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Study On Develompment and Revitalization of Public Transport in Sidoarjo Regency

By

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Abstract

Sidoarjo is part of Gersik, Bangkalan, Mojokerto, Surabaya, Sidoarjo and Lamongan (Gerbangkertasusila) which is a metropolitan area, so facilities and infrastructure are important to support the needs of the city. Because of the high level of urbanization from Surabaya to Sidoarjo, adequate public transportation is needed. Public transport provided for transportation is lyn and bison, but still has problems, namely high transport load factor and slow transport speed. Based on this, it's necessary to develop public transportation to mass transportation that has greater than capacity. According to the survey conducted by the *Analytic Hierarchy Process* (AHP) Methode was obtained model $Y= 0{,}158X_1 + 0{,}187X_2 + 0{,}135X_3 + 0{,}156X_4 + 0{,}126X_5 + 0{,}131X_6 + 0{,}066X_7 + 0{,}042X_8$, the result of calculation show that he city of Sidoarjo is ready to develop public transportation. The development is changing the existing transportation terminal purabaya – terminal porong route become public transportation road based, namely a medium bus with a capacity of 30 passengers, circulation time 1 hour 49,25 minutes/trip, load factor of 77%, headway of 11.55 minutes, and requires 12 units of the bus fleet. And the temporary tariff determined accroding to the Vehicle Operating Costs is Rp. 8.334,-. Revitalization of existing transportation is by scraping, rereouting existing transportation becoming a feeder, rejuvenating existing transporation, selling to another city, and if its is not very feasible is sold in old scrap wreckage by the kiloan method.

Keyword : Development, Revitalization, Public Transport, Mass Transportation.

Introduction

Public transport is a passenger transport service by a group level sytem that is available for public use, usually managed on schedule, operated, on a defined route,and its change for each trips. Sidoarjo Regency is part of the Gerbangkertosusila development area, with its position as part of the Surabaya Metropolitan Area (SMA), which has rapidly pushed this region to grow and develop. The consequence of this development is the emergence of traffic flow that demands the provision of adequate facilities and infrastructure and reliable transportation management, with regard to the function of transportation as the main support for community activities. Inefficiency of service together with poor service quality and quantity make low availability of local public transport service in many countries [13][20].

The success of development is strongly influenced by the role of transportation as the pulse of political, economic, socio-cultural, and defense-security life. The development of the transportation sector is directed at the realization of an effective and efficient[14] transportation

system in supporting and at the same time driving the dynamics of development, supporting the mobility of people[9], goods and services, supporting national distribution patterns and supporting regional development especially in East Java Province. The development of public transport is expected to make the people easier to travel with good service[21][22]. The traffic problem are getting more and more seriouse, which make then one of the first few issues around the world especially in the major cities. [11] The consequence of this development is the emergence of traffic flow that demands the provision of adequate facilities and infrastructure and reliable transportation management, with regard to the function of transportation as the main support for community activities[8].

Improving public transportation and infrastructure prior to any modal choices by travelers is essential, as doing so would help trevelers make ratio choice motivated not merely by the simple desire to escape somehow frim the tremendously poor conditions of the existing transportation supplies[16].

The phenomenon of urban sprawl Surabaya to the periphery (LPMM ITS, 2007) that triggers high movement effect from population mobility to sub urban areas and the otherwise. The large number of Sidoarjo residents who carry out their activities in Surabaya results in heavy road loads due to the use of private vehicles more and more. But the traffic infrastructure cannot grow as steadly as the private vehicle[10]. The private vehicles used increasingly caused by one of them due to poor public transport performance [15] and high load factor. The high load factor results in all service users on the main road not being able to be transported.

Revitalization and development of public transportation as a means of transportation in Sidoarjo regency is expected to be the backbone of urban and inter-city passenger transportation, so that it can become one of the main movers in the economy [12]of East Java, with the development of transportation facilities that are integrated with other modes can improve the efficiency of the economy of Sidoarjo regency.

Literature Review

2.1 Public Transportation

According to Warpani (1990) public transportation is a system of payment or rent. The main purpose of public existence is to provide good and proper transportation services for the community because of its mass nature, it is necessary to have a common ground between the passenger among the passenger regarding the origin and destination .[1]

2.2 Public Transport Performance

Public transport performance is assessed based on certain parameters both quantitatively and qualitatively regarding the characteristics of the transport system under review. These parameters can be used as a basis for calculations used in determining the number of public transport fleets, one of which is urban transportation[13]. The standard

2.3 value for public transport performance is summarized from

a. Letter of Statement Dirjen No.687/AJ.206/DRJD/2002 about Technical Guidelines for Public Transport [2]
b. Ministerial Regulation No.98 of 2013 about minimum service standards for transportating people by motorized vehicles [3].

As in the table below:

Table 1 *Service Parameters*

No	Value Parameter	Unit	Standart value		
			Minus = 1	Medium =2	Good = 3
1	Load factor during peak hours	%	>100	70-100	<70
2	Load factor during low peak hours	%	>100	70-100	<70
3	Speed	Km/hour	<5	6-10	>10
4	Headway	Minute	>15	10-15	<10
5	Travel time	Minute/km	>12	6-12	<6
6	Operating time	Hour	<13	13-15	15
7	frequency	vehicle/hour	<4	4-6	>6
8	Total of operating vehicles	%	<80	80-89	90-100
9	Waiting time	Seconds	>120	61-199	<60
10	Total passanger	vehicle/day	<180	180-250	>250
11	Circulation time	Minute	>120	120-60	<60

In table 1, with three weighting criteria, namely weight 1, the service is not good enough. Weight 2 is in the medium service level and weight 3 is service with good level.

The right number of fleets according to the difficult needs of certainty that can be done is the amount close to the magnitude of the needs. The basics of calculating the number of fleets according to the technical guidelines of the Republic of Indonesia Department of Transportation (2002). are as follows

a. Capacity sold and capacity available for one trip which is commonly expressed as a percent (%)
b. Vehicle capacity is the loading capacity of passengers on each public transport vehicle can be seen in the following table.

Table 2 *Vehicle Capacity*

Type of transport	Vehicle capacity			Passenger capacity
	Sit	Stand	Total	
Passenger car	8	-	8	250-300
Small bus	19	-	19	300-400
Medium bus	20	10	30	500-600
Large bus single floor	49	30	79	1.000-1.200
Large bus double floor	85	35	120	1.500-1.800

Methodeolgy

The step of methode used show in the Figure 1. in the bellow. The research data collection was obtained from certain sources:

a. Secondary data
1) Population data from BPS Sidoarjo regency
2) Landuse condition data from BPS Sidoarjo Regency
b. Primary data
1) Observation of AHP interviews
2) Observation of Stated Preference interviews
3) Total of Bison and Lyn JSP Passengers

4) Transportation Performance

c. Determine the Sample

1) The sample in the AHP Survey uses the Suharsimi Ari Kunto method (2010)[4] by taking 10% of the population.
409 of the bison passenger population
Sample = 409 x 10% = 40.9 respondents
Then the respondents to be surveyed in the AHP interview were 41 respondents

2) Determination of the sample in the Stated Preference survey using the Slovin method[17].(Setiawan; 2007)[5]. Then from calculation the respondents to be surveyed stated Preference interviews were 80 respondents. Survey location were divided into two locations, in Purabaya Bus Station 40 respondents, in Porong Bus Station 40 respondents.

Result And Disscusion

2.4 City readiness for development through the Analytical Hierarchy Process

Processing data is use AHP method [18] for making process decision by solving the problem into a parts arranging variables in a hierarchical arrangement. (Saaty, 1997)[6]

Analytical hierarchy process is used to determine the weighting results of each criterion that has an effect on the development of public transportation that has been surveyed by interviews with 41 sources that are considered experts, then formed in the readiness model to determine readiness in developing public transportation.

1) Recapitulation of assessment

After the survey, to find out the result the data have been to recapitulations. The recapitulation data is in the below table :

Table 3 *Recapitulation Value*

Criteria	Economic scale and regional fiscal ability	Transportation policy	Land Use	Public transport integration	Ticket and travel time	Supporting infrastructure	City Function	City Size
Economic scale and regional fiscal ability	1,00	1,00	0,33	1,00	3,00	1,00	2,00	5,00
Transportation policy	1,00	1,00	1,00	3,00	2,00	1,00	2,00	5,00
Land Use	3,00	1,00	1,00	0,40	0,33	1,00	1,00	3,00
Public transport integration	1,00	0,33	2,50	1,00	2,00	1,00	3,00	3,00
Ticket and travel time	0,33	0,50	3,00	0,50	1,00	1,00	2,00	3,00
Supporting infrastructure	1,00	1,00	1,00	1,00	1,00	1,00	2,00	3,00
City Function	0,50	0,50	1,00	0,33	0,50	0,50	1,00	1,00
City Size	0,20	0,20	0,33	0,33	0,33	0,33	1,00	1,00
Total	8,03	5,53	10,17	7,57	10,17	6,83	14,00	24,00

2) Normalize the Reciprocal Matrix to get the priority vector value
After the recapitulation data is entered then data must be normalized as the below table 4 ;

Table 4 *Normalize Matrix*

Criteria	Economic scale and regional fiscal ability	Transportation policy	Land Use	Public transport integration	Ticket and travel time	Supporting infrastructure	City Function	City Size
Economic scale and regional fiscal ability	0,1245	0,1807	0,0328	0,1322	0,2951	0,1463	0,1429	0,2083
Transportation policy	0,1245	0,1807	0,0984	0,3965	0,1967	0,1463	0,1429	0,2083
Land Use	0,3734	0,1807	0,0984	0,0529	0,0328	0,1463	0,0714	0,1250
Public transport integration	0,1245	0,0602	0,2459	0,1322	0,1967	0,1463	0,2143	0,1250
Ticket and travel time	0,0415	0,0904	0,2951	0,0661	0,0984	0,1463	0,1429	0,1250
Supporting infrastructure	0,1245	0,1807	0,0984	0,1322	0,0984	0,1463	0,1429	0,1250
City Function	0,0622	0,0904	0,0984	0,0441	0,0492	0,0732	0,0714	0,0417
City Size	0,0249	0,0361	0,0328	0,0441	0,0328	0,0488	0,0714	0,0417
Total	1,0000	1,0000	1,0000	1,0000	1,0000	1,0000	1,0000	1,0000

3) Priority vector values
After normalized data can seen the priority vector value can used. It show at the table 5.

Table 5 *Priority Vector*

Criteria	Priority vector
Economic scale and regional fiscal ability	0,158
Transportation policy	0,187
Land Use	0,135
Public transport integration	0,156
Ticket and travel time	0,126
Supporting infrastructure	0,131
City Function	0,066
City Size	0,042

4) Before used the vector priority value, must know the vector priority consistency :
a. Look for the vector value K

$$(K) = \begin{bmatrix} 1,00 & 1,00 & 0,33 & 1,00 & 3,0 & 1,00 & 2,00 & 5,00 \\ 1,00 & 1,00 & 1,00 & 3,00 & 2,00 & 1,00 & 2,00 & 5,00 \\ 3,00 & 1,00 & 1,00 & 0,40 & 0,33 & 1,00 & 1,00 & 3,00 \\ 1,00 & 0,33 & 2,50 & 1,00 & 2,00 & 1,00 & 3,00 & 3,00 \\ 0,33 & 0,50 & 3,00 & 0,50 & 1,00 & 1,00 & 2,00 & 3,00 \\ 1,00 & 1,00 & 1,00 & 1,00 & 1,00 & 1,00 & 2,00 & 3,00 \\ 0,50 & 0,50 & 1,00 & 0,33 & 0,50 & 0,50 & 1,00 & 1,00 \\ 0,20 & 0,20 & 0,33 & 0,33 & 0,33 & 0,33 & 1,00 & 1,00 \end{bmatrix} \times \begin{Bmatrix} 0,158 \\ 0,187 \\ 0,135 \\ 0,156 \\ 0,126 \\ 0,131 \\ 0,066 \\ 0,042 \end{Bmatrix} = \begin{Bmatrix} 1,394 \\ 1,670 \\ 1,222 \\ 1,420 \\ 1,143 \\ 1,149 \\ 0,596 \\ 0,359 \end{Bmatrix}$$

b. Look for the Eigen Value (E)

$$(E) = \begin{Bmatrix} 1,394/0,158 \\ 1,670/0,187 \\ 1,222/0,135 \\ 1,420/0,156 \\ 1,143/0,126 \\ 1,149/0,131 \\ 0,596/0,066 \\ 0,359/0,042 \end{Bmatrix} = \begin{Bmatrix} 8,831 \\ 8,938 \\ 9,041 \\ 9,121 \\ 9,095 \\ 8,772 \\ 8,982 \\ 8,644 \end{Bmatrix}$$

c. Looking for λmaks

$$\lambda maks = \frac{8,831 + 8,938 + 9,041 + 9,121 + 9,095 + 8,772 + 8,982 + 8,644}{8}$$
$$= 8,928$$

d. Look for a consistency index

$$CI = \frac{8,928 - 8}{7} = 0,133$$

e. Test the consistency of priority vector values

$$CR = \frac{0,133}{1,41} = 0,094$$

2.5 0,094≤0,1 (consistency)

So based on the results of the analysis above, it is known that the consistency of vector values gets consistent results, so the vector values can be used. Further it is stated in the percentage of Economic Scale and Regional Fiscal Capacity of 15.8%, Transportation Policy of 18.7%, Land Use by 13.5%, Public Transport Integration 15.6%, Tickets and Travel Time of 12.6 %, Supporting Infrastructure 13.1%, City Functions at 6.6%, and City Size 4.2%.

From the results of data processing then included in the linear regression equation:

Y=0,158X1+0,187X2+0,135X3+0,156X4+0,126X5+0,131X6+0,066X7+0,042X8

2.6 Scale processing factor values X1, X2, X3, X4, X5, X6, X7, and X8 that affect the development of public transportation

This score assessment is based on existing conditions in the field

Table 6 *Value Scale*

Atribut	Factor	Value Scale
X1	Economic scale and regional fiscal ability	0
X2	Transportation policy	0,75
X3	Land Use	0,75
X4	Public transport integration	0,75
X5	Ticket and travel time	0,75
X6	Supporting infrastructure	0,75
X7	City Function	0,75
X8	City Size	0,75

The scale of values in the existing conditions is included in multiple linear regression to determine the readiness of public transport development, the scale of readiness is in the table below;

Table 7 *Readiness Value*

No	Readiness Value (Y)	Explanation
1	< 0,50	Public transportation cannot be developed yet
2	Between 0,51 – 0,61	Public transportation cannot be fully developed yet.
3	Between 0,61 – 0,70	Public transportation is ready to be developed.
4	Between 0,71 – 1,00	Public transportation is more ready to be developed.
5	>1	Public transportation is very ready to be developed.

From the scale results of observations of existing conditions that have been known will be calculated using a linear regression equation, based on the calculation has a result of 0.632. Then from the results of 0.632 Sidoarjo regency was ready to do the development of public transportation.

4.1 Development of public transport lync JSP and Bison into Mass Transportation

The priority of public transport development was realized by the modernization of the fleet and investment in energy-efficient and low emission vehicles : in other words, buses powered by compressed natural gas, modern buses tha meet the highest environmental standars[7].

4.2 JSP lyn performance

Table 8 *Lyn JSP Performance*

No	Parameter	Unit	Result	Quality
1	Load factor	%	100%	2
2	Frequency	Vehicle/hour	39	3
3	Headway	Minute	1,94	3
4	Speed	Km/Hour	20-33	3

It was concluded that the JSP lyn transport performance was categorized as good because on average it had a weight of 3.

4.3 Bison performance

Table 9 *Performance Bison*

No.	Parameter	Unit	Result	Quality
1	Load factor	%	92,86	2
2	Frequency	Vehicle/Hour	30	3
3	Headway	Minute	1,91	3
4	Speed	Km/Hour	30-50	3

It is concluded that Bison transportation performance is categorized as good because on average it has a weight of 3.

Development of existing transportation to mass transportation must be in accordance with

the conditions of the city of Sidoarjo, required data on the number of passengers, determination of mode, travel time, road length, headway, circulation time, vehicle speed prediction.

1) Determination the type of vehicle

The type of vehicle that will be used for the development of public transportation to mass transportation is a medium bus with a capacity of 30 passengers.

2) Circulation time

Circulation time with an average speed regulation of 20 km per hour with a deviation of 5% of travel time. With the formula:

CTABA = (TAB + TBA) + (σAB + σBA) + (TTA + TTB)
CTABA = (50 + 45) + (2.5 + 2.25) + (5 + 4.5)
= 109.25 minute atau 1 hour 49.25 minute.

3) Load factor

$$LF = \frac{Total\ Passenger}{carrying\ capacity} \times 100\%$$

$$LF = \frac{23}{30} \times 100\%$$

= 77%

4) Headway

$$H = \frac{60.C.Lf}{P}$$

$$H = \frac{60.30.0.77}{120}$$

= 11,55 minute

5) Fleet needs

$$K = \frac{Total\ Passenger}{carrying\ capacity}$$

$$K = \frac{360}{30}$$

= 12 units vechile

6) Vehicle operating costs

The BOK value of bus transportation is currently having its own estimated price of Rp. 8,334

4.4 Results of the Stated Preference Survey

Stated preference methods can also be used to model perceptions andbehavioural responses to different types and levels of severance[19]. in this research stated preference be used to model perceptions cost level, frequency departure level, and travel time level.

4.5 Response to the difference in travel costs (ΔX1).

Table 10 *Difference Travel Costs*

Difference in Travel Costs Bus – LRT (Rp) (ΔX_1)	**Total of Respondents Rating.**					**Total**
	1	2	3	4	5	
-0	39	4	13	3	26	85
-250	39	4	12	2	28	85
-500	39	4	12	2	28	85
-1.000	44	2	12	0	27	85
-1.500	25	2	11	0	47	85
-2.000	24	2	11	1	47	85
-2.500	24	2	11	1	47	85
-3.000	24	2	10	1	48	85

4.6 Response to travel time difference (ΔX2)

Table 11 *Travel Time Difference*

Difference in Travel Time (Minutes) (ΔX_2)	Total of Respondents Rating.					Total
	1	2	3	4	5	
-30	21	2	6	2	54	85
-27	20	2	6	5	52	85
-24	20	3	6	3	53	85
-20	22	2	6	3	52	85
-16	24	1	7	3	50	85
-12	49	1	7	3	25	85
-8	46	1	9	2	27	85
-4	45	1	10	2	27	85

4.7 Response to changes in the frequency of departures (ΔX3).

Table 12 *Frequency Departure*

Difference in Departure Frequency (vehicle/day) (ΔX_3)	Total of Respondents Rating.					Total
	1	2	3	4	5	
-16	54	1	7	2	21	85
-14	54	1	7	2	21	85
-12	54	1	7	2	21	85
-10	49	5	8	2	21	85
-8	47	4	9	2	23	85
-6	44	2	11	4	24	85
-4	30	7	11	4	**33**	85
-2	28	2	10	10	**35**	85

4.8 Data Stated Preference Analysis

Data that has been obtained through surveys in the form of a qualitative scale is transformed into a form of a probability scale and then converted to a symmetric scale that will later become a utility scale that corresponds to a probability scale.

Table 13 Symmetric Scale

Scala	Respons	Probability Scale (P)	Utilitas Ln$\left(\frac{0,9}{1-0,9}\right)$
1	Definitely choose a bus.	0,9	2,1972
2	Maybe choose a bus	0,7	0,8473
3	Comparable	0,5	0,0000
4	Maybe choose LRT	0,3	-0,8473
5	Definitely choose LRT	0,1	-2,1972

After the symmetric scale is known the next step is regression analysis to obtain utility where the symmetric scale will be the dependent variable while the independent variable is the difference between each attribute.

By using linear regression, a constant and efficient method can be obtained for each utility model

4.9 (UB – UTV) = b0 + b1(ΔX1) + b2(ΔX2)……..+ bn(ΔXn)

From the utility model obtained, the probability of modal selection is obtained using binomial logit. The response of passengers obtained was then analyzed using SPSS so that the constants and regression coefficients of each model were obtained. Then the forumula utility is used to find the probability of mode selection with the binomial logit model.

4.10 Travel Cost Attributes

In the selection of transportation modes, ticket prices are one of the considerations for service users to determine the choice of mode to be used. Based on the regression analysis obtained a constant value of 2,558 and a coefficient of -0,001904. So that the utility equation

is obtained.

$(U_B - U_{TV}) = b_0 + b_1(\Delta X_1)$
$(UB - ULRT) = 2.558 - 0.01904\ \Delta\ X_1$

Obtained an equation to calculate the bus and LRT probabilities as follows:

$$P_B = \frac{e^{U_B}}{e^{U_B} + e^{ULRT}} = \frac{e^{(U_B - U_{LRT})}}{1 + e^{(U_B - U_{LRT})}}$$
$$P_B = 1 - P_{LRT}$$

So we get bus probabilities and LRT probabilities as follows:

Table 14 *Cost Travel Utility*

No	ΔX_1	(UB -ULRT)	PB	PLRT
1	0	2,558	0,928	0,072
2	250	2,082	0,889	0,111
3	500	1,606	0,833	0,167
4	1000	0,654	0,658	0,342
5	1300	0,083	0,521	0,479
6	1500	-0,298	0,426	0,574
7	2000	-1,250	0,223	0,777
8	2500	-2,202	0,100	0,900
9	3000	-3,154	0,041	0,959

The interpretations and conclusions of the above model are as follows;

a. This model constant of 2,558 means that if the two modes have the same ticket price, the utility difference is 2.558. In this condition the bus probability is 0.928 while the LRT probability is 0.07 so passengers tend to choose the bus over the LRT when the ticket price is the same.
b. The coefficient Δ X1 is -0,001904. This coefficient can be interpreted that if the price of a Bus and LRT ticket rises by 1 rupiah, the bus utility will increase by 0.001904, so the coefficient will result in the probability of choosing the LRT
c. The coefficient of determination of 78.5% shows that travel costs contribute as much as 78.5%, to the choice of travel mode.
d. When the ticket price difference is Rp. 1,300, then the probability of choosing a bus is 0.521 while the user chooses an LRT of 0.479, from the results on the difference in travel costs Rp. 1,300 the user tends to choose the bus, and vice versa if the difference is more than Rp. 1,300 then users tend to choose LRT.
e. Then when the maximum price of Rp. 6,300, - the probability increases, so users tend to choose to use bus transportation for Purabaya Terminal - Porong Terminal trips.

4.11 Travel Time Attributes

In the selection of transportation modes, travel time is one of the considerations for service users to determine the choice of mode to be used for travel. Based on regression analysis using SPSS software, a constant value of 3.179 was obtained with a coefficient of -0.212. so we get the utility equation

$(U_B - U_{TV}) = b_0 + b_2(\Delta X_2)$
$(UB - ULRT) = 3{,}179\text{-}0{,}212\ \Delta X_2$

Obtained an equation to calculate the bus and LRT probabilities as follows:

$$P_B = \frac{e^{U_B}}{e^{U_B} + e^{ULRT}} = \frac{e^{(U_B - U_{LRT})}}{1 + e^{(U_B - U_{LRT})}}$$
$$P_B = 1 - P_{LRT}$$

So we get bus probabilities and LRT probabilities as follows:

Table 15 *Travel Time Utility*

No	ΔX_2	(UB -ULRT)	PB	PLRT
1	30	-3,181	0,040	0,960
2	27	-2,545	0,073	0,927
3	24	-1,909	0,129	0,871
4	20	-1,061	0,257	0,743
5	16	-0,213	0,447	0,553
6	15	-0,001	0,500	0,500
7	12	0,635	0,654	0,346
8	8	1,483	0,815	0,185
9	4	2,331	0,911	0,089

The interpretations and conclusions of the above model are as follows;

a. The constant in the model is 3.179, this means that if both modes have the same travel time, the probability of the bus selector will increase
b. The coefficient is -0.212, interpreted that if the difference in travel time for bus trips and LRT rises by one minute then the bus utility will rise by -0.212, resulting in an increase in bus probability.
c. The coefficient of determination 74.1% shows the travel time of travel contributes 74.1% to the choice of travel mode.
d. When the travel time is 15 minutes faster than the LRT, the bus utility will increase so that the bus probability increases. Then respondents tend to choose buses over LRT. On the other hand, if the travel time is 15 minutes slower than LRT, the probability of LRT rises, so that respondents tend to choose LRT.
e. Then during the Purabaya Terminal - Porong Terminal travel time of 40 minutes the probability of the bus will increase, so users tend to choose the bus for travel mode.

4.12 Departure Frequency Attributes

The frequency of departure is one of the considerations in determining the choice of transportation mode. Based on the regression analysis using SPSS, a constant of -0.1726 and a coefficient of 0.314 are obtained, so that the following utilities are obtained;

$(U_B - U_{TV}) = b_0 + b_1(\Delta X_1)$
$(U_B - U_{TV}) = -1{,}726 + 0{,}314\ \Delta X_3$

Obtained an equation to calculate the bus and LRT probabilities as follows:

$$P_B = \frac{e^{U_B}}{e^{U_B} + e^{ULRT}} = \frac{e^{(U_B - U_{LRT})}}{1 + e^{(U_B - U_{LRT})}}$$
$$P_B = 1 - P_{LRT}$$

So we get bus probabilities and LRT probabilities as follows:

Table 16 *Frequency Departure*

No	ΔX_3	(UB -ULRT)	PB	PLRT
1	16	3,298	0,964	0,036
2	14	2,670	0,935	0,065
3	12	2,042	0,885	0,115
4	10	1,414	0,804	0,196
5	8	0,786	0,687	0,313
7	5,5	0,001	0,500	0,500
8	4	-0,470	0,385	0,615
9	2	-1,098	0,250	0,750

The interpretations and conclusions of the above model are as follows;

a. The constant in the model is -1.726, if both modes have the same frequency, then the bus
b. probability is 0.151 while the LRT probability is 0.750. So in this condition the user tends to choose LRT
c. The coefficient is equal to the coefficient of 0.314 can be interpreted if the difference in the frequency of bus departures and LRT increases by one time then the utility increases by 0.314, so that the increase in the coefficient results in an increase in bus probabilities
d. The coefficient of determination of 57.1% indicates that the frequency of travel departures contributed 57.1% to the choice of travel mode.
e. If the departure frequency is 5.5 times more than the LRt per day then the utility will go up and the probability of the bus will go up, and respondents tend to choose the bus. And vice versa if the frequency of bus departures is less than 5.5 times per day compared to the LRT, the probability of the LRT will rise and the user will choose the LRT
f. In the condition of the frequency of bus departures 20 times per day, the probability of the bus will go up and the user will tend to choose the bus as the transportation of Purabaya Terminal - Porong Terminal.

4.13 Stages of the Mass Transportation Plan Operation Plan

According to calculations that have been carried out the needs of the fleet of 12 units that will be procured 3 times with the distribution of routes as figure 2. 8 bus have route Purabaya Station – Porong Station. 4 bus have route Purabaya Station – Krian Station.

4.14 Revitalizing Public Transport to Mass Transportation

Revitalization of public transport carried out in this study is existing public transportation which is confused with planned mass transportation. Revitalization of this transportation refers to the performance of each transport as shown in the table:

Table 17 *Existing Transportation Performance*

No	Code Route	Route	Extend permission	Rill	Load Factor	Headway (Menit)
1	HB2	Krian – Sidoarjo – Larangan	89	103	75%	10
2	LTP	Ps. Larangan – Tanggulangin – Telasih – Jatikalang -Pejangkung – Kedungsugo – Kedungwonokerto – Prambon	34	28	52%	8
3	HP	Ps. Larangan – Prasug – Darmasih - Sedati	-	2	-	9

The forms of revitalization / reform of lyn transport are as follows

1. Refers to the performance of the transport if the service level can be improved by improving the cause of the poor service level so that service can be optimized
2. If the load factor is large, then the transportation can be increased, but if the load factor is small, then transportation is rerouted to another route.
3. If the load factor is excessive and the headway tends to be small, it is necessary to replace a larger transport capacity.
4. Decapitation of the route on the main route which is passed by mass transportation. So to support the beheading, sub-terminals are needed to make it easier for service users to switch modes.
5. Cutting off existing transportation will certainly have an impact on the revenue of the transport manager, so it can be done by adding routes to unreached zones (blankspots)

Below this is the sub terminal layout and decapitation that will be done.

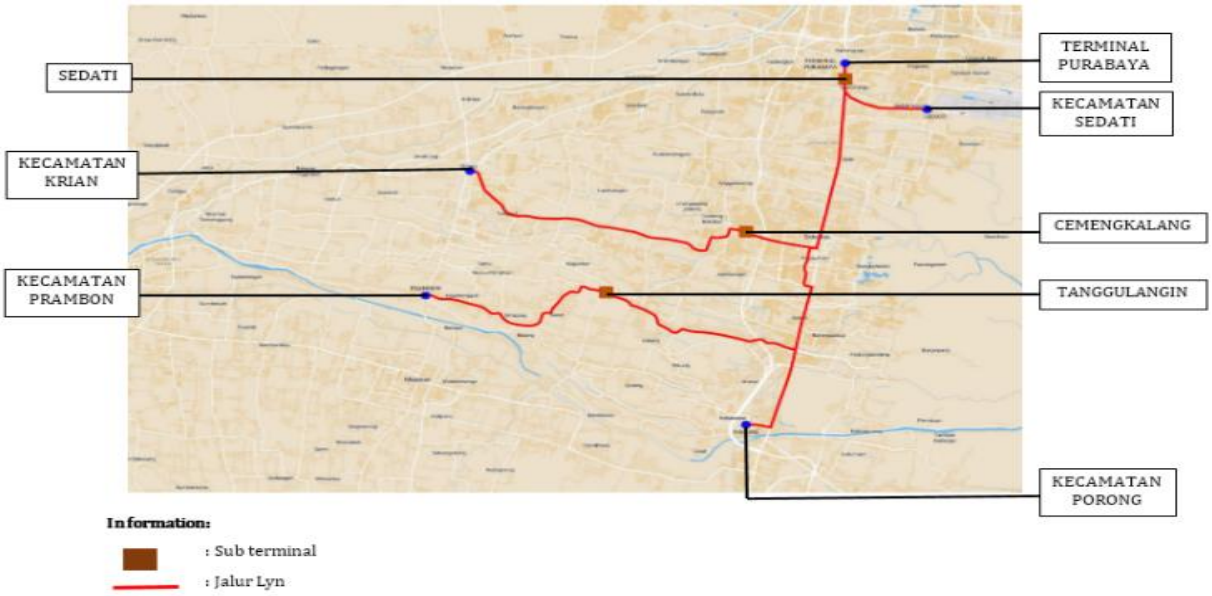

Fig 2. Sub Terminal Plan Layout

The lyn transportation serving the main road as in the above layout is revitalized;

1. Referring to the load factor and headway on the lyn HB2 route, the revitalization is to replace the transport capacity to a larger one, namely a 17 van mini passenger capacity, and beheaded at Cemengkalang which will then be made into a sub-terminal in the decapitation area,
2. Referring to the Lyn LTP route load factor and headway, the form of revitalization carried out is the decapitation of the Tanggulangin area, which is confused with mass transportation on the main road. Then it will be given a sub terminal in the area of decapitation.
3. Referring to the load factor and headway on the Lyn HP route, revitalization efforts are carried out by decapitation of the sedati area, and a sub terminal will be made.

4.15 Transport Development Scenarios

Existing transportation development, namely JSP lynn and Bison, was carried out scraping aimed at avoiding overlapping transportation with planned mass transportation and rejuvenating inappropriate transportation into mass transportation. The technical

implementation of scraping is done by selling JSP lyn and bison out of town or diverting to other routes (rerouting) by being used as a feeder and rejuvenation and if it is not very improper to do sales in palm oil using the kiloan method.

Then the next step is to make a consortium or cooperative that aims as a manager of public transportation. So that transport entrepreneurs and owners of JSP and Bison lyn transports will not be disadvantaged by the existence of this mass transport, it is necessary to conduct socialization for fleet owners who aim to offer their transportation can be invested in medium bus mass transportation where the comparison made for lyn is 1 medium bus : 4 lyn vehicles, the purpose of the comparison is for 1 medium bus, the lyn invested is 4 units of lyn, and for bison the ratio is 1 medium bus: 3 bison, then 1 medium bus, then bison invested is 3 bison units. Another thing that can be a bidding option for transport entrepreneurs is to provide subsidies from the government but are willing to run or operate according to the specified terms and standards. And there are also other options used in the offer is to use a rental system.

Conclusion

Based on the results of the AHP analysis, Sidoarjo regency is ready to develop public transportation to mass transportation. The route that is being developed is the route of Purabaya Terminal - Porong Terminal, which is on the main route using Medium Bus mass transportation with a capacity of 30 passengers, 77% load factor, 11.55% headway, circulation time needed 1 hour 49.25 minutes / trip, and needs the bus fleet is 12 units of vehicles

Revitalization is carried out on existing transportation, one of the routes is in mass transportation on the main road, namely Lyn HB2, LTP, and HP. The forms of revitalization carried out differ depending on the performance conditions and the load factor of the transport. The forms of revitalization undertaken are:

1. Improve service performance
2. Rerouting to other routes
3. Increased carrying capacity
4. Simultaneous decapitation of routes along with sub-termina in each decapitation area,
5. Adding routes to blankspot zones.

Recommendation

From the results of the development and revitalization of other public transportation currently serving the West-East, East-South and North-South

corridors, it is necessary to recommend the Sidoarjo Regency Government:

1. To realize the planned development of Porong-Terminal Purabaya Corridor-based mass public transportation buses, it is necessary to have the availability of the infrastructure of the bus stop at the gathering points of passenger movements
2. To support the revitalization plan of other public transport lyn, which is in the form of route beheading, the Government needs to provide sub-terminal infrastructure, so that the performance of mass public transport in Porong-Terminal Purabaya Corridor is not affected by performance. Regarding the beheading route, the route served will remain the same or add routes with areas that have not been served by public transportation.
3. Revitilization by scraping existing public transportation that has the potential to

coincide with mass transportation, and reducing existing public transport that is no longer operational. The action taken is by diverting routes, sold out of town, rejuvenated, and sold metal scrap by the kiloan method.

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