Determining the advertisement of tax priority on urban road based on road performance

Nunung Nuring Haryati[1,*], *Wahyu* Agus Winarno[2], and *Sonya* Sulistyono[2]

[1] Jember University, Department of Civil Engineering, Jember, Indonesia
[2] Jember University, Department of Accounting, Jember, Indonesia

Abstract. Each region has the potential to be explored as a source of income without necessarily harming people and the environment. One of them is the utilization of public space as a media campaign or advertisement. The advertisement placement should be planned to have a function, adding the aesthetic aspect of urban space and not disturbing the comfort and safety of the community. Promotional media can take advantage of active and passive outdoor space. The active outer space is a space that is deliberately created as a public outdoor space such as city park, pedestrian and road. While the passive outer space is a outer space that is not accidentally created or already exist by it, such as river banks, railroads and natural green spaces. Promotional media nowadays is not only in physical, but also in electronic form. Placement of advertisement associated with the tax burden. The amount of tax can be determined from road performance. Where the more crowded the urban space, the more people see the advertisement. This can certainly be used as one of the parameters in determining which points are having the biggest impact on tax value.

1 Introduction

City space has great potential for the media community, namely advertising. Advertisement serves as the dissemination of information for marketing purposes. Advertising is temporary (short term, less than one year) because it is usually associated with a certain moment and there are fixed or long-term installation (above one year). Strategic placement of billboards can provide an opportunity for people to gain good visual access to information resources. The existence of variety of shapes, sizes, and colors that are striking, will be interesting when it viewed at a certain distance. If the media is designed attractively with the arrangement of beautiful lights, it will further brighten the face of the city at night.

The result from the observation in the field indicated, that the condition of the billboard is not organized and ruined the city landscape. The proportion of billboards with urban space is often unbalanced. Some billboards that are temporary placement irregular, interfere with road corridors, the level of security is also less attention. Therefore, it is necessary to

* Corresponding author: nunung.nuring@unej.ac.id

arrange the billboard in order to add the beauty of the city, also the function of information to the community, with good and optimal arrangement can increase Jember Revenue.

City location mapping is divided into several zones. These zones are all potential, easily visible and located in strategic areas. However, the placement of billboards also can be classified according to the zones where this determines the rental price. The zone-determining parameters are based on the strategic location determined by the number of people passing through the site, the accessibility, and how much attention it can attract. So it is necessary to map which locations are potential laying billboards and the distribution of the zones. The use of advertisement is important in order to give information to people. However, it needs to be handling carefully to create an aesthetic and neat arrangement. For instance, the advertisement can be creating as a combination between road signs and street name plate in the same place. Most of all, the suitability of the advertisement has been done in Jember, from Hayam Wuruk road - Gajah Mada road. Some of the billboard has a different shape and size. Generally, the condition of billboard needs to get more attention in terms of aesthetic, architectural, and environment aspect, not only on business or marketing goals. It can be seen from a various kind of advertisement that do not really consider about other aspect, that is the reason why there should be a regulation that oversee the balance of structuring that might have some effects to other sector.

Based on a review of the problems that have been submitted in the previous few paragraphs, the purpose of this study is to create an optimum model placement of advertisement tax based on road performance.

2 Research methods

What is done in the placement optimization of advertisement locations are:

1. Understanding the definition of advertisement

Advertising is an information or instruction tool or communication media. Based on the content of the message, the material, the nature of the information and the technical installation, the billboard are divided into two, namely: commercial media, concerning advertisement media that give information in goods or services for the benefit of trade (private sign),non-commercial media, and regarding signs containing information services to the public (public sign).

2. Advertisement planning evaluation

In the advertisement evaluation, there are some things that can be alluded to in its implications. Here is the theory of planning billboard in terms of open space, building and massing, strategic location and the aesthetics of the city.

The definition of evaluation in Indonesian dictionary means an assessment and results. Evaluation is an attempt to document and assess what happened and why it happened, the simplest evaluation is to gather the information about the circumstances before and after the implementation of a program [1].

According to PP Number 39 Year 2006 on Procedures for Control and Evaluation of Implementation of Development Plans, in the implementation, evaluation activities can be done at different stages of evaluation at: the planning stage (ex-ante), evaluation at the on-going stage, and evaluation at the post-implementation stage (ex-post) [2].

3. Open Spaces

Open space is a room within a city or a larger area, either in the form of an area, or in the form of longitudinal areas or pathways, the use is more open nature that is basically without building, consisting of green open space and non-green open space. Meanwhile, classifications of open space into two types are elongated and cluster [3].

4. Building Use and Massing

The city masses including buildings, soil surfaces, and objects that form city spaces and patterns to define mass and shape of buildings with principles and thoughts behind the physical form of the city. Based on Long Beach Design Guidelines, the appearance and configuration of the buildings include elevation, lighting and front-of-store design. While made a synthesis shape and mass of buildings that include the scale, associated with views, circulation, the size of adjacent buildings [4]. City space is a major element of urban design, scale and sense of surroundings (sense of enclosure), also a type and space of the building.

5. Strategic location of Advertisement

Advertising always choose a strategic location. It is intended to attract as many people as possible and also to increase the clarity of details of the messages delivered. It is also intended to reduce costs as low as possible in the installation of billboards. In a variety of literatures that discusses both billboards and signage placement, at a point location, several factors of concern issues was found.

In the process of optimizing the placement of billboards to increase the PAD (locally-generated revenue) of Jember District, two models were developed using the least squares least squares (OLS) approach. The tool used to create this modeling is Minitab 17 Software. The first model is used to predict and define the priority of layout/placement of advertisements in accordance with the strategic mapping of the road segment (Strategic Road Model Model). The second model is used to predict and define priority of layout/placement of advertisements in accordance with road corridor (Strategic Model of Road Corridor).

The methods used in these two models, based on the results of the study data in the field of transportation in Jember District, the results of the studies are grouped based on roads and road corridors. The information contained in the assessment, such as the degree of saturation, travel time, velocity, and V/C ratio, is used to create an OLS model based on roads and road corridors. So, the model can be used to predict and determine the priority of layout and placement of advertisements.

Table 1. Issue of concern in strategic value factors

Source	Issue of Concern
Otto Klepper's Advertising Procedure, Russel, Thomas and Verril, Glenn, 1986	Traffic Volume, dimensions, land use, in addition to specifying the value (value) is based on; Visible billboard distance; Speed of travel; The viewpoint of the billboard; The distance between billboards.
The Appraisal of Outdoor Advertising Signs, Suute. Donald, 1994 [5]	Location (future land use tendency), billboard structure, land use lease, point of view, and type of traffic.
Signs Regulations for Small and Midsize Commu-nities, Kelly, Eric Damain and Rasso, Garry J, 1989	Technical installation, land use, and altitude.

3 Result and discussions

The procedure of calculating the rent value, and the selling value of the tax object and the strategic value of advertisement in Jember Regency as regulated in Jember District Regulation Number 28 Year 2011. The strategic value component of advertisement calculation is based on: land use, size/dimension of advertisement, viewpoint, class of the road, and price point/location of installation of billboard.

The price of the installation point of the billboard is based only on the national and regency road classes or classes 1 and 2. However, in addition to the two road classes, there are additional parameters: road function, strategic location value, delays, volume of passing vehicles, and speed of vehicle.

Overview of road conditions is divided into roads and intersections. The favorite position of an advertisement is located at the intersection. Compared to the road segment, the position of this intersection is potential in billboard placement. On the road side the rider's sight is straight and continuing to run, to be able to pay attention and read billboards smaller. At the intersection position, the average rider reduces their speed. This behavior depends on the type of intersection; the intersection in Jember is divided into 3: Signal intersection, intangible intersection and intersection with roundabout. At the signal intersection, the rider will stay for a while or stop at the red light, so the opportunity to pay attention around the intersection is bigger.

Population density effects on how big the billboard will be read by the public. The denser the existence of this, the billboard will be more and more potentially seen by many people around. Vehicle volume is also influential. The higher the volume of vehicles, the more potential to be seen by many people. In addition to volume, vehicle speed is also influential. The slower, the longer the person is at the intersection / the road, the more people who potentially see the billboard. Survey of traffic volume at intersection is done by classification. Vehicles crossing the survey sites are classified into several types, namely light vehicles (LV), heavy vehicles (HV), motorcycles (MC), and non-motorized vehicles (UM). The collection of volume data on each intersection is divided into four periods. On the effective day of the morning period is done at 06.30 - 08.30 WIB, the period of noon at 10:30 to 12:30 pm, the afternoon period at 14:30 to 16:30 pm, and the night period from 18:30 to 20:30 pm. While on the holiday period of the morning carried out at 09.30 - 11.00 pm, the period of noon at 12:45 to 14:00 pm, the period of noon at 16:15 - 17:15 pm, and the period of the night at 18:15 - 19:45 pm. Each type of vehicle has its own equivalence value (EMP).

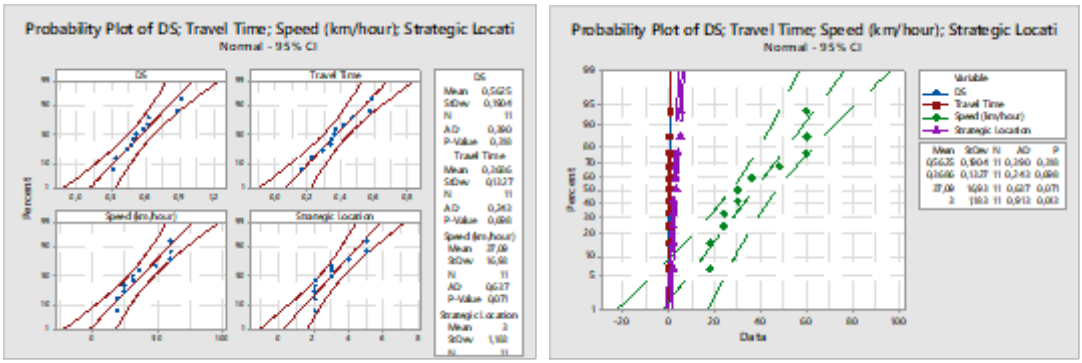
3.1 Modeling based on road segments

The first model developed is an optimization model based on road segment. The data obtained from the transportation survey in the city of Jember, there are 11 road segments that allow optimization done with modeling using OLS. Table 2 presents the results of road performance analysis based on transportation survey results in Jember. Road performance is described in, DS, travel time, and speed.

Table 2. Road performance and strategic location

No.	Road Segment	DS	Travel Time (minute)	Speed (km/hour)	Strategic Location
1	Jalan Hayam Wuruk	0.32	0.58	60	3
2	Jalan Gajah Mada	0.34	0.57	60	3
3	Jalan Sultan Agung	0.52	0.35	60	4
4	Jalan Ahmad Yani	0.91	0.34	18	5
5	Jalan Trunojoyo	0.87	0.22	18	5
6	Jalan Kalimantan	0.58	0.33	24	2
7	Jalan Sumatra	0.44	0.15	36	2
8	Jalan Mastrip	0.48	0.36	30	2
9	Jalan Riau	0.62	0.46	30	2
10	Jalan Jawa	0.63	0.41	24	2
11	Jalan Panjaitan	0.48	0.28	48	3

In making model-based segment optimization model using OLS, then there is assumption BLUE (Best, Linear, Unbiased and Estimator) to be fulfilled so that modeling become a good model. One of the tests to be done is to determine whether the data obtained is in accordance with the assumption of normality or not. The assumption requires the distribution of data can be process properly when the distribution of the data follows a diagonal curve line, or the data spreads along the diagonal line. Based on the test results in Figure 1, the Probability Plot of each variable, either individually plot or mixed plot between variables, shows the distribution of data following the diagonal curve line, or the data spreads along the diagonal line. This means that the variables used in the modeling meet the assumption of normality, and deserve to be used for modeling.



(a) (b)

Figure 1. Normal probability plot– model road segment (a) Normal probability plot individual, (b) Normal probability plot mixed

The next stage is to create a strategic model with the dependent variable / response in this modeling is the strategic location score of each road segment. While the independent variable are the degree of saturation, travel time, and speed. The assumption underlying this modeling is that the strategic location scores on the road segment are determined on all three variables. The more saturated, the longer the travel time, the slower the vehicle through the road segment, then the location is a strategic location to place the billboard. It wills makes the riders have a longer stop/slow time on the road segment. Although it has the potential for a higher billboard location, the priority is to make the priority scale to do the arrangement of the advertisement placement on the road segment. Based on the model developed below, it can be a priority order on the score of the expected strategic location so that it can be used as the guideline for the advertisement arrangement.

Based on the output of modeling using Minitab 17, the model is obtained as follows:

Regression Equation is:

Strategic Location = -5,02 + 9,34 DS - 0,86 Travel Time + 0,0832 Speed (km/hour)

Predictor	Coef	SE Coef	T	P
Constant	-5,02	1,55	-3,23	0,014
DS	9,34	1,59	5,87	0,001
Travel Time	-0,86	1,58	-0,54	0,603
Speed (km/hour)	0,0832	0,0186	4,47	0,003

S = 0,574294 R-sq = 83,51% R-sq(adj) = 76,44%

Based on these outputs, the important variables that become significant predictors of determining the strategic location is the variable DS is the variable saturation degree of road segment. This can be seen from the regression coefficient of 9.34 with a significance value of 0.004 <0.05 which means that this statistically significant variable becomes a predictor of the dependent variable (strategic location). The second variable is a significant predictor of velocity variable with regression coefficient value of 0.0832 and significance value 0.004 <0.05 which means that statistically this variable is significant to be the predictor of the dependent variable (strategic location). While the travel time variables are not statistically significant influence in determining the location of strategic placement of advertisement. This model can also obtain the ability of a model in explaining a dependent variable by looking at the value of R2 over the model. This model has a R2 value of 83.51% and R-adjusted of 76.44%. This means the model can explain the change of the dependent variable of 76.44%.

From the model that has been developed, it can be seen in the following table that presented the value of expectations (expected value) on the predictor value that can be used to create the priority of ordering/placement of advertisements as follows:

Table 3. Priority rank base on road segment model

No.	Road Segment	Expected Value	Priority Order	No.	Road Segment	Expected Value	Priority Order
1	Jalan Hayam Wuruk	2.46	8	7	Jalan Sumatra	1.92	10
2	Jalan Gajah Mada	2.66	6	8	Jalan Mastrip	1.65	11
3	Jalan Sultan Agung	4.53	2	9	Jalan Riau	2.85	5
4	Jalan A Yani	4.68	1	10	Jalan Jawa	2.51	7
5	Jalan Trunojoyo	4.41	3	11	Jalan Panjahitan	3.24	4
6	Jalan Kalimantan	2.11	9				

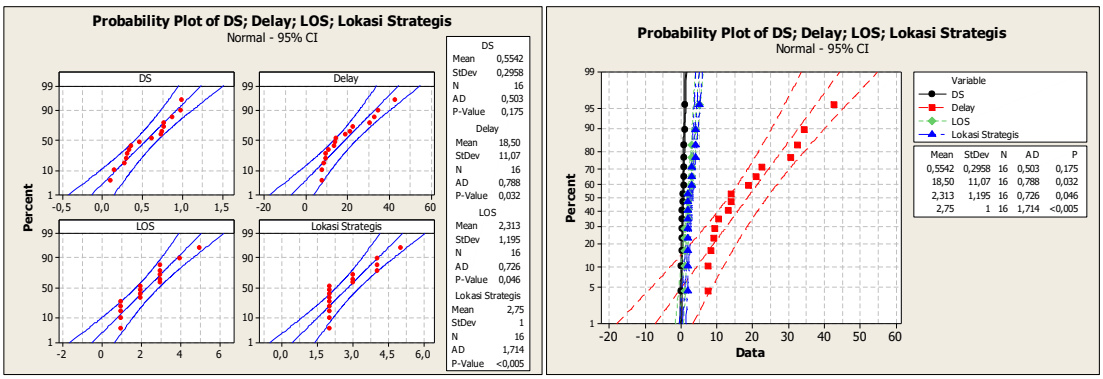
3.2 Modelling based on road corridors

From the survey data of transport of outer corridor group (26 outer corridors), and corridor inside (4 corridors inside), there are 16 lines of intersection data that can be processed and used to create road-based corridor modeling. Table 4 is a tabulation of road performance survey results data on each road corridor. In the street-based intersection of the road corridor, there are 3 predictors considered to affect the strategic location of DS, Delay, and LOS. Based on the results of one of the BLUE assumption tests, it shows that the variable "Delay/delay time" of the graphic shows a data pattern that is too critical, meaning there is potential for data not following the normal pattern. The standard deviation of this variable is 11.069. The abnormality of this data pattern is corroborated by the value of KS of 0.219 and the value of P-value of 0.032 is lower than 0.05 which means the data pattern is not normal. For an interval estimate of 95% we believe that the mean degree of saturation is in the range 0.396 to 0.711 where,

Table 4. Corridor road performance and strategic location

No.	Intersection Name	DS	D	LOS	Strategic Location
1	KFC [1]	0.75	18.70	2	3
2	Kenanga[1]	0.99	8.33	1	2
3	GatotSubroto[1]	0.88	22.52	3	3
4	Tembakan[1]	1.00	20.94	3	3
5	Dr. Wahidin[1]	0.11	9.26	1	2
6	PasarTanjung[4]	0.28	13.30	2	5
7	RS Subandi[3]	0.32	14.04	2	4
8	Jarwo[3]	0.47	30.53	3	4
9	PKK/ Mastrip[5]	0.77	13.97	2	2
10	RRI [4]	0.36	34.32	3	4
11	DPR [5]	0.74	42.64	4	2
12	Gladakkembar[3]	0.62	32.47	5	2
13	Polres[2]	0.34	10.55	1	2
14	Istana [1]	0.78	9.29	3	2
15	Matahari[1]	0.15	7.63	1	2
16	UntungSuropati[1]	0.31	7.54	1	2

Note: [1]Un-signalized intersection with three legs
[2]Un-signalized intersections with four legs
[3]Signalized intersections with three legs
[4] Signalized intersections with four legs
[5] Roundabout intersections with four legs



(a) (b)

Figure 1. Normal probability plot– model road segment (a) Normal probability plot individual, (b) Normal probability plot mixed

The strategic location variable shows the data pattern is too oblique to the right side, meaning there is potential data not follow the normal pattern. The standard deviation of this variable is 1. The abnormality of this data pattern is corroborated by a KS value of 0.336 and a P-value value of 0.0005 which is lower than 0.05 which means the data pattern is

abnormal. For an estimated 95% interval we are convinced that the average degree of saturation is in the range of 2.21 to 3.28.

The next step is to develop a strategic location optimization model based on the road corridor. The dependent variable / response in this modeling is the strategic location score of each road corridor segment. While the independent variable is the degree of saturation, delay time (delay), and LOS. The more saturated, the longer the delay, and the slower the vehicle through the road corridor, the location is strategic to place the billboard, because it makes the riders have a longer stop / slow time on the road segment. Although it has the potential for a higher billboard location, the priority is to make a priority scale to do the arrangement of the advertisement placement on the road segment. To develop the model of the variables in this second model, it is worth noting there are two variables whose data pattern does not follow normal data pattern rules i.e.; delay and strategic location variables. To overcome these problems so that it can be done further analysis and modeling, then both variables are done with logarithmic calculation (log) on the original value. After this stage, a priority ranking can be made on the score of the expected strategic location that can be used as a guideline for the advertisement arrangement. The results of the regression model are shown in Table 5.

Table 5. The results of the regression model

Predictor	Coef.	SE Coef	T	P
Constant	0.0156	0.6189	0.03	0.980
DS	-0.3166	0.3299	-0.96	0.362
LnDS	0.1273	0.3591	0.35	0.731
Delay	-0.0156	0.0132	-1.18	0.267
LnDelay	0.9318	0.6181	1.51	0.166
LOS	-0.2612	0.1104	-2.37	0.042
LnLOS	1.2884	0.5965	2.16	0.059

Indicators of the model: S = 0.0977; R-Sq = 72.6%; R-Sq(adj) = 54.4%

Based on these outputs, consistently these results indicate that the important variable becomes a significant predictor of determining the strategic location is the LOS variable only. It can be seen from LOS regression coefficient of -1.7839 with significance 0.004 <0.054 which means statistically this variable is significant to be predictor of dependent variable (strategic location). Furthermore, comparative with variables on logarithmic calculation LnLOS obtained regression coefficient of 9.029 with a significance value of 0.068 if done on two tailed test then this logarithmic variable also statistically significant to predictor strategic location. The second test model is to use variables that all are logarithmic first. The results also show consistency that LOS variables affect the strategic location. While the other two variables, statistically have no significant effect in determining the strategic location on advertisement placement. In this model the ability of a model is to explain a dependent variable by looking at the value of R^2 over the model. This model has R2 value of 69.6% and R-adjusted of 49.3%. This means that the model can explain the change of the dependent variable by 49.3%. While the comparison model with logarithmic value has a R2 value of 72.6% and R-adjusted by 54.4%. This means that the model can explain the change of the dependent variable by 54.4%.

From the model that has been developed, then in the following table can be presented the value of expectation (expected value - EV) on the predictor value that can be used to create the priority of ordering/placement of advertisements as follows:

Table 4. Corridor road performance and strategic location

No.	Intersection Name	EV-1	EV-2	Priority Order	No.	Intersection Name	EV-1	EV-2	Priority Order
1	KFC [1]	3,40	0,52	5	9	PKK/ Mastrip[5]	3,10	0,47	6
2	Kenanga[1]	1,00	0,17	16	10	RRI [4]	3,85	0,57	1
3	GatotSubroto[1]	3,04	0,47	7	11	DPR [5]	2,30	0,35	12
4	Tembakan[1]	2,76	0,44	8	12	Gladak kembar[3]	1,92	0,29	15
5	Dr. Wahidin[1]	2,36	0,35	10	13	Polres[2]	2,53	0,38	9
6	PasarTanjung[4]	3,82	0,56	3	14	Istana [1]	2,35	0,34	11
7	RS Subandi[3]	3,84	0,57	2	15	Matahari[1]	2,10	0,31	13
8	Jarwo[3]	3,77	0,57	4	16	Untung Suropati[1]	2,03	0,29	14

Note: [1] Un-signalized intersection with three legs
[2] Un-signalized intersections with four legs
[3] Signalized intersections with three legs
[4] Signalized intersections with four legs
[5] Roundabout intersections with four legs

The data were obtained from surveying on road sections in four cities in Indonesia, namely Palembang, Bandung, Yogyakarta and Surakarta. The road network includes national road network as well as urban road network. Three types of surveys had been conducted, namely travel time and delay survey, traffic volume survey, and road geometry survey. Travel time and delays survey was done to get travel time experienced by a normal moving vehicle on the road sections. This survey produced travel times and delays along with the location and cause. Traffic volume survey was done by counting the various passing vehicle on a certain spot location and generally conducted for 16 hours with the types of vehicles include motorcycles, light vehicles, heavy vehicles, and unmotorized vehicles. The geometry survey was conducted to identify the width and number of lanes, the median, the width of road shoulders/curb, and the land use/side friction along the road sections to calculate the road capacity.

4 Conclusions

Both models are developed based on road segment and road corridor, it can be concluded that (1) in the road segment-based model, which becomes the main predictor in optimizing the determination of strategic location, the variable DS is the variable of saturation degree of road segment, followed by Variable speed. While the other two variables are the ratio and travel time is not statistically significant as a predictor in optimizing the placement of the billboard. Furthermore, from the statistical model obtained, the road segment Ahmad Yani ranks as the first priority of a strategic location that needs to be done. It optimizes the arrangement and placement of billboards; and (2) in a road-based corridor model, only LOS variables are the main predators and the only statistically significant variables that need to be considered in optimizing the layout and placement of billboards. Furthermore, from the statistical model obtained, RRI intersection is the main corridor which becomes the priority of strategic location for optimization of layout and placement of advertisement.

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