significantly influence the selection of freight routes in Manado City, namely: the mileage and transportation composition with the model:

$$Y = 0.325+0.534X1+0.406X4$$

while two other variables, namely VCR and the travel time has no significant effect on the selection of freight routes.

REFERENCES

Bekhor, S., M.E. Ben-Akiva and M.S. Ramming, 2006. Evaluation of choice set generation algorithms for route choice models. Ann. Oper. Res., 144: 235-247.

Fitrianingsih, A., 2008. [The effect of traffic load against route selection]. Master Thesis, Diponegoro University, Semarang, Indonesia. (In Indonesian)

Gliebe, J., J. Broach and J. Dill, 2009. Development of a multi-class bicyclist route choice model using revealed preference data. Proceedings of the 12th International Conference on Travel Behavior, December 13-18, 2009, Portland State University, Jaipur, India, pp: 1-31.

Juneman, 2010. [Urban transportation problems and social psychology approach (In Indonesian)]. J. Pre Print Vers. Psikobuana, 1: 173-189.

Prato, C.G., 2009. Route choice modeling: Past, present and future research directions. J. Choice Modell., 2: 65-100.

Rao, A.M. and K.R. Rao, 2012. Measuring urban traffic congestion-a review. Intl. J. Traffic Transp. Eng., 2: 286-305.

Sismono, A., E. Normelani and P. Angriani, 2016. [Perception of transport of city transport banjarmasin to transfer of terminal park of kilometer 6 banjarmasin to terminal parking kilometer 17 gamble (In Indonesian)]. J. Geogr. Educ., 2: 1-19.